SL. NO.	quantities	FORMULA (RELATIONS)	Electrostatics
1	Quantisation of Elect. Charges (Q) on a body	$Q = n.e$	n is Integral Number, e is charge on electron 1.6×10^{-19} C
2	Electrostatic force constant	$1/(4\pi\epsilon_0)$	value : $9 \times 10^9 \ Nm^2C^{-2}$
3	Permittivity	ϵ_0	$8.85 \times 10^{-12} \ C^2N^{-1}m^{-2}$
4	Coulumb's Law	$F = q_1q_2/4\pi\varepsilon_0r^2$	q_1 and q_2 are two charges placed at distance r.
5	Forces on two charges	$F_{12} = - F_{21}$	Direction of F is along r.
6	Dielectric Constant	$K = \varepsilon/\varepsilon_0 = \varepsilon_r$	ε is absolute permittivity of medium, ε_0 is permittivity of free space, ε_r is relative permittivity.
7	Electric Field at a point	$E = F/q$	F is force experienced by the test charge q at a point. E is called **field intensity at that point**
	Force with respect to field	$F = q.E$	
8	Electric field due to source charge Q at distance r	$E = Q/(4\pi\varepsilon_0r^2)$	Direction of E is along r.
9	Electric Field due to dipole on a point on axial line	$E = 2P/(4\pi\varepsilon_0r^3)$	P is dipole moment, r is distance from centre of dipole on axial line.
10	Electric Field due to dipole on a point on equitorial line	$E = P/(4\pi\varepsilon_0r^3)$	P is dipole moment, r is distance from centre of dipole on equitorial line.
11	Electric Field due to dipole at any general point, at distance r making angle θ with P	$E = P\sqrt{(3\cos^2\theta+1)}/4\pi\varepsilon_0r^3$	r is distance of point from midpoint of dipole, θ is angle between direction of r and dipole moment P
	E makes angle α with r then	$\tan\alpha = \frac{1}{2}\tan\theta$	α is angle between resultant field and direction of r, θ is angle between r and P
12	E at any point on the axis of a uniformly charged ring at distance r	$qr/4\pi\varepsilon_0(r^2+a^2)^{3/2}$	
13	Torque on a dipole kept in Electric Field	$\tau = PE\sin\theta$ or $\vec{\tau} = \vec{P} \times \vec{E}$	P is dipole moment, E is electric field, Direction of Torque is normal to plain containing P and E
14	Work done for rotating dipole by angle θ	$W = PE(1- \cos\theta)$	P is dipole moment. E is electric field
15	Potential Energy of dipole in equilibrium condition when P is along E.	$U = - PE$	P is dipole moment. E is electric field
16	Potential energy of dipole at 90 degree to E	Zero	
17	Potential energy of dipole at 180^0	$U = + PE$	P is dipole moment. E is electric field
18	Electric Flux ϕ_E	$\phi_E = E.S = \int E.ds$	
19	gauss theorem	$\phi_E = \oint [E.ds] = q/\varepsilon_0$	Flux linked to a closed surface is q/ε_0 times the charge enclosed in it.
20	Field due to infinite long straight charged conductor	$\lambda/2\pi\epsilon_0r$	λ is linear charge density in the conductor, r is the perpendicular distance.
21	Electric field due to infinite plane sheet of charge	$\sigma/2\epsilon_0$	σ is areal charge density. Independent of distance
22	Within two parallal sheets of opposite charges	σ/ϵ_0	Outside, field is zero
23	Within two parallal sheets of similar charges	zero	Outside, field is σ/ϵ_0
24	Electric field due to spherical shell, out side shell	$E = q/(4\pi\varepsilon_0r^2)$	q is charge on shell, r distance from centre.

25	Electric field on the surface of spherical shell.	$E = q/(4\pi\varepsilon_0 R^2)$	R is radius of shell
26	Electric field inside spherical shell.	Zero	
27	Electric field inside the sphere of charge distributed uniformly all over the volume .	$E = r\rho/3\epsilon$	r is radius of sphere, ρ is volumetric charge density, is permittivity of medium
28	Potential due to charge Q at distance r	$V = Q/(4\pi\varepsilon_0 r)$	Potential is characteristic of that location
29	Potential Energy with charge q kept at a point with potential V	$U = qV = Qq/(4\pi\varepsilon_0 r)$	Potential Energy is that of the system containing Q and q.
30	Work done for in moving a charge q through a potential difference of V	$W = q(V_2-V_1)$	$V = (v_2 - v_1)$
	Energy of system of two charges	$U = q_1q_2/(4\pi\varepsilon_0 r)$	
31	Relation of E and V	$E = - dv/dr$	dv is potential difference between two points at distance r where r and E are in the same direction.
32	Relation of E and V and θ	$E \cos\theta = - dv/dr$	where θ is angle between dr and E
33	Potential at infinity / in earth	Zero	
34	Electric Potential due to dipole on a point on axial line	$V = P/(4\pi\varepsilon_0 r^2)$	P is dipole momentum, r is distance from centre of dipole
35	Electric Potential due to dipole on a point on equitorial line	Zero	
36	Electric Potential due to dipole at any general point,	$V = P\cos\theta / 4\pi\varepsilon_0 (r^2 - a^2 \cos^2\theta)$	P is dipole momentum, r is distance from centre of dipole, a is half length of dipole, is angle between r and P
37	Work done in moving a charge between two points of an equipotential surface	Zero	
38	Capacitance of a spherical conductor	$4\pi\varepsilon_0 R$	R is radius of the sphere
39	Capacitance of a parallal plate capacitor	$\varepsilon_0 kA/d$	A is area of each plate, d is distance between them, k is dilectric constant of the medium between plates.
40	Dielectric Constant	$k = C / C_0$	Cis capacitance with medium within plates, and C_0 is capacitance in free space.
41	Capacitance of a spherical capacitor.	$C = 4\pi\varepsilon_0 r_a r_b/(r_a-r_b)$	r_a and r_b are radius of internal and external spherical shells
42	Equivalent capacitance for Capacitors in parallal	$C = c_1 + c_2 + c_3....$	Cis equivalent capacitance, c_1, c_2 are capacitnce of the capacitors joint together.
43	Equivalent capacitance for Capacitors in series	$1/C = 1/c_1 + 1/c_2 + 1/c_3$ ...	
44	Charge, capacitance, Potential Difference	$C = q/V$	q ischarge on the plate of capacitor and V is Potential Difference between the plates.
45	Energy stored in capacitor	$\frac{1}{2}cv^2$, $\frac{1}{2}qv$, $\frac{1}{2}q^2/c$	q is charge, c is capacitance, v is Pot. Difference
46	Common Potential	$V=C_1V_1+C_2V_2)/C_1+C_2$	
47	Energy loss in connecting	$\frac{1}{2}\frac{C_1C_2}{C^1+C_2}(V1-V2)^2$	c_1 at v_1 is connected to c_2 at v_2
48	C with dielectric slab inserted	$\varepsilon_0 kA/d-t(1-1/k)$	t is thickness of dielectric slab of constant k,
49	C with metal plate inserted	$\varepsilon_0 kA/(d-t)$	t is thickness of metal plate inserted,
50	Force of attraction between plates	$\frac{1}{2}q^2/\varepsilon_0 A$, $\frac{1}{2}\varepsilon_0 E^2 A$	q is charge on plate, A is area, E Elect. Field.

DYNAMICS AND KINEMATICS

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

$$F_s = -kx$$

$$\vec{F}_{net} = m\vec{a}$$

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$\vec{F}_{net} = \frac{d\vec{p}}{dt}$$

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$f_k = \mu_k N$$

$$f_s \le \mu_s N$$

$$T = 2\pi\sqrt{\frac{I}{mgr}}$$

$$a_c = \frac{v^2}{r} = \omega^2 r$$

WORK, ENERGY, POWER, AND MOMENTUM

$$W = \int \vec{F} \cdot d\vec{s}$$

$$P = \frac{dW}{dt}$$

$$U_s = \frac{1}{2}kx^2$$

$$\vec{p} = m\vec{v}$$

$$U_g = mgh$$

$$F_x = -\frac{dU}{dx}$$

$$KE = \frac{1}{2}mv^2$$

$$\vec{r}_{cm} = \frac{\sum_i m_i \vec{r}_i}{\sum_i m_i}, \quad \vec{r}_{cm} = \frac{\int \vec{r}\,dm}{\int dm}$$

ROTATIONAL MOTION

$$s = r\theta$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\vec{\tau} = \vec{r} \times \vec{F}, \quad \vec{\tau} = \frac{d\vec{L}}{dt}$$

$$\vec{L} = \vec{r} \times \vec{p}, \quad \vec{L} = I\vec{\omega}$$

$$I_{ring} = MR^2$$

$$I_{disc} = \frac{1}{2}MR^2$$

$$I_{sphere} = \frac{2}{5}MR^2$$

UNIVERSAL GRAVITATION

$$F = \frac{Gm_1m_2}{r^2}$$

$$T^2 = \frac{4\pi^2}{GM}r^3$$

$$U_g = -\frac{Gm_1m_2}{r}$$

THERMODYNAMICS

$$\Delta L = \alpha L_0 \Delta T$$

$$W = \int p\,dV$$

$$Q = mc\Delta T$$

$$\Delta S = \int \frac{dQ}{T}$$

$$Q = Lm$$

$$\varepsilon \le 1 - \frac{T_L}{T_H}$$

$$pV = nRT = NkT$$

$$dE = dQ - dW$$

$$\frac{dQ}{dt} = kA\frac{T_H - T_C}{L}$$

$$e = \frac{W_{out}}{Q_{in}}$$

$$\frac{Q_C}{W} = \text{COP}$$

WAVES

$$v = f\lambda$$

$$y = A\sin(kx - \omega t)$$

$$k = \frac{2\pi}{\lambda}$$

$$v = \sqrt{\frac{T}{\mu}}$$

$$f' = f\frac{v \pm v_D}{v \mp v_S}$$

$$I = \frac{P}{A}$$

$$\beta = (10\text{ dB})\log_{10}\frac{I}{I_0}$$

MAGNETISM

$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$\vec{F} = i\vec{l} \times \vec{B}$$

$$d\vec{B} = \frac{\mu_0}{4\pi}\frac{i\,d\vec{s} \times \hat{r}}{r^2}$$

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

ELECTROSTATICS

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

$$\Delta V = -\int \vec{E} \cdot d\vec{s}$$

$$\vec{E} = \frac{\vec{F}}{q}$$

$$\Phi_E = \int \vec{E} \cdot d\vec{A}$$

$$E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$$

$$C = \frac{Q}{V}$$

$$U = qV$$

$$C = \frac{\kappa\varepsilon_0 A}{d}$$

$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$

$$U = \frac{1}{2}CV^2$$

CURRENTS

$$i = \frac{dq}{dt}$$

$$J = n|q|v_d$$

$$E = \rho J$$

$$R = \frac{\rho\ell}{A}$$

MECHANICS OF FLUIDS

$$p = p_0 + \rho gh$$

$$\rho vA = \text{constant}$$

$$p + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$$