JEE MAIN PHYSICS SUB TOPICS ANALYSIS 2021, 2022, 2023

SL NO	CHAPTERS	2021	2022	2023	TOTAL
1	MODERN PHYSICS	70	54	71	195
2	CURRENT ELECTRICITY	46	49	49	144
3	KTG & THERMODYNAMICS	57	42	44	143
4	UNITS & DIMENSIONS, ERRORS, VECTORS	46	38	33	117
5	MOVING CHARGES & MAGNETIC EFFECT OF CURRENT	30	41	42	113
6	KINEMATICS	30	36	37	103
7	SEMICONDUCTORS	40	28	25	93
8	GRAVITATION	34	22	36	92
9	RAY OPTICS AND INSTRUMENTAL INSTRUMENTALS	32	29	31	92
10	ELECTROSTATICS	30	27	33	90
11	WORK ENERGY POWER & CIRCULAR MOTION	20	28	35	83
12	ROTATIONAL MOTION	37	19	26	82
13	SIMPLE HARMONIS MOTION	35	16	26	77
14	ALTERNATIVE CURRENT	31	25	21	77
15	LAWS OF MOTION	33	24	19	76
16	COMMUNICATION SYSTEM (DELETED TOPIC FOR JEE MAIN 2024)	24	22	24	70
17	CAPACITORS	23	24	19	66
18	ELECTROMAGNETIC INDUCTION	17	16	28	61
19	ELECTRO MAGNETIC WAVES	17	20	23	60
20	WAVE MOTION	16	19	20	55
21	WAVE OPTICS	18	17	18	53
22	FLUID MECHANICS	12	19	21	52
23	CENTER OF MASS AND COLLISION	22	17	9	48
24	PROPERTIES OF SOLIDS	12	14	17	43
25	THERMAL PROPERTIES AND HEAT TRANSFER	11	14	13	38

Units & Dimensions, Errors, Vectors

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Finding dimensions & dimension analysis	17	16	17	50
2	Error analysis	11	8	5	24
3	Vectors	11	5	5	21
4	Vernier caliper	3	6	2	11
5	Screw gauge	3	2	1	6
6	Significant figures	0	0	0	0

Kinematics

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Motion in 1D with constant acceleration	11	15	6	32
2	Projectile motion	5	12	14	31
3	Graph based questions	5	2	6	13
4	Average velocity & acceleration, displacement	0	2	7	9
5	Relative motion in 2D	4	1	1	6
6	Motion in 1D with varying acceleration	3	1	0	4
7	Relative motion in 1D	1	0	2	3
8	Motion in 2D general case	0	1	0	1

LAWS OF MOTION

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Constant force (basic & pulley block)	8	6	7	21
2	Friction on block (horizontal/incline/repose angle)	7	5	6	18
3	Static equilibrium	1	3	2	6
4	Impulse or change in momentum	2	1	2	5
5	Weighing & spring balance (apparent weight)	1	2	1	4
6	Circular turns & banking of roads	3	1	0	4
7	Variable force questions (calculus based)	2	1	0	3
8	Two block system	2	1	0	3
9	Friction/normal/tension in circular motion	3	0	0	3
10	Pseudo force application questions	2	1	0	3
11	Constraint motion	0	1	0	1

WORK ENERGY POWER & CIRCULAR MOTION

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Horizontal circular motion	0	5	9	14
2	Power (avg or instantaneous)	3	2	5	10
3	KE, v & relation between P & KE	3	3	4	10
4	Work done due to varying force	1	4	4	9
5	Conservation of energy	4	4	1	9
6	Vertical circular motion	3	4	1	8
7	Work Energy Theorem (Friction or Fext is there)	2	2	3	7
8	Work done due to const force	2	0	2	4
9	Equilibrium (F= 0, U is min or max), F = -dU/dr	2	1	0	3

CENTER OF MSS AND COLLISION

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	1 D collision	4	4	4	12
2	Finding COM (particle, continuous mass, cavity)	3	4	0	7
3	Collision + energy conservation	3	1	2	6
4	Gun-bullet question (recoil)	1	0	3	4
5	2D collision or oblique collision	4	0	0	4
6	Variable Mass question (thrust force)	1	3	0	4
7	Explosion based question	2	1	0	3
8	2 block spring system	1	1	0	2
9	COM velocity & acceleration	1	0	0	1

Rotational Motion

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Moment of inertia(uniform &non-uniform mass)	12	4	10	26
2	Rolling on inclined plane, rolling kinematics	10	2	7	19
3	Angular momentum and impulse (conservation)	5	2	4	11
4	Finding torque	2	2	1	5
5	Rotation about fixed axis	2	2	1	5
6	Rotation about fixed axis(energy conservation)	2	2	0	4
7	Rotational equilibrium	0	2	1	3
8	Combined Trans + Rot motion (L = const)	1	1	0	2

GRAVITATION

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Orbital motion(KE, U, TE, BE, T, omega, orbital speed)	9	3	6	18
2	Variation of g with h,d and rotation	3	7	7	17
3	g & V due to ring ,solid & hollow sphere	7	3	6	16
4	Escape velocity, Hmax or speed at infinity questions	5	3	7	15
5	Kepler's law	3	2	4	9
6	Gravitational Force& PE (among particle system)	2	4	0	6
7	Binary star system	2	0	1	3
8	Elliptical orbit(L & energy conservation)	2	0	0	2
9	Relation between g and V	0	0	1	1

PROPERTIES OF SOLIDS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Hooke's law- young's modulus , Y	8	11	11	30
2	Hooke's law- bulk's modulus, B	2	0	2	4
3	Energy density or total potential energy	1	0	2	3
4	Hooke's law- shear modulus, G	0	2	0	2
5	Possion ratio,relation among Y, G & B	1	0	1	2
6	Elongation due to self weight	0	1	0	1

FLUID MECHANICS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Application of Bernoulli's equation(ex: efflux speed, Venturimeter,aeroplane)	3	4	4	11
2	Terminal velocity	1	5	3	9
3	Surface energy	1	2	5	8
4	Excess pressure(bubble drop,interface radius etc.)	3	1	2	6
5	Pressure at depth, Pascal's law	2	0	3	5
6	Buoyancy	0	2	1	3
7	Reynold's number	1	1	0	2
8	Viscous force	1	0	1	2
9	Capillary Action, Contact Angle	0	1	1	2
10	Rotation of liquid(vessel,pipe)	0	1	0	1
11	Equation of continuity	0	0	1	1

Simple Harmonic Motion

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Position, v, a, KE, U and TE based ques in SHM	11	5	11	27
2	Spring- block system (find T, also Keq and Meq based)	9	3	6	18
3	Simple pendulum (basic,geff also), second 's Pendulum	5	4	2	11
4	Graph based question	3	2	3	8
5	T of other systems(gravitation, electrostatics, fluids etc)	2	1	1	4
6	Superposition of SHM	3	0	1	4
7	Damped oscillation	2	0	0	2
8	Physics Pendulum	0	0	0	0

Thermal Properties and Heat Transfer

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Calorimetry	4	5	2	11
2	Thermal expansion and thermal stress	2	3	3	8
3	Newton's law of Cooling	2	1	4	7
4	Thermal conduction in rod (must know its V=IR analogy)	1	3	1	5
5	Thermometry	0	0	3	3
6	Thermal conduction in cylindrical/ spherical shell	1	0	0	1
7	Effective thermal conductivity	1	0	0	1
8	Stefan's Boltzmann law	0	1	0	1
9	Wien's displacement law	0	0	0	0

KTG & Thermodynamics

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Carnot engine (Heat engine & Regrigeration)	8	10	6	24
2	Maxwell 's distribution of speed, Vrms, Vmp, Vav	6	7	7	10
3	Graphical questions (graph conversion, find W, ΔQ or ΔU	9	3	4	16

4	Isothermal, isobaric, isochoric, adiabatic process	4	5	6	15
5	Ideal Gas equation, postulates of KTG	7	3	1	11
6	1st law of Thermodynamics	3	3	5	11
7	Equipartition of energy, Avg KE	3	2	5	10
8	Degree of freedom, fmix, $U = fRnT/2$	3	2	2	7
9	Cp, Cv, γ & mix of gases	2	2	3	7
10	Mean free path & time	2	1	2	5
11	Polytropic process(finding C, W and ΔQ)	3	0	0	3
12	Cylinder Piston questions	1	1	0	2

WAVE MOTION

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Question of wave equation, superposition	3	4	6	13
2	Doppler's effect in sound	4	4	5	13
3	Standing Waves in String (Fixed & Free End case)	2	2	3	7
4	Organ pipes (standing waves), resonance tube	3	2	2	7
5	Wave speed on a string	2	1	1	4
6	Beats (f1-f2, effect due to adding or removing mass)	1	2	0	3
7	Speed of sound (in gas, solid rod)	0	1	2	3
8	Sonometer experiment	0	0	1	1
9	Sound wave equation, intensity, loudness	1	0	0	1
10	Doppler's effect in light	0	1	0	1

ELECTROSTATICS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Coulomb's Law, F= qE, EF & U due to point System	10	9	9	28
2	Gauss's law, Electric Flux	7	3	5	15
3	EF due to uniformly charged wire, ring, disc, infinite sheet	5	2	3	10
4	V, E & Self energy due to solid sphere & Hollow sphere (also graphs of V and E)	2	1	6	9
5	Conductor brought into contact, conductor properties	2	3	2	7
6	Dipole in uniform EF (Torque & PE)	0	2	2	4
7	SHM based questions	2	1	1	4

8	Relation between E and V	0	1	1	2
9	V, E due to short dipole, dipole moment	1	0	1	2
10	EF due to non-uniform charge (rod, sphere etc)	0	1	0	1

CAPACITORS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Capacitor with dieletric inside (Ceq, Electic field, PE)	7	8	5	20
2	Ceq in series & parallel, Q =CV	4	7	4	15
3	2 Capacitor in parallel (Find final q & V, Heat Generated)	2	4	4	10
4	Circuit question with capacitor at steady state	2	1	3	6
5	Charging & discharging of capacitor	4	1	0	5
6	EF, PE stored in parallel plate capacitor	1	2	2	5
7	Capacitance of Concentric shells (spherical, cylindrical)	0	1	1	2
8	Induced charge density (dielectric in capacitor)	1	0	0	1
9	Find C (variable dielectric const, variable d)	1	0	0	1

CURRENT ELECTRICITY

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Circuit Analysis (KCL, KVL, Point Potential, Cell Eeq)	12	13	16	41
2	Find equivalent resistance, $R=\rho L/A$, resistance of cylindrical & spherical shell	12	10	15	37
3	Thermal Effect of Current (Find Power, Heat, bulb ques)	7	4	5	16
4	Potentiometer	4	6	3	13
5	$= \rho J$	4	3	3	10
6	Meter Bridge	1	4	2	7
7	Converting Galvanometer into Ammeter & Voltmeter	1	2	2	5
8	Variation of R & ρ with Temperature	1	1	1	3
9	i= dq/dt, area of Current vs time is charge flown	1	0	1	2
10	Color Code	1	0	0	1
11	Current & Voltage Sensitivity of Galvanometer	0	1	0	1
12	Max Power Transfer Theorem	0	0	0	0

MOVING CHARGES, MAGNETIC EFFECT OF CURRENT & MAGNETISM

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	B due to current carrying wire, circular loop, solenoid	7	8	19	34
2	Short Magnets & Magnetic Properties	11	5	6	22
3	Charge moving in B (Circular & Helical Path)	4	10	5	19
4	Earth Magnetism	2	5	1	8
5	Moving Type Galvanometer (cΘ = NIAB), sensitivity	1	0	5	6
6	B due to current carying Solid & Hollow long cylinder	2	2	1	5
7	Force on a current carrying wire & loop	1	2	2	5
8	Torque & PE -Current carying loop in B, Magnetic Moment	2	2	1	5
9	Force between 2 parallel current carying wires	0	3	1	4
10	Cyclotron	1	2	0	3
11	Charge moving in B & E	0	1	0	1
12	Ampere Circuital Law	0	0	0	0

ELECTRO MAGNETIC INDUCTION

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Faraday's Law & Lenz Law (Find induced emf & current)	4	6	7	17
2	Motional EMF in translating or rotating rod	6	2	6	14
3	Growth & Decay of Current in LCR Circuit	3	1	1	5
4	LR Circuit at Steady State or at t=0	3	1	1	5
5	Coil rotating in uniform B	1	1	3	5
6	Self inductance (finding L, energy stored & emf across L)	1	1	2	4
7	Mutual Inductance	1	1	2	4
8	Eddy Currents	0	0	3	3
9	Equivalent Self Inductance	0	1	0	1
10	LC Oscillation	0	1	0	1
11	Charge Flown	0	0	1	1

ALTERNATING CURRENT

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	RLC in Series (Resonance, Q-Factor, Band Width)	17	12	14	43
2	Only L,C or R across AC source	4	6	2	12
3	LR and RC circuit across AC source	4	3	1	8
4	Transfomer	1	1	2	4
5	RMS and average current (even super position based question)	3	0	0	3
6	Circuit with very high or low frequency	1	1	0	2

RAY OPTICS AND OPTICAL INSTRUMENTS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Combination of lens / mirror/ slabs	2	2	6	10
2	Critical Angle and TIR	4	4	1	9
3	Snells Law(formulae based), refractive index	0	7	2	9
4	lens Maker formulae, equivalent focal length, power	3	3	3	9
5	Reflection from plane mirror (image, angle of deviation etc)	3	1	4	8
6	Refraction from prism	5	2	1	8
7	Optical instrument (microscope and telescope) and eye	3	1	2	6
8	Image formation in spherical mirror	3	0	2	5
9	Apparent depth and height	1	0	4	5
10	Refraction from spherical surface	2	1	1	4
11	Image formation in lenses	2	0	2	4
12	Graph based questions	1	2	0	3
13	Dispersive power, net deviation and dispersion	1	1	1	3
14	Resolving power, telescope/microscope/eye	0	2	1	3
15	Velocity of image in spherical/plane mirror and lens	1	1	0	2
16	Lateral displacement (refraction through a slab)	0	1	1	2
17	Vector relation among reflected ray, incident ray and normal	1	0	0	1

WAVE OPTICS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	YDSE (fringe, maxima, minima)	8	5	5	18
2	Intensity in interference (Inet, Imax, Imin)	4	6	3	13

3	Polarization of light (Malus law, Brewst's angle)	2	2	6	10
4	YDSE with thin film after slits	0	0	2	2
5	Effect on fringes width with YDSE in a medium	0	2	0	2
6	Single slit defraction	0	1	1	2
7	Optical path, effect on λ (lamda)	1	0	1	2
8	Defraction by Circular Apperture	1	0	0	1
9	Wave front	0	0	0	0

ELECTRO MAGNETIC WAVES

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	EM wave equation (Relation among c, E & B)	9	7	7	23
2	Intensity of EM waves, energy density	5	4	4	13
3	Theoretical fact based/ conceptual questions	0	4	8	12
4	Speed of EM wave	3	2	2	7
5	Maxwell's equation	0	0	2	2
6	Displacement current	0	1	0	1

COMMUNICATION SYSTEM (DELETED TOPIC FOR JEE MAIN 2024)

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Amplitude modulation	13	9	10	32
2	lOS communication	8	4	5	17
3	Theoretical questions	0	4	6	10
4	Power radiated & antenna height	0	3	3	6
5	Number of channels and stations	1	1	0	2
6	Frequency modulation	0	1	0	1

SEMICONDUCTORS

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Logic gates	12	3	10	25
2	Transistor as amplifiers, basic npn CE transistor	8	7	4	19
3	zener diode circuit questions, Theoretical	8	4	2	14
4	PN diode, its circuit questions, characteristic curve	5	6	3	14

5	photodiode, led & solar cell	1	3	3	7
6	p & n type semiconductor, fermi level	3	0	3	6
7	Logic gates using diodes & transistors	2	2	0	4
8	Transistor as switch & oscillator	0	1	0	1

NO	SUB-TOPICS	2021	2022	2023	TOTAL
1	Atomic physics (Atomic models, Bohr Model)	15	12	22	49
2	Radioactivity	17	12	8	37
3	Debroglie wavelength, dual nature	15	9	12	36
4	Photoelectric effect	12	11	10	33
5	Nuclear size, binding energy, fission/fusion, mass defect, Q value, alpha - beta - gamma decay	5	8	16	29
6	Photon flux, radiation force & pressure	0	2	2	4
7	X - rays	4	0	0	4

MODERN PHYSICS