

Guidance to Prepare for M2 (Mathematics-II) – Especially for MSTs

Hey everyone! Your MSTs are coming soon, so here's some solid guidance to prepare for M2 efficiently 🙌

🚫 First of all – Don't rely only on college classes. Yes, they *might* complete the syllabus in a week, but that's cutting it too close. Start your own preparation from now.

Step-by-Step Strategy:

☐ Start with Unit 5 (Vector Calculus)

This unit is highly scoring and will help you the most in MST. Complete it first with proper practice of:

- Directional Derivative**
- Green's & Gauss Theorem**
- Solenoidal & Irrotational Fields**




☑ Then focus deeply on CF + PI (Complementary Function & Particular Integral)

Practice this topic very well. This is the core of Units 1 & 2 and appears every year.

❏ Now go for Unit 3 (PDEs)

Give good time to Charpit's Method and PDE with constant coefficients. These are repeated every year.

❏ Unit 4 – Do at least these 3 important topics:

-  Cauchy's Integral Formula / Theorem
(*Appeared in all 5 papers*)
-  Analytic Function Conditions (C-R equations)
-  Residue Theorem + Poles


❏ If time allows, do Unit 1 & 2 after that

They are not difficult — in fact, they are easy and must-attempt topics in the final RGPV exam.

 In short — Do full Unit 1, 2, and 5 before the final exams for sure!

 **Bonus Tip:**

If you're having trouble with CF & PI, watch Pradeep Giri Academy's lectures on YouTube. They're simple and effective. Then PRACTICE different types of questions.

 The more you practice, the better you'll get. M2 is all about solving variety!

? Any doubts? Just ask me!

**I'll guide you the best I can... but the real hard work
has to be done by YOU. 💪 🔥**

All the best champ! You got this! 🚀 😊

Mathematics-II (BT-202) – Unit-wise Important Topics and Repeated Questions (RGPV 2022–2024)

UNIT 1: Ordinary Differential Equations – I

Repeated Topics:

- **Bernoulli's Equation – (Nov 2022, Dec 2023)**
- **Exact Equation / Linear ODE – (Dec 2024, Dec 2023, June 2023, Nov 2022)**
- **Simultaneous Differential Equations – (Dec 2024)**
- **Higher Order with Constant Coefficients – (Dec 2023, Nov 2022)**

Important for Upcoming Exams:

- **Exact differential equations**
 - **Bernoulli and Leibnitz equations**
 - **Simultaneous ODEs**
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UNIT 2: Ordinary Differential Equations – II

Repeated Topics:

- **Variation of Parameters – (Dec 2024, Dec 2023, Nov 2022, June 2022)**

- **Power Series Solution (Frobenius) – (June 2023)**
- **Legendre/Bessel Function Properties – (Dec 2024)**

Important for Upcoming Exams:

- **Variation of parameters for non-homogeneous equations**
 - **Bessel function properties (e.g., $J_n(-x) = (-1)^n J_n(x)$)**
 - **Power series methods (Frobenius method)**
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UNIT 3: Partial Differential Equations (PDEs)

Repeated Topics:

- **Charpit's Method – (Dec 2024, Dec 2023, June 2023)**
- **Form PDE by eliminating arbitrary function – (June 2022)**
- **PDEs with constant coefficients – (All 5 papers)**

Important for Upcoming Exams:

- **Charpit's method**
- **Forming PDE from a given function**
- **Solving linear PDEs with constant coefficients**

UNIT 4: Functions of Complex Variables

Repeated Topics:

- **Cauchy's Integral Formula / Theorem – (All 5 papers)**
- **Analytic function conditions (C-R equations) – (Dec 2024, Dec 2023, Nov 2022)**
- **Residue Theorem and Poles – (Dec 2024, Dec 2023, Nov 2022, June 2022)**

Important for Upcoming Exams:

- **Cauchy Integral Theorem (direct integration)**
- **Analytic function derivation using Cauchy-Riemann equations**
- **Finding residues and evaluating real integrals**

UNIT 5: Vector Calculus

Repeated Topics:

- **Directional Derivative – (Dec 2024, June 2023)**
- **Divergence Theorem – (Dec 2023, June 2022)**
- **Green's Theorem – (Dec 2024, Nov 2022)**

- **Solenoidal and Irrotational Fields – (Nov 2022, June 2022)**

Important for Upcoming Exams:

- **Directional derivative**
 - **Solenoidal and Irrotational vector fields**
 - **Application of Gauss and Green's theorems**
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Prediction Summary for Next Exam – Must-Prepare Topics:

- **Variation of parameters**
 - **Bessel function properties**
 - **Charpit's method for PDE**
 - **Cauchy's Integral and Residue Theorem**
 - **Directional derivative and Divergence theorem**
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**Leave Your reaction or comment if u
found this helpful this will motivate me**

Mathematics-II (BT-202) RGPV - Previous Year Questions Unit-Wise (2022 - 2024)

UNIT 1: Ordinary Differential Equations I

- 1. Solve: $(1 + y^2) dx = (\tan^{-1} y - x) dy$
(Dec 2024, Dec 2023, June 2023)**
- 2. Solve: $\cos(x) dy = (\sin(x) - y) dx$ using Bernoulli's method
(Nov 2022)**
- 3. Solve: $\sin^2(x) dy/dx - y = \tan(x)$
(Nov 2022)**
- 4. Solve: $x^2 p^2 + y^2 q^2 = z$
(Nov 2022)**
- 5. Solve: $(1 + e^x) dx + e^x(1 - y) dy = 0$
(June 2022)**
- 6. Solve the linear differential equation:
 $dy/dx = ((1 + y^2) + (x - e^x)y) / \sin^2(x)$
(June 2022)**
- 7. Solve the simultaneous equations: $dy/dx = -x - y$
and $2x - 5y = 0$
(Dec 2024)**

UNIT 2: Ordinary Differential Equations II

**1. Solve: $(D^2 + 3D + 2)y = \sin(3x)$
(Dec 2024)**

**2. Solve: $(D^2 - 4D + 3)y = \cos(2x)$
(Dec 2023)**

**3. Solve: $(D^2 + 9)y = \tan(3x)$ using method of
variation of parameters
(Dec 2023)**

**4. Solve: $(D^2 + 4)y = \tan(2x)$ using variation of
parameters
(Nov 2022)**

**5. Solve: $(D^3 - 7D^2 + 14D - 8)y = e^x * \cos(2x)$
(Nov 2022)**

**6. Solve: $(D^2 - 2D - 3)y = x^3e^x$
(June 2022)**

**7. Solve: $(D^2 + a^2)y = \tan(ax)$ using variation of
parameters
(June 2022)**

**8. Solve using Frobenius method: $x(1 - x)y'' + 2(1 - 2x)y' - 2y = 0$
(June 2023)**

9. Prove: $J_n(-x) = (-1)^n J_n(x)$
(Dec 2024)

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UNIT 3: Partial Differential Equations

1. Solve using Charpit's method: $(p^2 + q^2)y = qz$
(Dec 2024, June 2023)

2. Solve using Charpit's method: $px + qy = pq$
(Dec 2024)

3. Form PDE by eliminating arbitrary function: $z = f(x/y)$
(June 2022)

4. Solve: $(D^2 - 4DD' + 4D'^2)z = \cos(2x + y)$
(Dec 2024)

5. Solve: $(D^2 + 4DD' - 5D'^2)z = \sin(2x + 3y)$
(Dec 2023)

6. Solve: $(D^3 - 3D^2D' + 4D'^2)z = e^{(x + 2y)}$
(June 2022)

7. Solve: $(x - y)p + (x + y)q = 2x^2$
(Dec 2023)

8. Construct PDE from: $f(x^2 + y^2 + 2z^2 - 2xy) = 0$
(Dec 2024)

UNIT 4: Functions of Complex Variable

- 1. Find poles and residues of: $1 / (z + 1)$
(Dec 2024)**
- 2. Evaluate: $\oint (z^2 / (z - 1)^2(z - 3)) dz$ using Cauchy's Theorem
(Nov 2022)**
- 3. Evaluate using Cauchy's Integral Formula:
 $\oint [(\sin(\pi z^2) + \cos(\pi z^2)) / (z - 1)^2(z - 3)] dz$, where $|z| = 3$
(June 2023)**
- 4. Show that $f(z) = cz$ is differentiable but not analytic at origin
(Nov 2022)**
- 5. Construct analytic function whose real part is $e^x \cos(y)$
(June 2022)**
- 6. Determine P so that $f(z) = \log(x + y^2) + i \tan^{-1}(x)$ is analytic
(Dec 2024, Dec 2023)**
- 7. Write short notes on:
(i) Cauchy-Riemann equations**

(ii) Stokes theorem
(Dec 2023)

UNIT 5: Vector Calculus

- 1. Find directional derivative of $f = x^2yz + 4xz^2$ at $(1, 2, -1)$ in direction $2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$**
(Dec 2024)
- 2. Verify Green's Theorem for $\oint [(x + y^2) dx + x dy]$ where C is bounded by $y = x$ and $y = x^2$**
(Dec 2024)
- 3. Verify Gauss Divergence Theorem for $\mathbf{F} = x^2\mathbf{i} + y^2\mathbf{j} + z^2\mathbf{k}$ over a cube**
(Dec 2023)
- 4. Prove that $r^n \mathbf{r}^{\rightarrow}$ is solenoidal if $n = -3$**
(June 2022)
- 5. Show vector field $(x^2 - yz)\mathbf{i} + (y^2 + 2x)\mathbf{j} + (z^2 - xy)\mathbf{k}$ is irrotational. Find scalar potential**
(Nov 2022)
- 6. Find angle between surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y - 3$ at point $(2, -1, 2)$**
(June 2022)

7. Find directional derivative of $\phi(x, y, z) = e^x \cos(yz)$ at $(0, 0, 0)$ in direction of tangent to curve:

$$x = a \sin(t), y = a \cos(t), z = at$$

(June 2023)