



MAHARANA PRATAP GROUP OF INSTITUTIONS

Kothi, Mandhana, Kanpur

THINK CAREER ▶

THINK MAHARANA ▶

DREAM | GROW | LEAD

CREATE YOUR FUTURE





A success option for students

FORMULAE HANDBOOK



MAHARANA PRATAP GROUP OF INSTITUTIONS



■ VISION

To provide a platform for a life paradigm shift for today's youth so they can enhance their skills to emerge as resilient, dynamic and self-motivated change agents, contributing to an empowered nation.

■ MISSION

- To stay committed and excel in field of technical, medical and higher education whilst making available the global perspectives to the students.
- To aim for an Intellectual transformation of students by exposing them to new ideas, new approaches and a dynamic curriculum.
- To help students develop a keen technical insight and a critical thinking mind.

■ OUR VALUES

- **Integrity:** Our blunt refusal to compromise on our standards.
- **Excellence:** Approaching the ordinary with an extraordinary edge.
- **Commitment:** Relentless consistency for great accomplishments.

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COURSES OFFERED

B.TECH

Assured Placement

in collaboration with



- Full Stack Development
- Business Analyst

B.TECH

- Computer Science
- Computer Science Engineering
- CSE - Artificial Intelligence
- CSE - Artificial Intelligence
Machine Learning
- CSE - Data Science
- CSE - Internet of Things

B.TECH

Core Engineering

- Electrical Engineering
- Mechanical Engineering
- Electronics & Telecommunication
- Civil Engineering

BCA

- Regular
- Artificial Intelligence
- Data Analytics

BBA

- Regular
- CIBOP
- Data Analytics

MCA - Assured Placement

in collaboration with



- Full Stack Development

MCA - Regular

MBA - Assured Placement

in collaboration with



- CIBOP
- Business Analytics

MBA - Regular

M.PHARM

1. Master Of Pharmacy (M. PHARM)

D.PHARM

Diploma In Pharmacy (D. PHARM)

B.PHARM

1. B.PHARM - Regular
2. B.PHARM - Regulatory Affairs
3. B.PHARM - Pharma Covigilance

DENTAL SCIENCE

Bachelor Of Dental
Sciences (BDS)

AYURVEDIC SCIENCE

(I) Bachelor of Ayurvedic Medicine
and Surgery (BAMS)

NURSING & PARAMEDICAL

(I) B.Sc. - Nursing

ABOUT MAHARANA GROUP

Maharana Pratap Group of Institutions was established way back in 1995 under the vision and guiding light of Late Ram Singh Bhadauria Ji. The very first center for the delivery of education was Maharana Pratap Education Centre (MPEC) which was an English medium public school affiliated to UP Board. Since its inception, MPGI has grown into eleven institutions, one university and five schools across Kanpur, Lucknow, New Delhi and Jaipur. We have been providing excellence in education by offering various courses in the diverse streams of Engineering, Pharmacy, Management, Computer Applications, Dental, Nursing, Ayurvedic Sciences & Law*.

Our Campuses extend over several hundred acres of lush green surroundings, possess modern infrastructure, well-equipped laboratories and enviable libraries. We work as a committed and inspired team of more than 1000 highly qualified faculty members providing vision and academic insights to more than 10,000 students. It is our conscious intent to ensure each student has an array of opportunities to showcase his/her talents for the best job prospects through campus placement drives.

MERITORIOUS STUDENTS



2nd Rank

ADITYA KUMAR
(B.TECH-ME-2024)



3rd Rank

RASHMI SACHAN
(MCA-2024)



4th Rank

SHRUTI YADAV
(MCA-2024)



5th Rank

SHIKSHA KATIYAR
(MCA-2024)



9th Rank

JHANVI SHUKLA
(MCA-2023)



8th Rank

RINKI
(MCA-2023)



3rd Rank

SHRUTI OMER
(B.TECH-2022)



8th Rank

ASHI SRIVASTAVA
(MCA-2021)



1st Rank

SHIVANGI PAL
(MBA-2019)



4th Rank

VISHWAS AWASTHI
(MBA-2019)



5th Rank

SUNIDHI SHUKLA
(MCA-2019)



8th Rank

NOUREEN EHSAAAN
(MCA-2019)

• Engineering • Pharmacy • Management • Computer Applications
• Dentistry • Nursing • Ayurvedic Sciences



SCHOLARSHIP PROGRAMME FOR MERITORIOUS STUDENTS

waiver of

50%

of tuition fees

90% in class X, Class XII
& JEE MAINS 90%

waiver of

25%

of tuition fees

85% in class X, Class XII
& JEE MAINS 85%

waiver of

15%

of tuition fees

80% in class X, Class XII
& JEE MAINS 80%

waiver of

10%

of tuition fees

75% in class X, Class XII
& JEE MAINS 75%

FOR MORE DETAILS CONTACT

1800 270 5600

*Terms & Conditions Apply

• Engineering • Pharmacy • Management • Computer Applications
• Dentistry • Nursing • Ayurvedic Sciences

FUNDAMENTAL PHYSICAL QUANTITIES

1.	Mass	M	Kg
2.	Length	L	Meter
3.	Time	T	Sec
4.	Electric Current	I or A	Ampere
5.	Amount of substance	N	Mole (mol)
6.	Luminous Intensity	J	Candela (cd)
7.	Temperature	K or	Kelvin

DERIVED PHYSICAL QUANTITIES

1.	Area	$l \times b$	$[M^0L^2T^0]$	m ²
2.	Volume	$l \times b \times h$	$[M^0L^3T^0]$	m ³
3.	Density	$\frac{M}{V}$	$[ML^{-3}T^0]$	kg/m ³
4.	Specific Gravity	$\frac{\text{Density of Substance}}{\text{Density of Water}}$	$[M^0L^0T^0]$	No units
5.	Frequency	$\frac{\text{Number of Vibrations}}{\text{Time}}$	$[M^0L^0T^{-1}]$	Hertz
6.	Angle	$\frac{\text{Arc}}{\text{Radius}}$	$[M^0L^0T^0]$	No units
7.	Velocity	$\frac{\text{Displacement}}{\text{Time}}$	$[M^0L^1T^{-1}]$	m/sec
8.	Speed	$\frac{\text{Distance}}{\text{Time}}$	$[M^0L^1T^{-1}]$	m/sec
9.	Areal Velocity	$\frac{\text{Area}}{\text{Time}}$	$[M^0L^2T^{-1}]$	m ² /sec ⁻¹
10.	Acceleration	$\frac{\text{Change in velocity}}{\text{Time}}$	$[M^0L^1T^{-2}]$	m/sec ²
11.	Linear Momentum	M X V	$[M^1L^1T^{-1}]$	Kg m/sec
12.	Force	mass X acceleration	$[M^1L^1T^{-2}]$	Kg m/sec ² or Newton
13.	Weight	W=mg	$[M^1L^1T^{-2}]$	Kg m/sec ² or Newton
14.	Moment of force/ Torque/Couple	Force X arm length	$[M^1L^2T^{-2}]$	kgm ² sec ⁻²
15.	Impulse	Force X time	$[M^1L^1T^{-1}]$	kgm/sec or Ns

DERIVED PHYSICAL QUANTITIES

16.	Pressure	$\frac{\text{Force}}{\text{area}}$	$[ML^{-1}T^{-2}]$	N/m ² or Pa
17.	Work	Force X Distance	$[M^1L^2T^{-2}]$	Nm or Joule
18.	Kinetic Energy	$\frac{1}{2}mv^2$	$[M^1L^2T^{-2}]$	Joule
19.	Potential Energy	mgh	$[M^1L^2T^{-2}]$	Joule
20.	Gravitational Constant	$\frac{\text{Force X (Length)}^2}{(\text{mass})^2}$	$[M^{-1}L^3T^{-2}]$	kg ⁻¹ m ³ /sec ²
21.	Gravitational field strength	$\frac{\text{Force}}{\text{mass}}$	$[M^0L^1T^{-2}]$	N kg ⁻¹
22.	Gravitational Potential	$\frac{\text{Work}}{\text{mass}}$	$[M^0L^2T^{-2}]$	J kg ⁻¹
23.	Force constant(k)	$\frac{F}{L}$	$[M^1L^0T^{-2}]$	Nm ⁻¹
24.	Power	$\frac{\text{Work}}{\text{time}}$	$[M^1L^2T^{-3}]$	W or J/Sec
25.	Moment of Inertia	Mass X Distance ²	$[M^1L^2T^0]$	Kgm ²
26.	Stress	$\frac{\text{Force}}{\text{Area}}$	$[M^1L^{-1}T^{-2}]$	N/m ² or Pa
27.	Strain	$\frac{\text{Change in length}}{\text{Original length}}$	$[M^0L^0T^0]$	No Units
28.	Modulus of Elasticity	$\frac{\text{Stress}}{\text{Strain}}$	$[M^1L^{-1}T^{-2}]$	N/m ² or Pa
29.	Poisson's Ration (σ)	$\frac{\text{Lateral Strain}}{\text{Longitudinal Strain}}$	$[M^0L^0T^0]$	No Units
30.	Velocity gradient	$\frac{\text{Change in velocity}}{\text{Distance}}$	$[M^0L^0T^{-1}]$	sec ⁻¹
31.	Coefficient of dynamic viscosity	$\frac{\text{Tangential stress}}{\text{Velocity Gradient}}$	$[M^1L^1T^{-1}]$	Poiseuille
32.	Surface Tension	$\frac{\text{Force}}{\text{Length}}$	$[M^1L^0T^{-2}]$	kgsec ² , N/m
33.	Angular displacement(?)	$\frac{\text{Arc}}{\text{radius}}$	$[M^0L^0T^0]$	radian
34.	Angular velocity(ω)	$\frac{\text{Angular displacement}}{\text{Time}}$	$[M^0L^0T^{-1}]$	rad/sec
35.	Angular acceleration(α)	$\frac{\text{Change in angular velocity}}{\text{Time}}$	$[M^0L^0T^{-2}]$	rad/sec ²
36.	Angular momentum	$I\omega$	ML^2T^{-1}	kg-m ² sec ⁻¹
37.	Angular impulse	$I\omega$	ML^2T^{-1}	kg-m ² sec ⁻¹
38.	Temperature		? or K	Celsius or kelvin

DERIVED PHYSICAL QUANTITIES

39.	Linear Expansion (α)	$\frac{l_2 - l_1}{l_1 \times \text{temp } (t_2 - t_1)}$	$[M^0 L^0 T^0 K^{-1}]$	/Kelvin
40.	Specific heat	$\frac{\text{Energy}}{\text{Mass} \times \text{temp}}$	$[M^0 L^2 T^{-2}]$	J/kg ⁰ C
41.	Latent heat	$\frac{\text{Energy}}{\text{Mass}}$	$[M^0 L^2 T^{-2}]$	Joule-kg ⁻¹
42.	Entropy	$\frac{Q}{?}$	$[M^1 L^2 T^{-2}]$	J/k
43.	Thermal Capacity	$\frac{H}{?}$	$[ML^2 T^{-2}]$	
44.	Gas constant	$\frac{PV}{mT}$	$M^0 L^2 T^{-2} k^1 \text{joule-k}^{-1}$	
45.	Coefficient of thermal conductivity	$\frac{Qd}{A(\theta_2 - \theta_1)t}$	$[MLT^{-3} ?^{-1}] Wm^{-1} k^{-1}$	
46.	Pole strength Ampere X meter		$M^0 L^1 T^0 A$	Am
47.	Magnetic Moment		$M^0 L^2 T^0 A$	Amp-m ²
48.	Magnetic flux		$ML^2 T^{-2} A^{-1}$	weber
49.	Magnetic field, magnetic flux, density (B)		$ML^0 T^{-2} A^{-1}$	Tesla or Gauss (1G=10 ⁻⁴ T)

CHEMISTRY

ATOMIC STRUCTURE

- $r = n^3 h^2 / 4\pi^2 mZe^2 = 0.529 (n^2 Z) \text{Angstrom}$
- $E_i = KE - PE / 2 = -13.6 (z^2 / n^2) \text{ev}$
- Heisenberg uncertainty principle $(\delta x) (\delta p) \geq h/4\pi$
- Moseley's law: $\sqrt{\nu} = a(z-b)$
- Nodes $(n-1) = \text{total nodes}$, $\ell = \text{angular nodes}$, $(\ell-1) \text{ radial nodes}$
- Photoelectric effect: $h\nu = h\nu_0 + 1/2 m v^2$
- Orbital angular momentum: $[\sqrt{\ell(\ell+1)}] h/2\pi$

CHEMICAL BONDING

- Percentage % ionic character = Actual dipole moment / Calculated dipole moment * 100
- Fajan's Factors: following factors are helpful in bringing covalent character in ionic compounds.
 - Small cation
 - Big anion
 - High charge on cation
 - High charge on anion
 - Cations having pseudo inert gas configuration e.g. Cu^+ , Ag^+ etc.
 - Coming of colour or darkness of colour in compounds formed with colourless ions.
- M.O. Theory : a) Bond order = $1/2 (N_B - N_A)$
 - Higher the bond order higher is the bond dissociation energy greater is the stability shorter is the bond length.
- Relative bond strength: $sp^3 d^2 > dsp^3 > sp > p-p \text{ (co-axial)} > p > s > p-p \text{ (co-lateral)}$
- VSEPR theory
 - (LP-LP) repulsion > (LP-BP) > (BP-BP)
- Bond Angle: (a) $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3$ (b) $\text{H}_2\text{O} > \text{H}_2\text{Se}$ (c) $\text{NH}_3 > \text{NF}_3$ (d) $\text{Cl}_2\text{O} > \text{OF}_2$

CHEMICAL EQUILIBRIA

- $K_p = K_c (RT)^{\Delta n}$
- Free energy change (ΔG)
 - If $\Delta G = 0$ then reversible reaction would be in equilibrium
 - If $\Delta G = (+ve)$ then equilibrium will displace in backward direction
 - If $\Delta G = (-ve)$ then equilibrium will displace in forward direction
- $K_c \text{ unit} - (\text{moles/lit})^{\Delta n}$
- $K_p \text{ unit} - (\text{atm})^{\Delta n}$
- Total moles at equilibrium = {total initial moles + Δn }
- Time required to establish equilibrium $\propto 1/K_c$

CHEMISTRY

THE SOLID STATE

- a) No of atoms per unit cell : Simple cubic =1 Fcc=4, Bcc=2, Hcp=6
 b) Packing fraction (%): Simple cubic =0.52, Bcc=0.68, Fcc=0.74, Hcp=0.74, Diamond=0.34
 c) Atomic radius r of the unit cell pure elements: simple cubic $r = a/2$ bcc $r = \sqrt{3}a/4$ fcc $r = \frac{a}{2\sqrt{2}}$
 d) Neighbour distance of the unit cell: Simple cubic $d=a$ bcc $d = \sqrt{3}a/2$ fcc $d = \frac{a}{\sqrt{2}}$
 e) Density of the unit cell $d = z \cdot M / N_A \cdot a^3$

SOLUTIONS

- 1) Molarity = no. of moles of solute/volume of solution (litre)
- 2) Molality=no. of moles of solute/mass of solvent (kg)
- 3) $m = 1000M/1000d - MM_s$ & Molarity 1/temp
- 4) Mole % = mass fraction *100
- 5) Mass fraction of A = $W_A / W_A + W_B$
- 6) PPM= (mass of solute/mass of solution)*10⁶
- 7) Normality = gram equivalent of solute/volume of solution (litres)
- 8) Raoult's law: $P_o - P_s / P_s = n/n+N$
- 9) $i = \text{normal molar mass} / \text{observed molar mass}$

POLYMERS : SOME COMMON POLYMERS

1. Bakelite (phenol + formaldehyde)
2. Nylon 6, 6 (hexamethylene diamine + adipic acid)
3. Nylon 6 (caprolactum)
4. Rubber (isoprene)
5. Polyvinyl chloride (vinyl chloride)
6. Polythene (ethene)

ELECTRO CHEMISTRY

- i. Faraday's first law of electrolysis: $m \propto Q$, $m = Z \cdot I \cdot t$ [where $z = E/96500$]
- ii. Faraday's second law of electrolysis: $m \propto E$ & $(E_1/E_2) = m_1/m_2$
- iii. Resistance: $R = \rho l/a$
- iv. Conductance: $G = 1/R$
- v. Kohlrausch's law: $\Lambda^\circ_{\pm} = \lambda^\circ_+ + \lambda^\circ_-$
- vi. Degree of dissociation : $\alpha = \frac{\Lambda^1}{\Lambda^0}$
- vii. Nernst equation- $E = (E^0 - 0.591/n) (\text{products}) / [\text{reactants}]$
- viii. $\Delta G = -nFE_{\text{cell}}$
- viii. $K_{\text{eq}} = \text{antilog} \frac{nE_0}{0.0591}$

CHEMISTRY

OXIDATION & REDUCTION

- Oxidant / itself is reduced (gives O_2)
Or Oxidant-e(s) Acceptor
Reductant itself is oxidised (gives H_2)
Or reductant -e (s) Donor
- Electrochemical series: Li, K, Ba, Sr, Ca, Na, Mg, Al, Mn, Zn, Cr, Fe, Cd, Co, Ni, Sn, Pb, H_2 , Cu, Ag, Pt, Au
As we move from top to bottom in this series:
 - Standard reduction potential increases
 - Standard oxidation potential decreases
 - Reducing capacity decreases
 - Ionization potential increases
 - Reactivity decreases
- Formal charge = Group no. - [No. of bonds + No. of non bonded e(s)]
- At Anode-Oxidation, Cathode-Reduction

CHEMICAL KINETICS

- Unit of rate constant :- $K = \text{mol}^{1-\text{an}} \text{lit}^{\text{an}-1} \text{sec}^{-1}$
- Zero order reaction : $K = x/t$ and $t_{1/2} = a/2k$
- First order reaction : $K = (2.303/t) * \log [a/a-x]$ and $t_{1/2} = 0.693K$
- Second order reaction : $k = 1/t(x/a[a-x])$
 $k = \{2.303/t(a-b)\} \log [b(a-x)/a(b-x)]$ and $t_{1/2} = 1/Ka$.
- Arrhenius equation : $k = Ae^{-E_a/R.T.}$
- Energy of activation = Threshold energy- energy of reactant.

VOLUMETRIC ANALYSIS

- Equivalent weight of Element = Atomic Wt. of The Element/Valence Factor
- Equivalent Weight of Compound = Formula Wt. of Compound/Valence Factor
- Equivalent Weight of An Ion = Formula Wt. (at. Wt.) of Ion/ Its Valency
- Law of Dulong And Petit: Atomic Wt. X Specific Heat = 6.4
- Normality (n) = No. of gm Equivalents/ Volume of The Solution in Litres
- Molarity (m) = No. of Moles/ Volume of The Solution in Litres
- When A Solution is Diluted: N_1V_1 (before Dilution) = N_2V_2 (after Dilution)

CHEMISTRY

MOLE CONCEPT

I. Mole concept: GAM 1 gm atom 6.02×10^{23} atom

GMM = 1gm mole 6.02×10^{23} molecules

$N_A = 6.02 \times 10^{23}$

II. Moles (gases) at NTP = volume (L)/22.4

III. Molecular mass = 2X vapour density

NUCLEAR CHEMISTRY

1. Radius of nucleus: $R = R_0 A^{1/2}$

2. The amount N of the radioactive substance left after 'n' half-lives = No. (initial amount)/ 2^n

3. Half- period $t_{1/2} = 0.693/\lambda$

4. Rate of disintegration: $dN/dt = \lambda \cdot N$ & $\lambda = (2.303/t) \log_{10} N_0/N = N_0 e^{-\lambda t}$

5. Average life (t_{av}) = total life time of all the atoms/ total number of atoms = $1.44 t_{1/2}$.

SURFACE CHEMISTRY & COLLOIDAL STATE

1. Higher is the valency of active ion, the greater is its coagulating power.

2. Emulsion: Colloidal solution of two immiscible liquids [O/W emulsion, W/O emulsion]

3. Emulsifier: Long chain hydrocarbons are added to stabilize emulsion.

4. Lyophilic colloid: Starchy gum, gelatin have greater affinity for solvent, Sol, Can be easily prepared by bringing in contact with solvent and warming.

5. Lyophobic colloid: No affinity for solvent special methods are used to prepare Sol. [e.g. As_2S_3 , $Fe(OH)_3$, Sol].

6. Properties of colloidal solution:

- Dispersion method
- Condensation method.

7. Properties of colloidal solution.

- Tyndall effect
- Brownian movement
- Coagulation
- Filtrability

COORDINATION COMPOUNDS

1. Coordination number is the number of the nearest atoms or groups in the coordination sphere.

2. Ligand is a Lewis base donor of electrons that bonds to a central metal atom in a coordination compound.

3. Paramagnetic substance is one that is attracted to the magnetic field this results on account of unpaired electrons present in the atom/molecule/ion.

4. Effective atomic number EAN = (Z-Oxidation number) + (2Coordination number)

5. Factors affecting stability of complex.

- Greater the charge on the central metallion, greater is the stability.
- Greater the ability of the ligand to donate electron pair (basic strength) Greater is the stability.
- Formation of chelate rings increases the stability.

CHEMISTRY

MAIN USES OF SOME COMPOUNDS

Alkane- fuel, Alkene- polymer, Alkyne solvent making westron, Westrosol, General alkyl hollide- as solvents, CHCl_3 -Anaesthetic, Germicide, CH_2Cl_2 antiseptic and deodorant, CCl_4 - pyrene and fire distinguisher, CH_3OH - antifreeze, defarming of alcohol, $\text{C}_2\text{H}_5\text{OH}$ - tonic, wine preparation, CH_3CHO - antiseptic CH_3NH_2 - refrigerating agent $\text{C}_2\text{H}_5\text{H}_2$ -photography.

IDENTIFICATION TESTS

- Unsaturated compound (Bayer's reagent) -Decolorising the reagent
- Alcohols (Ceric ammonium nitrate solution) Red coloration
- Phenols (Neutral FeCl_3 solution)- Violet/deep blue coloration
- Aldehydes and ketones (2-4 D.N.P.) Orange precipitate
- Acids (NaHCO_3) Brisk effervescence (CO_2 is evolved)
- 1° amine ($\text{CHCl}_3 + \text{KOH}$)- foul smell
- 2° amine ($\text{NaNO}_2 + \text{HCl}$) -Yellow oily liquid (Nitrosoamine)

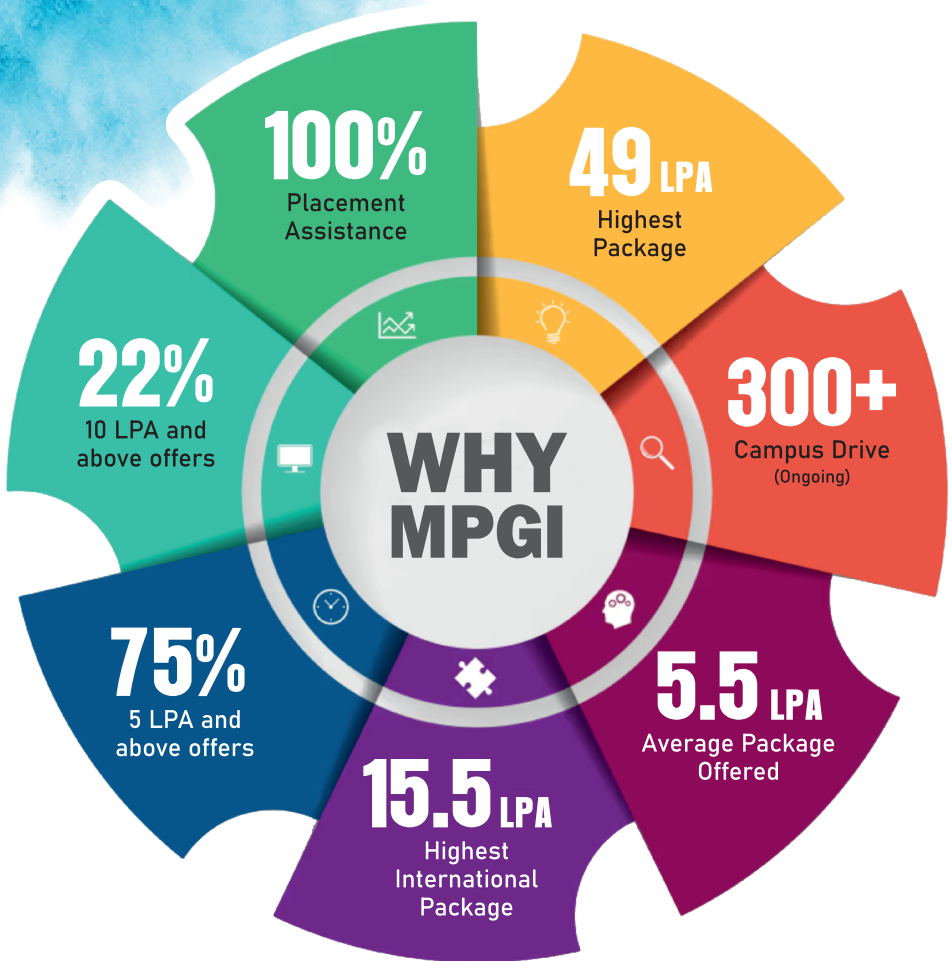
GENERAL ORGANIC CHEMISTRY

- The order of decreasing electro negativity of hybrid orbitals is $sp > sp^2 > sp^3$
- Conformational isomers are those isomers which arise due to rotation around a single bond.
- A meso compound is optically inactive, even though it has asymmetric centres (due to internal compensation of rotation of plane polarised light).
- An equimolar mixture of enantiomers is called racemic mixture which is optically inactive.
- Tautomerism is the type of isomerism arising by the migration of hydrogen.
- Reaction intermediates and reagents: homolytic fission- Free radicals heterolytic fission- ions (Carbonium, Carbanion, ioncarbonium etc.)
- Nucleophiles- electron rich.
- Electrophiles - electron deficient
- Inductive effect is due to sigma electron displacement along a chain and is permanent effect.
- +I(inductive effect)- increases basicity-I (inductive effect) increases acidity of compounds.
- Resonance is a phenomenon in which two or more structures can be written for the same compound but none of them actually exists.

ARENES

- All ortho and para directing groups are ring activation groups (except-X).
They are:- OH , -NH_2 , -X-R , -OR , etc.
- All meta directing groups are ring deactivating group.
They are:- CHO , -COOH , -NO_2 , -CN , $\text{-N}^+\text{R}_3$, etc.

UNPARALLELED PLACEMENT STATISTICS



AFFILIATIONS & APPROVALS



All India Council for Technical Education



Dental Council of India



Pharmacy Council of India



Abdul Kalam Technical University



Chatrapati Sahu Ji Maharaj University



State Medical Faculty



Board of Technical Education



National Commission for Indian System of Medicine



The Bar Council of India



Atal Bihari Vajpayee Medical University Lucknow

ASSOCIATIONS



PHYSICS

ELECTROSTATICS

1. Coulombs law : $F = (1/4\pi\epsilon_0)q_1q_2/r^2$
2. Electric field : $E = (1/4\pi\epsilon_0)q/r^2$
3. Potential energy(work done by external agency): $U = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r}$
4. Electric flux : $\Phi_E = \oint_s \vec{E} \cdot d\vec{s}$
5. Capacitance : $C = Q/V$
6. Capacitance for parallel plate capacitor: $C = \epsilon_0 A/d$
7. Capacitance of a sphere: $C = 4\pi\epsilon_0 R$ {where R = radius of the sphere}
8. Energy stored in a capacitor: $U = (1/2) QV = (1/2) CV^2 = \frac{Q^2}{2C}$
9. For capacitors in series: $1/C = 1/C_1 + 1/C_2 + 1/C_3 + \dots$
10. For capacitors in parallel combination: $C = C_1 + C_2 + C_3 + \dots$

CURRENT ELECTRICITY

1. Current flowing through a wire : $I = dq/dt$
2. Ohm's law: $V \propto I \Rightarrow V = IR$
3. Resistance: $R = \rho \frac{L}{A}$
4. For resistance in series: $R = R_1 + R_2 + R_3 + \dots$
5. For resistance in parallel: $1/R = 1/R_1 + 1/R_2 + 1/R_3 + \dots$
6. Drift velocity: $V_d = eE\tau/m$
7. Current in terms of drift velocity: $I = neAv_d$
8. Current density : $J = I/A = nev_d$
9. Mobility: $\mu = V_d/E = e\tau/m$
10. Primary cell : Leclanche cell, Daniel cell
11. Secondary cell : Lead accumulator, Alkali cell
12. Kirchoff's Current law: $i_1 + i_2 + i_3 + \dots + i_n = 0$
13. Kirchoff's Voltage or loop law: $iR = mf$
14. Terminal voltage : $V = E - IR$
15. Internal resistance: $r = E - V/I$
16. Maximum power transfer theorem: $P = E^2/4R$
17. Power dissipation in electric circuit: $P = VI = I^2R = V^2/R$ watt

PHYSICS

MAGNETISM

- Magnetic moment : $M = (e/2m)L = -n(ch/2\pi m)$
- For a bar magnet : $M = m \times 2L$ {where $m =$ pole strength}
- Field due to bar magnet (on axial point) : $B = (\mu_0/4\pi) 2M/r^3$
- Field due to bar magnet (on equatorial point) : $B = (\mu_0/4\pi)M/r^3$
- Intensity of magnetization : $I = M/V$ or $I = m/A$ {where $m =$ pole strength, $A =$ area of cross sec.}
- Magnetic susceptibility : $X_m = \frac{1}{H}$
- Magnetic permeability : $\mu = B/H$
- Relative permeability : $\mu_r = \mu/\mu_0$ {where $\mu_0 =$ permeability of free space}
- Relation b/w B and μH : $B = \mu_0(H+I)$
- Relation b/w X_m and μ_r : $\mu_r = 1 + X_m$
- Curie law and Curie temperature : $X_m = C/(T-T_c)$ where $\{T_c =$ curie's temp.)

ELECTRO MAGNETIC INDUCTION

I. Magnetic flux: $\Phi_b = \int \vec{B} \cdot d\vec{S}$

II. Faraday's law: $e = \alpha \frac{d\Phi}{dt}$

III. Lenz's law: $e = -L \frac{di}{dt}$

IV. Emf induced due to linear motion of a conducting rod: $e = Bvl$ volt

V. Emf induced due to rotation of a conducting rod: $e = \frac{1}{2} B\omega l^2 = B\pi n l^2$

VI. Self inductance: $L = \Phi_b/I = e/-(di/dt)$

VII. Self inductance of a solenoid: $L = \mu_0 N^2 A/l$ {where $l =$ length}

VIII. Mutual inductance: $M = \mu_0 N_1 N_2 A/l$

IX. For inductors in series: $L = L_1 + L_2 + 1/L_3 + \dots$

X. For inductors in parallel: $1/L = 1/L_1 + 1/L_2 + 1/L_3 + \dots$

XI. Energy stored in an inductor: $U_s = (1/2)LI^2$

ALTERNATING CURRENT (A.C.)

A. Alternating emf: $E = E_0 \sin \omega t$

B. Alternating current : $I = I_0 \sin \omega t$

C. Reactance : $X = E/I = E_0/I_0$

D. Inductive reactance: $X_L = \omega L = 2\pi fL$

E. Capacitive reactance : $X_C = 1/\omega C = 1/2\pi fC$

F. Impedence: $Z = E_{rms}/i_{rms}$

PHYSICS

ALTERNATING CURRENT (A.C.)

G. Susceptance: $S=1/X$ mho

H. Conductance: $G=1/R$ mho

I. Admittance : $Y = 1/Z$ mho

J. Power in a.c. Circuit : $P = I \times E$ $P_{INST} = E_{INST} I_{INST}$ $P_{AV} = E_{RMS} I_{RMS} \cos\Phi$

K. Power factor : $\cos\Phi = R/Z$

MOTION IN A STRAIGHT LINE

- The area under the velocity-time curve b/w times t_1 and t_2 is equal to the displacement of the object during that interval of time.
- If a body falls freely, the distance covered by it in each subsequent second starting from first second will be in the ratio 1:3:5:7 etc.
- If a body is thrown vertically up with an initial velocity u , it takes u/g second to reach maximum height and u/g second to return, if air resistance is negligible.
- If air resistance acting on a body is considered, the time taken by the body to reach maximum height is less than the time to fall back the same height.
- Kinematic equations: $v=u+at$, $s=ut+\frac{1}{2}at^2$
 $v^2=u^2+2as$
- \vec{u} =initial velocity \vec{v} = final velocity \vec{a} =acceleration = const \vec{s} =displacement
- If acceleration is variable use calculus approach.
- Relative velocity: $v_{BA}=u_B-v_A$

WORK, ENERGY AND POWER

- If a light body and a heavy body have equal kinetic energy, then heavy body has greater momentum.
- Work due to static force of friction on system as whole is always zero.
- If a body moves with constant power, its velocity (v) is related to distance travelled (x) by the formula $v \propto x^{3/2}$.
- Work due to kinetic force of friction between two contact surfaces is always negative. It depends on relative displacement between contact surfaces. $W_{FK} = -F_K (S_{rel})$,
- $W = \Delta K$ total work due to all kinds of forces, $\Delta K =$ total change in kinetic energy.
- $W_{CONSERVATIVE} = -\Delta U$ total work due to all kinds of conservative forces, $\Delta U =$ total change in all kinds of potential energy.
- Coefficient of restitution (e) = $\frac{-(v_2-v_1)}{u_2-u_1}$ -velocity of seperation / velocity of approach
- The total momentum of a system of particles is a constant in the absence of external forces.

PHYSICS

MODERN PHYSICS

1. Einstein's photoelectric equation is $\frac{1}{2} m v_{\text{max}}^2 = eV_0 = hu - \Phi_0 = h(u - u_0)$
2. The nuclear mass M is always less than the total mass $\sum m$, of its constituents. The difference in mass of a nucleus and its constituents is called the mass defect. $\Delta M = \{Zm_p + (A-Z)m_n\} - M$; $\Delta E_0 = \Delta Mc^2$; $1 \text{amu} = 931 \text{ MeV}$
3. $E_n = -13.6 \left(\frac{Z^2}{n}\right) \text{ eV}$ For hydrogen like atom
4. Bragg's law: $2d \sin \theta = n\lambda$
5. Law of radioactive decay: $N = N_0 e^{-\lambda t}$
6. Activity = $dN/N = -\lambda N$ (unit is Becquerel)
7. Half time period, $T_{1/2} = 0.693/\lambda$
8. X-rays: $\lambda_{\text{min}} = \frac{12400}{V} \text{ \AA}$
9. Mosley law : $\lambda = a(Z-b)^2$

KINETIC THEORY

- 1) Kinetic theory of an ideal gas gives the relation $P = \frac{1}{3} nmv^2$, where n is number density of molecules, m the mass of the molecule and \bar{v}^2 is the mean of square speed. Combined with the ideal gas equation it yields a kinetic interpretation of temperature, $\frac{1}{2} nmv^2 = \frac{3}{2} k_B T$.
- 2) The law of equipartition of energy is stated as : the energy for each degree of freedom in thermal equilibrium is $\frac{1}{2}(k_B T)$.
- 3) The translational kinetic energy $E = \frac{3}{2} k_B NT$. This leads to a relation $PV = \frac{2}{3} E$.
- 4) Speed of sound in a gas $v_s = \sqrt{RT/M}$, $v/v_{\text{rms}} = \sqrt{\gamma/3}$ where $v_s = v_{\text{rms}}$

MECHANICAL PROPERTIES OF SOLID

1. If S is the stress and Y is young's modulus, the energy density of the wire E is equal to $S^2/2Y$
2. If α is the longitudinal strain and E is the energy density of a stretched wire Y , Young's modulus of wire, when E is equal to $1/2 Y \alpha^2$.

MECHANICAL PROPERTIES OF FLUIDS

1. PASCALS'S LAW : a change in pressure applied to an enclosed fluid is transmitted undiminished to every point of the fluid and the walls of the containing vessel.
2. Bernoulli's principle states that during streamlined flow, the sum of the pressure energy (P), the kinetic energy per unit volume ($\rho v^2/2$) and the potential energy per unit volume (ρgh) remains constant. $\{P + \frac{1}{2} \rho v^2 + \rho gh = \text{constant}\}$
3. Surface tension is a force per unit length (or surface energy per unit area) acting in the plane of interface b/w the liquid and the bounding surface.
4. Stokes's law states that the viscous drag force F on a sphere of radius r a moving with velocity v through a fluid of viscosity η is, $F = -6\pi r \eta v$.

PHYSICS

MECHANICAL PROPERTIES OF FLUIDS

- The surface tension of a liquid is zero at boiling point. The surface tension is zero at critical temperature.
- If a drop of water of radius R is broken into n identical drops, the work done in the process is $4\pi R^2 S(n^{2/3}-1)$.
- Two capillary tubes each of radius r are joined in a parallel. The rate of flow is Q . if they are replaced by single capillary tube of radius R for the same rate of flow, then $R=2^{1/2} r$.
- If radius of a drop is doubled its terminal velocity increases to 4 times.

OSCILLATIONS

- The particle velocity and acceleration during SHM as functions of time are given by : $v(t) = -A\omega \sin(\omega t + \Phi)$ $a(t) = -A\omega^2 \cos(\omega t + \Phi)$ velocity amplitude $V_m = A\omega$ and acceleration amplitude $a_m = A\omega^2$.
- A particle of mass m oscillating under the influence of a Hooke's law restoring force given by $F = -kx$ exhibits simple harmonic motion with $\omega = \sqrt{k/m}$ (angular frequency), $T = 2\pi \sqrt{m/k}$ (time period). Such a system is also called linear harmonic oscillator.
- A body of mass M is suspended from a spring whose force constant is K and mass is m . The time period of this system will be $T = 2\pi \sqrt{\frac{M+m}{K}}$.
- Time period for conical pendulum $T = 2\pi \sqrt{\frac{l \cos \theta}{g}}$ where θ angle between string and vertical.

THERMAL PROPERTIES OF MATTER

- The coefficient of linear expansion (α_l) is defined by the relations : $\frac{\Delta l}{l} = 1 + \alpha_l \Delta T$
Coefficient of surface expansion (β) is defined by the relation $\frac{\Delta A}{A} = 1 + \beta \Delta T$
& Coefficient of volume expansion (γ) is defined by the relation $\frac{\Delta V}{V} = 1 + \gamma \Delta T$
The relation among α , β & γ is ($\gamma = 2\beta = 3\alpha$)
- In conduction, heat is transferred between neighbouring parts of a body through molecular collisions, without any flow of matter. For a bar of length L and uniform cross section A with its ends maintained at temperatures T_c and T_0 the rate of flow of heat H is $H = KA(T_c - T_0/L)$, where K is the thermal conductivity of the material of the bar.
- Convection involves flow of matter within a fluid due to unequal temperatures of its parts.
- Radiation is the transmission of heat as electromagnetic waves. Radiant heat travels with the speed of light.
- Stefan's law of radiation : $E = \sigma T^4$.
- Newton's law of Cooling: the rate of cooling of a body is proportional to the excess temperature of the body over the surroundings : $dQ/dt = -k(T_2 - T_1)$; where T_1 is the temp. of the surrounding medium and T_2 is the temperature of the body.



Jaipur Campus



Bithoor Campus



Baikunthpur Campus



Mandhana Campus, Kanpur



Lucknow Campus



Maharana Pratap Education Centre,
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Pratap International School,
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OUR CAMPUSES

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MATHEMATICS

LIMITS : SOME STANDARD EXPANSION FOR SOLVING LIMITS

1. $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$
2. $e^{-x} = 1 - x + \frac{x^2}{2} - \frac{x^3}{3} + \dots + \frac{(-1)^r \cdot x^r}{r} + \dots$?
3. $\log(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \dots$
4. $\log_e(1-x) = -x - \frac{x^2}{2} - \frac{x^3}{3} - \frac{x^4}{4} - \dots$?
5. $a^x = 1 + x(\log_e a) + \frac{x^2(\log_e a)^2}{2} + \frac{x^3(\log_e a)^3}{3} + \dots$?
6. $\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$
7. $\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots$
8. $\tan(x) = x + \frac{x^3}{3} + \frac{2x^5}{15} + \dots$

DIFFERENTIATION : DERIVATIVE OF SOME STANDARD FUNCTIONS

- A. $\frac{d}{dx}(\text{constant}) = 0$
- B. $\frac{d}{dx}(ax) = a$
- C. $\frac{d}{dx}(x^n) = nx^{n-1}$
- D. $\frac{d}{dx}(e^x) = e^x$
- E. $\frac{d}{dx}(a^x) = a^x \log_e a$
- F. $\frac{d}{dx}(\log_e x) = \frac{1}{x}$
- G. $\frac{d}{dx}(\log_a x) = \frac{1}{x \cdot \log_a a}$
- H. $\frac{d}{dx}(\sin x) = \cos x$
- I. $\frac{d}{dx}(\cos x) = -\sin x$
- J. $\frac{d}{dx}(\tan x) = \sec^2 x$
- K. $\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$
- L. $\frac{d}{dx}(\sec x) = \sec x \tan x$
- M. $\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$
- N. $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
- O. $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$
- P. $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
- Q. $\frac{d}{dx}(\sinh x) = \cosh x$
- R. $\frac{d}{dx}(\cosh x) = \sinh x$
- S. $\frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$

MATHEMATICS

INDEFINITE INTEGRATION STANDARD INTEGRALS

I. $\int 0 \cdot dx = c$

III. $\int K \cdot dx = Kx + c$

V. $\int \frac{1}{x} dx = \log_e |x| + c$

VII. $\int a^x dx = a^x / \log_e a + c = a^x \log_a e + c$

IX. $\int \cos x dx = \sin x + c$

XI. $\int \cot x dx = \log |\sin x| + c$

XII. $\int \sec x dx = \log |\sec x + \tan x| + c = -\log |\sec x - \tan x| + c$

XIII. $\int \operatorname{cosec} x dx = \log |\operatorname{cosec} x - \cot x| + c$

XV. $\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x + c$

XVII. $\int \operatorname{cosec}^2(x) dx = -\cot x + c$

XIX. $\int \frac{1}{x^2 - a^2} dx = \frac{1}{2a} \log \left| \frac{x-a}{x+a} \right| + c$

XXI. $\int \frac{1}{\sqrt{a^2 - x^2}} dx = \sin^{-1} \frac{x}{a} + c$

XXII. $\int \frac{1}{\sqrt{x^2 + a^2}} dx = \sinh^{-1} \left(\frac{x}{a} \right) + c = \log |x + \sqrt{x^2 + a^2}| + c$

XXIII. $\int \frac{1}{\sqrt{x^2 - a^2}} dx = \cosh^{-1} \left(\frac{x}{a} \right) + c = \log |x + \sqrt{x^2 - a^2}| + c$

XXIV. $\int \sqrt{a^2 - x^2} dx = \frac{1}{2} [x\sqrt{a^2 - x^2} + a^2 \sin^{-1} \left(\frac{x}{a} \right)] + c$

XXV. $\int \sqrt{x^2 + a^2} dx = \frac{1}{2} [x\sqrt{x^2 + a^2} + a^2 \log |x + \sqrt{x^2 + a^2}|] + c$

XXVI. $\int \sqrt{x^2 - a^2} dx = \frac{1}{2} [x\sqrt{x^2 - a^2} - a^2 \log |x + \sqrt{x^2 - a^2}|] + c$

XXVII. $\frac{e^{ax}}{a^2 + b^2} [a \sin (bx) - b \cos (bx)]$

XXVIII. $\frac{e^{ax}}{a^2 + b^2} [a \cos (bx) + b \sin (bx)] + c$

II. $\int 1 \cdot dx = x + c$

IV. $\int x^n dx = \frac{x^{n+1}}{n+1}$

VI. $\int e^x dx = e^x + c$

VIII. $\int \sin x dx = -\cos x + c$

X. $\int \tan x dx = \log \sec x + c = -\log |\cos x| + c$

XIV. $\int \sec x \tan x dx = \sec x + c$

XVI. $\int \sec^2 x dx = \tan x + c$

XVIII. $\int \frac{1}{x^2 + a^2} dx = \frac{1}{a} \tan^{-1} \left(\frac{x}{a} \right) + c$

XX. $\int \frac{1}{a^2 - x^2} dx = \frac{1}{2a} \log \left| \frac{a+x}{a-x} \right| + c$

MATHEMATICS

3-D COORDINATE GEOMETRY

- Distance between two points: $PQ = \sqrt{(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2}$
- Direction cosines of a line : $l = \cos\alpha$ $m = \cos\beta$ $n = \cos\gamma$ $\{l^2 + m^2 + n^2 = 1\}$
- Direction ratios of a line : $a/l = b/m = c/n$ $l = \pm a/\sqrt{a^2+b^2+c^2}$
 $m = \pm b/\sqrt{a^2+b^2+c^2}$
 $n = \pm c/\sqrt{a^2+b^2+c^2}$
- Conditions for parallel lines : if $AB \parallel CD$ - $\frac{l_1}{l_2} = \frac{m_1}{m_2} = \frac{n_1}{n_2}$
- Conditions for perpendicular lines : if $AB \perp CD$ - $l_1l_2 + m_1m_2 + n_1n_2 = 0$
- Cartesian eq. of a line through two points: $\frac{x-x_1}{x_2-x_1} = \frac{y-y_1}{y_2-y_1} = \frac{z-z_1}{z_2-z_1}$
- Coordinates of a mid point : $(x_1+x_2/2; y_1+y_2/2; z_1+z_2/2)$
- Centroid of a triangle: $(x_1+x_2+x_3/3; y_1+y_2+y_3/3; z_1+z_2+z_3/3)$

VECTORS : TYPES OF VECTORS

- Zero vector or null vector: a vector whose magnitude is zero
- Unit vector: a vector of unit magnitude ($\hat{u} = \text{vector } u / |u|$)
- Equal vector : $\vec{a} = \vec{b}$ and having same direction
- Co-initial vectors: vectors having same initial point
- Free vectors: the vector whose location is not fixed
- Position vector: a vector which give position of one point with respect to another.
- Addition of vectors: $\vec{c} = \vec{a} + \vec{b}$
- Subtraction of vectors: $\vec{a} - \vec{b} = \vec{a} + (-\vec{b})$
- Scalar or dot product: $\vec{a} \cdot \vec{b} = |a| |b| \cos\theta$ $\{\hat{i} \cdot \hat{i} = 1, \hat{j} \cdot \hat{j} = 1, \hat{k} \cdot \hat{k} = 1$
 $\hat{i} \cdot \hat{j} = 0, \hat{j} \cdot \hat{k} = 0, \hat{k} \cdot \hat{i} = 0\}$
- Vector or cross product: $\vec{a} \times \vec{b} = |a| |b| \sin\theta \hat{n}$
- Area of triangle : $\frac{1}{2} | \vec{AB} \times \vec{AC} |$
- Area of parallelogram: $| \vec{a} \times \vec{b} |$
- Volume of Parallelopiped: $[\vec{a} \ \vec{b} \ \vec{c}]$ {scalar triple product}
- Vector triple product: $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$

PROBABILITY

- $P(A)$ = no. of favourable cases to A/no. of exhaustive cases to A
- $P(A \cup B) = P(A) + P(B)$ { for mutually exclusive events }
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (for not mutually exclusive events)
- Conditional probability: $P(B/A) = \frac{P(A \cap B)}{P(A)}$

MATHEMATICS

SOME IMPORTANT RESULTS

- | | |
|--|------------------|
| i. $P(A) + P(A') = 1$ | $*AB = A \cap B$ |
| ii. $P(A+B) = 1 - P(A'B')$ | $A+B = A \cup B$ |
| iii. $P(A/B) = \frac{P(A \cap B)}{P(B)}$ | $A^1 = \bar{A}$ |
| iv. $P(A+B) = P(A) + P(B) - P(A \cap B)$ | $B^1 = \bar{B}$ |
| v. $P(A'B) = P(B) - P(A \cap B)$ | |
| vi. $P(AB) = P(A) + P(B) - P(A+B)$ | |
| vii. $P(\text{exactly one event}) = P(A'B) + P(A'B')$ | |
| viii. $P(A^1+B^1) = 1 - P(A \cap B)$ | |
| ix. $P(\text{neither A nor B}) = P(A'B') = 1 - P(A+B)$ | |
| x. No. of exhaustive cases on tossing coin n times = 2^n | |
| xi. No of exhaustive cases on throwing one dice n times = 6^n | |
| xii. $P(A \cap B \cap C) = P(A) P(B) P(C)$, if A, B & C are independent | |

INVERSE TRIGONOMETRIC FUNCTIONS MULTIPLE ANGLE FORMULAE INVOLVING 2A AND 3A

- $\sin 2A = 2 \sin A \cos A$
- $\sin A = 2 \sin (A/2) \cos (A/2)$
- $\cos 2A = \cos^2 A - \sin^2 A = 2 \cos^2 A - 1 = 1 - 2 \sin^2 A$
- $\sin 2A = 2 \tan A / (1 + \tan^2 A)$
- $\cos 2A = \frac{1 - \tan^2(A)}{1 + \tan^2(A)}$
- $\tan 2A = 2 \tan A / (1 - \tan^2 A)$
- $\sin 3(A) = 3 \sin(A) - 4 \sin^3(A)$

DOMAIN AND RANGE OF INVERSE TRIGONOMETRIC FUNCTIONS

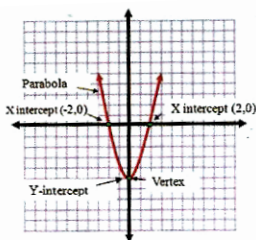
Function	Domain	Range
$y = \sin^{-1} x$	$[-1, 1]$	$[-\pi/2, \pi/2]$
$y = \cos^{-1} x$	$[-1, 1]$	$[0, \pi]$
$y = \tan^{-1} x$	$(-\infty, \infty)$	$(-\pi/2, \pi/2)$
$y = \cot^{-1} x$	$(-\infty, \infty)$	$(0, \pi)$
$y = \sec^{-1} x$	$(-\infty, -1] \cup [1, \infty)$	$[0, \pi/2) \cup (\pi/2, \pi]$
$y = \operatorname{cosec}^{-1} x$	$(-\infty, -1] \cup [1, \infty)$	$[-\pi/2, 0) \cup (0, \pi/2]$

- $\cos 3A = 4 \cos^3(A) - 3 \cos A$
- $\tan 3A = 3 \tan A - \tan^3 A / (1 - 3 \tan^2 A)$
- $\sin^{-1}(x) + \cos^{-1}(x) = \pi/2$

MATHEMATICS

CONIC SECTIONS

1. The equation of a circle with centre (h, k) and the radius r is $(x-h)^2 + (y-k)^2 = r^2$
2. Equation of tangent: $xx_1 + yy_1 + g(x+x_1) + f(y+y_1) + c = 0$
3. The equation of the parabola with focus at $(a, 0)$ $a > 0$ and directrix $x = -a$ is $y^2 = 4ax$.
4. Latus rectum of a parabola is a line segment perpendicular to the axis of the parabola, through the focus and whose end points lie on the parabola.
5. Length of the latus rectum of the of the parabola $y^2 = 4ax$ is $4a$.
6. Equation of tangent $x - y + at^2 = 0$
7. An ellipse is the set of all points in a plane the sum of whose distances from two fixed points in the plane is a constant.
8. The equations of an ellipse with foci on the x-axis $x^2/a^2 + y^2/b^2 = 1$; tangent at $(\frac{x}{a}) \cos \theta + (\frac{y}{b}) \sin \theta - 1 = 0$
9. Latus rectum of the ellipse $x^2/a^2 + y^2/b^2 = 1$ is $2b^2/a$.
10. The eccentricity of an ellipse is the ratio between the distances of a point from the centre of the ellipse to one of the foci and to one of the vertices of the ellipse.
11. A hyperbola is the set of all points in a plane, the difference of whose distances from two fixed points in the plane is a constant.
12. The equation of a hyperbola with foci on the x-axis is $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ Two asymptotes : $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$
13. Latus rectum of the hyperbola : $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is $\frac{2b^2}{a}$



This parabola opens up and can be classified as **concave up**.

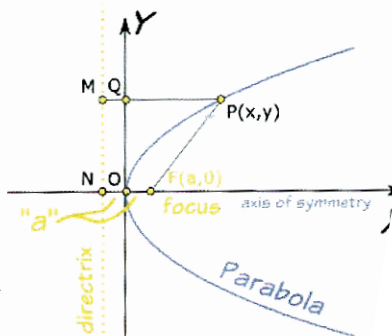
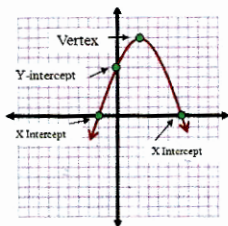
All parabolas that open up will have a **positive "a"** value.

The vertex is the lowest point or the **minimum point**.

This parabola opens down and can be classified as **concave down**.

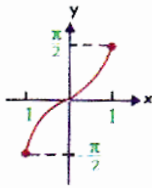
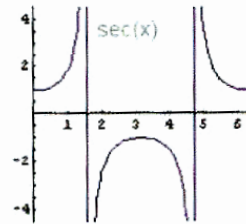
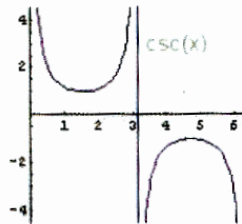
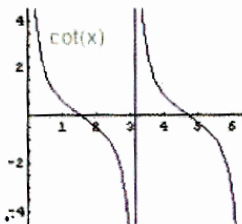
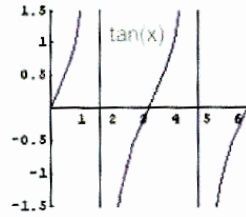
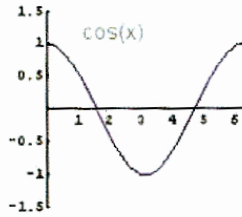
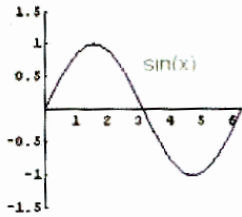
All parabolas that open down will have a **negative "a"** value.

The vertex is the highest point or the **maximum point**.

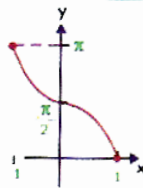


MATHEMATICS

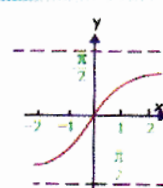
Graphs of Different Functions



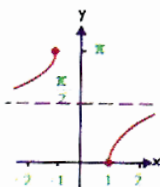
Domain : $-1 \leq x \leq 1$
Range : $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$



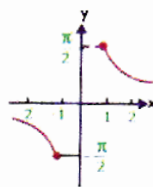
Domain : $-1 \leq x \leq 1$
Range : $0 \leq y \leq \pi$



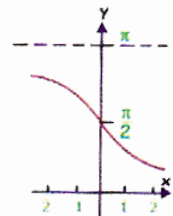
Domain : $-\infty < x < \infty$
Range : $-\frac{\pi}{2} < y < \frac{\pi}{2}$



Domain : $x \leq -1$ or $x \geq 1$
Range : $0 \leq y \leq \pi, y \neq \frac{\pi}{2}$



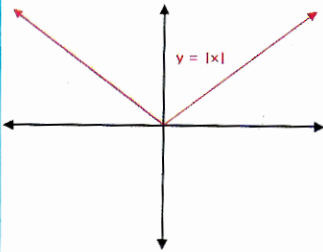
Domain : $x \leq -1$ or $x \geq 1$
Range : $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}, y \neq 0$



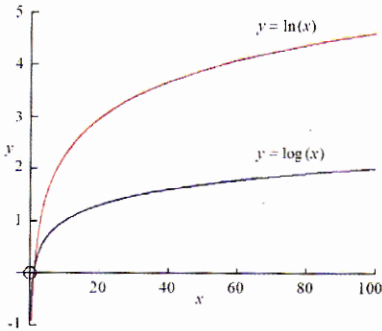
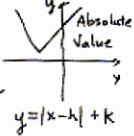
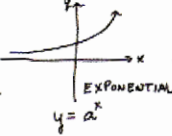
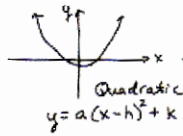
Range : $0 < y < \pi$
Domain : $-\infty < x < \infty$

MATHEMATICS

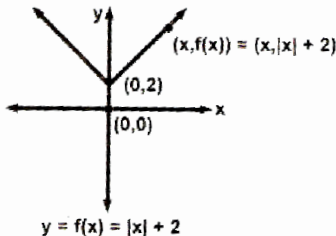
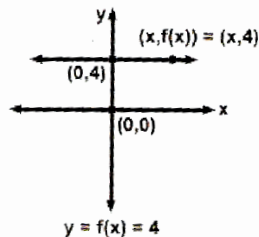
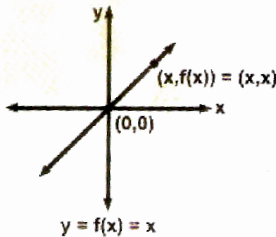
Graph of Some Other Functions



- Linear functions are lines, $y = mx + b$
- Some non-linear functions are



	Even Functions	Odd Functions
•		
-		



MATHEMATICS

STRAIGHT LINES

1. An acute angle (say?) between lines L_1 and L_2 , with slopes m_1 and m_2 is given by $\tan \theta = \frac{m_2 - m_1}{1 + m_1 m_2}$, $m_1 m_2 \neq -1$
2. Equation of a line passing through the points (x_1, y_1) & (x_2, y_2) is given by $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$
3. Equation of a line making intercepts a and b on the x and y axis, respectively, is $\frac{x}{a} + \frac{y}{b} = 1$
4. The perpendicular distance (d) of a line $Ax + By + C = 0$ from a point (x_1, y_1) is given by $d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$
5. Distance between the parallel lines $Ax + By + C_1 = 0$ and $Ax + By + C_2 = 0$, is given by $d = \frac{|C_2 - C_1|}{\sqrt{A^2 + B^2}}$

SEQUENCE & SERIES

1. The general term of the n term of the A.P. is given by $a_n = a + (n-1)d$
2. The sum S_n of the first n terms of an A.P. is given by $S_n = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}(a_1 + a_n)$
3. The sum S_n of the first n terms of G.P. is given by $S_n = a \frac{r^n - 1}{r - 1}$ or $a \frac{1 - r^n}{1 - r}$, if $r \neq 1$
4. A series whose each term is formed by multiplying corresponding terms of an A.P. and a G.P. is called an Arithmetic-geometric series, Summation of n terms :

$$S_n = \frac{a}{1-r} + \frac{(1-r)^{n-1} d r}{(1-r)^2} - \frac{(a+(n-1)d)r^n}{1-r}$$

5. Harmonical progression is defined as a series in which reciprocal of its terms are in A.P.

The standard form of a H.P. is $\frac{1}{a} + \frac{1}{a+d} + \frac{1}{a+2d} + \dots$

BINOMIAL THEOREM

1. The expansion of a binomial for any positive integral n is given by Binomial Theorem, which is $(a+b)^n = {}^n C_0 a^n + {}^n C_1 a^{n-1} b + {}^n C_2 a^{n-2} b^2 + \dots + {}^n C_{n-1} a b^{n-1} + {}^n C_n b^n$. The coefficients of the expansion are arranged in an array. This array is called pascal's triangle.
2. The general term of an expansion $(a+b)^n$ is $T_{r+1} = {}^n C_r a^{n-r} \cdot b^r$
3. In the expansion $(a+b)^n$, if n is even, then the middle term is the $\left(\frac{n+1}{2}\right)$ term. If n is odd, then the middle terms are $\frac{(n+1)}{2}$ and $\frac{(n+3)}{2}$

MATHEMATICS

PERMUTATIONS AND COMBINATIONS

1. The number of permutations of n different things taken r at a time, where repetition is not allowed, is denoted by ${}^n P_r$, and is given by ${}^n P_r = n! / (n-r)!$, where $0 \leq r \leq n$.
2. The number of permutations of n different things, taken r at a time, where repetition is allowed, is n^r .
3. The number of permutations of n objects taken all at a time, where p_1 objects are of first kind, p_2 objects are of the second kind,....., p_k objects are of the k^{th} kind and rest, if any, are all different is $n! / p_1! p_2! \dots p_k!$
4. The number of combinations of n different things taken r at a time, denoted by ${}^n C_r$ is given by ${}^n C_r = \frac{n!}{r!(n-r)!}$, $0 \leq r \leq n$.
5. Number of circular permutations of n things when p alike and the rest different taken all at a time distinguish clockwise and anticlockwise arrangement is $(n-1)! / p!$.

MATRICES

1. Order of matrix : a matrix which has m rows and n columns is called a matrix of order $m \times n$.

TYPES OF MATRICES

1. Row matrix - if in a matrix, there is only one row, then it is called a row matrix
2. Column matrix - if in a matrix, there is only column, then it is called column matrix.
3. Square matrix - if number of rows and number of column in a matrix are equal, then it is called a square matrix.
4. Singleton matrix - if in a matrix there is only one element then it is called singleton matrix
5. Null or zero matrix - if in a matrix all the elements are zero then is called a Zero matrix and it is generally denoted by O .
6. Diagonal matrix - if all elements except the principal diagonal in a square matrix are zero, it is called a Diagonal matrix.
7. Scalar matrix - if all the elements of the principal diagonal of a diagonal matrix are equal, E_r Non-Zero, it is called scalar matrix.
8. Unit matrix - if all elements of principal diagonal in a diagonal matrix are 1, then it is called Unit matrix. A unit matrix of order n is denoted by I_n



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Technology, Poland



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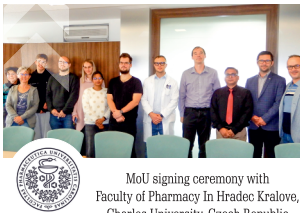
GLOBAL COLLABORATION



MoU signing ceremony with
Universitas Airlangga (UNAIR), Surabaya Indonesia



MoU signing ceremony with
Mahsa University, Selangor, Malaysia



MoU signing ceremony with
Faculty of Pharmacy in Hradec Kralove,
Charles University, Czech Republic



MoU signing ceremony
with The University of
Debrecen, Hungary



MoU signing ceremony with
University Sains Malaysia, Penang, Malaysia



MoU signing ceremony
with Management & Science
University, Malaysia



MoU signing ceremony with
Lithuanian University of Health Sciences

INDUSTRIAL COLLABORATIONS



MPGI is proud to collaborate with IBM India as this collaboration will help our students deal with the rapid technological change which comes with the VUCA world. IBM has proven its mettle in the area of Innovations, technology and its training, battling numerous changes in technology since 1911. We have collaborated for Btech students in the areas of Artificial Intelligence, Machine Learning, Big Data and Data Analytics, Data Science, Blockchain, Internet Of Things, Cyber Security and Full stack Developer



MPGI has Integrated SAP into the BTech and BCA curriculum and it offers students a pathway to success in today's technology-driven world. By gaining expertise in SAP modules, accessing cloud learning content, participating in ILT-classroom training, obtaining live server access, staying updated with SAP new technologies, and earning certifications, students can unlock a wealth of career opportunities and embark on a fulfilling journey towards professional excellence.



MPGI, has solidified its commitment to academic excellence by signing an MOU with Grant Thornton. Grant Thornton Bharat is one of the preeminent Indian professional services firms and offers end-to-end solutions for a business lifecycle. Through its people over profit focus, client centricity and impact on the ecosystems, its sector-first approach and services spanning Assurance, Tax, Advisory, Technology and Consulting, this collaboration paves the way for an integrated the Association of Chartered Certified Accountants (ACCA) certification program which we provide as an undergraduate BBA course. Through this partnership, students can seamlessly blend theoretical knowledge with practical skills, enhancing their employability and career prospects.



MPGI has collaborated with JBM to impart hands-on training on the live machines to enrich their practical knowledge. In this program, the students of MPGI are selected through a rigorous screening process and selected students from pre-final and final year have to undergo an Industrial training at various plants of JBM across India. Rigorous training on CNC machining, Coordinate Measuring machine (CMM) and various tool including laser cutting tool used in the manufacturing of parts of its client such as Maruti Suzuki, Eicher, Volvo, Honda four wheelers is imparted to our students.



MPGI takes a significant stride towards fostering cutting-edge education by partnering with Mobiiloitte Technologies Pvt Ltd. Mobiiloitte is a Premier Fullstack Custom Software Development Company with a special focus on Security, Scale and Performance. This MOU promises hands-on training in emerging technologies such as IoT, Artificial Intelligence, Machine Learning, Blockchain, and Metaverse.



In 2006, Amazon Web Services (AWS) began offering broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enterprise applications: on-demand, available in seconds, with pay-as-you-go pricing. MPGI has Collaborated with Amazon Web Services for certification courses in Cloud Developing, Cloud Operations, Cloud Foundations & Cloud Architecting. (for Educator and educatee)



Electronics & ICT Academy at IIT Kanpur was established in 2016 in partnership with the Ministry of Electronics and Information Technology (MeitY) and is mandated to provide industry focused and industry-driven hands-on courses in electronics & ICT. MPGI has signed an MOU with ICT-IITK for fundamental and advance training in verbal communication, Soft Skills, Matlab C++, Python, DBMS/SQL, CAD/CAM & Machine Learning.



Alembic Pharmaceuticals Pvt. Ltd. was established on January 5th, 1907 & stands as a pioneering force in the realm of pharmaceuticals. Renowned for its dedication to research, development, and manufacturing, Alembic specializes in delivering high-quality pharmaceutical solutions. The Memorandum of Understanding (MOU) with MPGI reaffirms their steadfast commitment to pushing the boundaries of pharmaceutical innovation and enriching healthcare provisions. With a primary focus on areas such as oncology, cardiology, neurology, and gastroenterology, Alembic continues to spearhead advancements that positively impact global healthcare outcomes.

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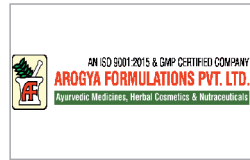
Successful Alumni

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RECRUITERS @ MPGI

INDUSTRIAL VISITS



HR CONCLAVE 2024

HR Conclave 2.0- Navigating the transition from campus to corporate. The conclave embarked on the journey of self discovery, learning and strategic planning by having industry leaders and experts from HCL Tech, Flipkart, Philips, Atlassian.



• Engineering • Pharmacy • Management • Computer Applications
• Dentistry • Nursing • Ayurvedic Sciences

TRAINING & PLACEMENT AS SAID BY CORPORATES



Ms. Pooja Umesh
Global Head HR,
Airfi.aero

The HR Conclave was exceptionally well organized! Kudos to the team for their tireless efforts and the outstanding hospitality extended throughout the event. The thoughtful initiative of organizing this conclave specifically for the 1st and 2nd-year students is commendable, reflecting a commitment to nurturing talent from the early stages.



Mr. Sachin Sharma
Senior Vice President
& National Manager,
AU Small Finance Bank

I extend my heartfelt gratitude to all the members of MPGI, interacting with the bright talents of MPGI today.. Each student exudes potential, showcasing themselves as wonderful and talented future leaders. May MPGI continue to be a beacon of excellence, producing leaders who contribute positively to the community and beyond.



Mr. Sumit Premi
Lead, Talent Acquisition
(Tech & Product), Associate
Director- HR, Flipkart

Impressive energy! Harness it wisely, dear students. The recruitment landscape has undergone a remarkable democratization. In this era, opportunities are more accessible to all, irrespective of background or circumstance. Seize the moment, utilize your skills, and make the most of this transformative period. Best of luck MPGI.



Mr. Ashish Bhalla
Director HR, Head
India Campus Relations,
HCL Tech

I express my sincere gratitude to MPGI for orchestrating such impactful events that go beyond textbooks, shaping students not only as professionals but also as well-rounded individuals. These experiences contribute significantly to their growth and development. Looking forward to more such enlightening sessions that bridge the gap between academia and the real world.



Mr. S.N. Rao
Lead Campus Recruitment
India Subcontinent,
Philips

What an amazing day spent with the vibrant students of MPGI, alongside the dedicated faculty and leadership. Your commitment to education is commendable and sets a remarkable example for all. To the students, I encourage you to be smart beyond your textbooks—discover your passions and pursue them wholeheartedly.



Mr. Abhishek Srivastava
Regional HR Head,
TCS Lucknow

Dear MPGI Management & Students, Sincerest gratitude to you for organizing the event & executing it quite well. I hope that my presence could add value to the students. Feels great to be here. All the best for your future endeavors.

TRAINING & PLACEMENT

ALUMNI TESTIMONIALS



Shruti Omer, Btech CSE, 2022, SDE-III, Microsoft

The holistic education I received at MPGI Kanpur not only honed my professional skills but also nurtured my personal development. Forever grateful for the experiences and memories!



Surbhi Srivastava, Btech CSE, 2022, SDE-III, Walmart Global Tech

MPGI Kanpur isn't just about academics; it's about discovering your passion, forging lifelong friendships, and preparing for a fulfilling future. Proud to be an alum!



Saurabh Chauhan, Btech ME, 2015,
Deputy Manager-Quality operation, Morris Garages (MG Motors)

MPGI Kanpur provided the perfect blend of academic rigor and extracurricular opportunities, setting the stage for a well-rounded education and a successful career for me.



Varsha Gupta, Btech CSE, 2015, Technical Lead, E&Y

As an alum of MPEC Kanpur, I can confidently say that the institution's commitment to excellence and innovation has shaped my career trajectory. Truly grateful for the invaluable lessons learned.



Payal Arora, Btech CSE, 2014, General Manager, HR, JSPL

MPGI Kanpur is where I found my voice, honed my skills, and discovered my true potential. The encouragement and support from faculty and peers alike were instrumental in my journey.



Shubham Pandey- Btech, ECE, 2013, Product at HCLTech

MPGI Kanpur has not just equipped me with academic excellence, but also instilled values of integrity and perseverance. It's more than just a college; it's a community that fosters growth.



Abhinav Singh Bhadouria- Btech CSE, 2009, Sr. Manager,
Product Management, Analytics Solutions, Walmart Global Tech

MPGI Kanpur provided me with a platform to explore my interests and excel in my chosen field. The supportive environment and top-notch facilities truly set it apart.



Vaibhav Maheshwari- Btech,ECE, 2008, Assistant Vice President, Barclays

My time at MPEC Kanpur was transformative. The dedicated faculty and vibrant campus life prepared me not just for my career but also for life's challenges.



Anshul Nagpal, Btech EI, 2005, Service Solution Manager, Nokia

The strong emphasis on practical learning at MPEC not only made me job-ready but also instilled in me a lifelong love for learning and growth.

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WORLD ENVIRONMENT DAY



YOGA DAY



YOGA DAY



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FAREWELL - HASTA LA VISTA



FAREWELL - HASTA LA VISTA

ACKNOWLEDGEMENT SLIP

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