St. Xavier's College
Ranchi

DEPARTMENT OF PHYSICS

ST. XAVIER'S COLLEGE (Autonomous), RANCHI

FYUGP
PHYSICS HONOURS/RESEARCH
Syllabus

Implemented w.e.f.
Academic Session 2025-26 & onwards

NAAC: B+

DEPARTMENT OF PHYSICS
ST. XAVIER'S COLLEGE, RANCHI
(An Autonomous College, affiliated to Ranchi University)
JHARKHAND 834 001
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Members of Board of Studies of the Department of Physics, St. Xavier's College, Ranchi

1. **Chairman:**

   Dr. Swarat Chaudhuri, Associate Professor
   Head, Dept. of Physics, St. Xavier's College, Ranchi

2. **Internal Members:**
   from the Dept. of Physics, St. Xavier's College, Ranchi

   1. Dr. Sumit Kumar Roy, Asst. Professor
   2. Dr. Mitesh Chakraborty, Asst. Professor
   3. Dr. Rajesh Kumar, Asst. Professor
   4. Dr. Ravi Kumar B., Asst. Professor
   5. Mrs. Swagata Chakraborty, Asst. Professor

3. **Experts from outside Ranchi University**

   1. Prof. (Dr.) Sarang Medhekar, Professor
      Dept. of Physics, CUJ, Ranchi
   2. Dr. Dilip Kumar Singh, Asst. Professor
      Dept. of Physics, BIT Mesra, Ranchi

4. **University Nominee:**

   Dr. Manoj Kumar, Principal
   Marwari College, Ranchi
   Ranchi University, Ranchi

5. **Alumnus:**

   Dr. Achint Kapoor, Associate Professor (Retd.)
   University Department of Physics, Ranchi University, Ranchi

6. **Representative from Industries/Corporate Sector or Related Placement Area**

   Mrs. Jyoti Agarwal, Director
   Meditron, Ranchi

COURSE STRUCTURE FOR FYUGP **'HONOURS/ RESEARCH/ PG DIPLOMA'**

Table 1: Credit Framework for Four-Year Undergraduate Programme (FYUGP) under State Universities of Jharkhand [Total Credits = 164]

Academic Level	Level of Courses	Semester	**MJ**: Discipline Specific Courses – Core or Major (80)	**AC**: Associated core courses from discipline/ Interdisciplinary/ vocational (8)		**ELC**: Elective courses may be opted from four paths [Follow table 2] (24)	**MDC**: Multidisciplinary Courses (From a pool of Courses) (9)	**AEC**: Ability Enhancement Courses (Modern Indian Language and English) (8)	**SEC**: Skill Enhancement Courses (9)	**VAC**: Value Added Courses (6)	**IKS**: (i) Indian Knowledge System (2) & **SA**: (ii) Social awareness (2)	**RC**: Research Courses (4+8)/ **AMJ**: Advanced Courses instead of Research (4+4+4)/ **PGD**: PG Diploma Level 6 (4+4+4)		**Total Credits**	**IAP**: Internship/Apprenticeship/ Project/ Vocational course/ Dissertation (4) **In between Sem I to Sem-VI**
	1	2	3 (Major- 80)	4 (Minor-32)			5	6	7	8	9	10	11	12	13
Level 4.5	Level 100-199: **Foundation or Introductory courses**	I	4	4	---	---	3	2	3	2	2	---	---	**20**	
		II	4	---	4	---	3	2	3	2	2	---	---	**20**	4
		Exit Point: Undergraduate Certificate provided with Summer Internship/ Project/ Vocational course/ Dissertation (4 credits)													
Level 5	Level 200-299: **Intermediate-level courses**	III	4+4	---		4	3	2	3	---	---	---	---	**20**	
		IV	4+4+4	---		4	---	2	---	2	---	---	---	**20**	
		Exit Point: Undergraduate Diploma provided with Summer Internship/ Project/ Vocational course/ Dissertation (4 credits)													
Level 5.5	Level 300-399: **Higher-level courses**	V	4+4+4+4	---		4	---	---	---	---	---	---	---	**20**	
		VI	4+4+4+4	---		4	---	---	---	---	---	---	---	**20**	
		Exit Point: Bachelor's Degree with Summer Internship/ Project/ Vocational course/ Dissertation (4 credits)												**124**	
Level 6	Level 400-499: **Advanced courses** Hons with Research (>7.5 CGPA)/ Honours/ PG Diploma	VII	4+4+4	---		4	---	---	---	---	---	4	4	**20**	—
		VIII	4+4	---		4	---	---	---	---	---	8	4+4	**20**	
		Exit Point: Bachelor's Degree with Honours/ Honours with Research/ PG Diploma Level 6												**164**	

Note: Honours students not undertaking research will do 3 courses for 12 credits in lieu of a Research project.

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Table 2: Options for Elective Minor Courses

Path A	Path B	Path C	Path D
ELC-A; Elective courses from Interdisciplinary Subjects 1 & 2 (24)	**ELC-B**; Elective courses from discipline (24)	**ELC-C**; Elective courses from vocational (24)	**ELC-D**; Elective courses from discipline for Double Major (48)
This pathway may be recommended for students who wish to develop core competency in multiple disciplines of study. In this case, the credits for the minor pathway shall be distributed among the constituent disciplines/subjects. If students pursuing FYUGP are awarded a UG Degree in a Major discipline, they are eligible to mention their core competencies in other disciplines of their choice if they have earned 12 credits each from pathway courses of two particular disciplines. In the first three years of FYUGP, this pathway is composed of one Major discipline with 60 credits from 15 courses, and two other disciplines, with 12 credits from 3 courses in each discipline. In this pathway, if the students choose one of the two disciplines for 12 credits in one discipline then they should choose a different discipline for the other 12 credits. If the students continue to the fourth year of FYUGP, the students need to earn an additional 4 credits in both disciplines.	This pathway may be recommended to those students who wish for an in-depth study in more than one discipline with a focus on one discipline (Major) and relatively less focus on the other (Minor). If students exit at the end of the third year of FYUGP, they are awarded a Major Degree in a particular discipline and a Minor in another discipline of their choice, if they earn a minimum of 24 credits from the courses in the Minor discipline. If the students continue to the fourth year of FYUGP, they should earn a minimum of 32 credits in the Minor discipline, to be eligible for a UG Degree (Honours) with a Major and a Minor. For this, in the fourth year, they should earn an additional minimum of 8 credits through 2 courses in the Minor discipline.	This pathway may be recommended to those students who wish for exposure to a vocational discipline in addition to the in-depth study in the Major discipline. The credit requirements for Major and Vocational Minor disciplines in this pathway are the same as those for Major with Minor pathway, except that the Minor courses are in a vocational discipline. If students exit at the end of the third year of FYUGP, they are awarded a Major Degree in a particular discipline and a Minor in vocational discipline of their choice, if they earn a minimum of 24 credits from the Vocational courses. If the students continue to the fourth year of FYUGP, they should earn a minimum of 32 credits in the vocational discipline. For this, in the fourth year, they should earn an additional minimum of 8 credits through 2 courses in the Vocational discipline.	To secure the required minimum credits in each discipline, students who wish to opt for a Double Major should include the credits earned by them from the Multi-Disciplinary Courses, Skill Enhancement Courses, and Value-Added Courses offered by the respective Major disciplines. The Double Major pathway is extended to the fourth year. Shifting to a double major from a minor in the third semester will be allowed subject to clearance of the courses of double major (not studied earlier) in succeeding sessions. In the fourth year, the student can continue to earn the required credits in either Major A or Major B to qualify for a UG Degree (Honours)/ UG Degree (Honours with Research) in A or B. If he/she opts to continue with Major B in the fourth year, he/she should earn an additional 16 credits of 300-399 level in Major B through mandatory online courses. The institution will not provide the courses in physical mode in the fourth year of this segment.

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Table 3: Credit Distribution in Elective Minor Courses during the Four Years of FYUGP

Academic Level	Level of Courses	Semester	Path A ELC: Elective courses from Interdisciplinary Subjects 1 & 2 (24)		Path B ELC: Elective courses from the discipline (24)	Path C ELC: Elective courses from vocational (24)	Path D ELC: Elective courses from the discipline for Double Major (64)
	1	2	3A. Subject 1	3B. Subject 2	4	5	6
Level 4.5	Level 100-199: **Foundation or Introductory courses**	I	---	---	---	---	4+4
		II	---	---	---	---	4+4
		Exit Point: Bachelor's Degree with Hons. with Research					
Level 5	Level 200-299: **Intermediate-level courses**	III	4	---	4	4	4+4
		IV	---	4	4	4	4+4
		Exit Point: Bachelor's Degree with Hons.					
Level 5.5	Level 300-399: **Higher-level courses**	V	4	---	4	4	4+4
		VI	---	4	4	4	4+4
		Exit Point: P.G. Diploma Degree					
Level 6	Level 400-499: **Advanced courses** Hons with Research (>7.5 CGPA)/ Honours/ PG Diploma	VII	4	---	4	4	4+4
		VIII	---	4	4	4	4+4
		Exit Point: (A) Bachelor's Degree with Hons. with Research/ (B) Bachelor's Degree with Hons./ (C) P.G. Diploma Degree					

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Table 4: Semester-wise Course Code and Credit Points for Single Major during the First Three Years of FYUGP

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits	
	Code	Papers	Paper	Semester
I	AEC-1	Language and Communication Skills (MIL-1; Modern Indian language Hindi/ English)	2	7 Papers (20 credits)
	VAC-1	Value Added Course-1	2	
	IKS-1	Indian Knowledge System-I (Foundation Course)	2	
	SEC-1	Skill Enhancement Course-1	3	
	MDC-1	Multi-disciplinary Course-1	3	
	AC-1	Associated core courses from discipline/ Interdisciplinary/ vocational	4	
	MJ-1	Major paper 1 (Disciplinary/ Interdisciplinary Major)	4	
II	AEC-2	Language and Communication Skills (MIL-1; Modern Indian language English/ Hindi)	2	7 Papers (20 credits)
	VAC-2	Value Added Course-2	2	
	SA	Social Awareness Activities	2	
	SEC-2	Skill Enhancement Course-2	3	
	MDC-2	Multi-disciplinary Course-2	3	
	AC-2	Associated core courses from discipline/ Interdisciplinary/ vocational	4	
	MJ-2	Major paper 2 (Disciplinary/ Interdisciplinary Major)	4	
III	AEC-3	Language and Communication Skills (MIL-2; MIL including TRL)	2	6 Papers (20 credits)
	SEC-3	Skill Enhancement Course-3	3	
	MDC-3	IKS as a Multi-disciplinary Course-3	3	
	ELC-1	Elective courses from discipline/ Interdisciplinary/ vocational	4	
	MJ-3	Major paper 3 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-4	Major paper 4 (Disciplinary/ Interdisciplinary Major)	4	
IV	AEC-4	Language and Communication Skills (MIL-2; MIL including TRL)	2	6 Papers (20 credits)
	VAC-3	Value Added Course-3	2	
	ELC-2	Elective courses from discipline/ Interdisciplinary/ vocational	4	
	MJ-5	Major paper 5 (Disciplinary/ Interdisciplinary Major having IKS)	4	
	MJ-6	Major paper 6 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-7	Major paper 7 (Disciplinary/ Interdisciplinary Major)	4	
V	ELC-3	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-8	Major paper 8 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-9	Major paper 9 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-10	Major paper 10 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-11	Major paper 11 (Disciplinary/ Interdisciplinary Major)	4	
VI	ELC-4	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-12	Major paper 12 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-13	Major paper 13 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-14	Major paper 14 (Disciplinary/ Interdisciplinary Major)	4	
	MJ-15	Major paper 15 (Disciplinary/ Interdisciplinary Major)	4	
Total Credits, excluding one Internship (IAP) of 4 credits =			120	120

Note: It is mandatory to take One Internship of 4 credits in any one of the semesters during the first three years in FYUGP or before exit at any of the exit points if a student wishes to opt for the same.

Table 5A: Semester-wise Course Code and Credit Points for Single Major during the Fourth Year of FYUGP for Bachelor's Degree (Honours with Research)

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits	
	Code	Papers	Paper	Semester
VII A	ELC-5	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-16	Major paper 16 (Research Methodology)	4	
	MJ-17	Major paper 17 (Disciplinary/Interdisciplinary Major)	4	
	MJ-18	Major paper 18 (Disciplinary/Interdisciplinary Major)	4	
	RC-1	Research proposal – Planning & Techniques (Disciplinary/Interdisciplinary Major)	4	
VIII A	ELC-6	Elective courses from discipline/ Interdisciplinary/ vocational	4	4 Papers (20 credits)
	MJ-19	Major paper 19 (Disciplinary/Interdisciplinary Major)	4	
	MJ-20	Major paper 20 (Disciplinary/Interdisciplinary Major)	4	
	RC-2	Research Internship/Field Work/Project/Dissertation/Thesis	8	
		Total Credits, excluding one Internship of 4 credits =	**160**	**160**

Table 5B: Semester-wise Course Code and Credit Points for Single Major during the Fourth Year of FYUGP for Bachelor's Degree (Honours)

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits	
	Code	Papers	Paper	Semester
VII B	ELC-5	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-16	Major paper 16 (Disciplinary/Interdisciplinary Major)	4	
	MJ-17	Major paper 17 (Disciplinary/Interdisciplinary Major)	4	
	MJ-18	Major paper 18 (Disciplinary/Interdisciplinary Major)	4	
	AMJ-1	Advanced Major paper-1 (Disciplinary/Interdisciplinary Major)	4	
VIII B	ELC-6	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-19	Major paper 19 (Disciplinary/Interdisciplinary Major)	4	
	MJ-20	Major paper 20 (Disciplinary/Interdisciplinary Major)	4	
	AMJ-2	Advanced Major paper-2 (Disciplinary/Interdisciplinary Major)	4	
	AMJ-3	Advanced Major paper-3 (Disciplinary/Interdisciplinary Major)	4	
		Total Credits, excluding one Internship of 4 credits =	**160**	**160**

Table 5C: Semester-wise Course Code and Credit Points for Single Major during the Fourth Year of FYUGP for Bachelor's Degree (with Postgraduate Diploma)

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits	
	Code	Papers	Paper	Semester
VII C	ELC-5	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-16	Major paper 16 (Disciplinary/Interdisciplinary Major)	4	
	MJ-17	Major paper 17 (Disciplinary/Interdisciplinary Major)	4	
	MJ-18	Major paper 18 (Disciplinary/Interdisciplinary Major)	4	
	JOC-1	Skill based Job Oriented paper (Disciplinary/Interdisciplinary Major)	4	
VIII C	ELC-6	Elective courses from discipline/ Interdisciplinary/ vocational	4	5 Papers (20 credits)
	MJ-19	Major paper 19 (Disciplinary/Interdisciplinary Major)	4	
	MJ-20	Major paper 20 (Disciplinary/Interdisciplinary Major)	4	
	JOC-2	Skill based Job Oriented paper (Disciplinary/Interdisciplinary Major)	4	
	JOC-3	Skill based Job Oriented paper (Disciplinary/Interdisciplinary Major)	4	
		Total Credits, excluding one Internship of 4 credits =	**160**	**160**

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AIMS OF BACHELOR'S DEGREE PROGRAMME IN PHYSICS

The aim of Bachelor's Degree Programme in Physics is intended to provide:

i. Broad and balance knowledge in Physics in addition to understanding of key Physical concepts, principles, and theories.

ii. To develop students' ability and skill to acquire expertise over solving both theoretical and applied Physics problems.

iii. To provide knowledge and skill to the students' thus enabling them to undertake further studies in Physics in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.

iv. To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about Physics and its significance is fostered in this framework, rather than mere theoretical aspects

v. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A Physics graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.

vi. To mold a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.

vii. To enable the graduate, prepare for national as well as international competitive examinations, especially UGC- CSIR NET, GATE, JAM, JEST, and UPSC Civil Services Examination.

viii. To enable student, seek their career in the field of Research, Applied Physics, Energy, Technology, Geophysics and meteorology, Space and Astronomy, Radiation Physics, Instrumentation, Oceanography and such many fields with a further specialization in the same.

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PROGRAMME LEARNING OUTCOMES

The programme learning outcomes relating to Honours/Research Degree in Physics:

i. The student graduating with the Degree Honours/Research in Physics would be able to:

ii. Core competency: Students will acquire core competency in the subject Physics, and in allied subject areas.

iii. Systematic and coherent understanding of the fundamental concepts in Physics and other related allied Physics subjects.

iv. Students will be able to use the evidence based comparative Physics approach to explain the scientific and technological problems.

v. The students will be able to understand the laws of nature.

vi. Students will be able to understand the basic principle of equipment; instruments used in the Physics laboratory.

vii. Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Physics.

viii. Disciplinary knowledge and skill: A graduate student are expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied Physics knowledge in various fields of interest like Mathematical Physics, Thermal and Statistical Physics, Electromagnetism, Waves and Optics, Analog and Digital Electronics, Modern Physics, Quantum Mechanics, Solid State Physics, Nuclear and Particle Physics, Classical Dynamics, Experimental Techniques, Devices and Instruments, etc.

ix. Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

x. Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic Physics knowledge and concepts.

xi. Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

xii. Team player: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field-based situation and industry.

xiii. Skilled project manager: The course curriculum has been designed in such a manner as to enable a graduate student to become a skilled project manager by acquiring knowledge about Physics project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

xiv. Digitally literate: The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of simulation software and related computational work.

xv. Ethical awareness/reasoning: A graduate student requires to understand and develop ethical awareness/reasoning which the course curriculum adequately provide.

xvi. Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

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INSTRUCTION TO QUESTION SETTER

SEMESTER INTERNAL EXAMINATION (SIE):

There will be Only One Semester Internal Examination in Major, Minor and Research Courses, which will be organized at college/institution level. However, Only One End semester evaluation in other courses will be done either at College/ Institution or University level depending upon the nature of course in the curriculum.

A. **(SIE 10+5=15 marks):**

There will be two group of questions. **Question No.1 will be very short answer type in Group A** consisting of five questions of 1 mark each. **Group B will contain descriptive type** two questions of five marks each, out of which any one to answer.

The Semester Internal Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks, (b) Class Attendance Score (CAS) of 5 marks.

B. **(SIE 20+5=25 marks):**

There will be two group of questions. **Group A is compulsory** which will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** two questions of ten marks each, out of which any one to answer.

The Semester Internal Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 20 Marks, (b) Class Attendance Score (CAS) of 5 marks.

Conversion of Attendance into score may be as follows:

Attendance Upto 45%, 1mark; 45<Attd.<55, 2 marks; 55<Attd.<65, 3 marks; 65<Attd.<75, 4 marks; 75<Attd, 5 marks.

END SEMESTER UNIVERSITY EXAMINATION (ESE):

A. **(ESE 50 marks):**

There will be two group of questions. **Group A is compulsory** which will contain one question. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

B. **(ESE 60 marks):**

There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 & 3 will be short answer type** of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

C. **(ESE 75 marks):**

There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

D. **(ESE 100 marks):**

There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. Group B will contain descriptive type six questions of twenty marks each, out of which any four are to answer.

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FORMAT OF QUESTION PAPER FOR MID/ END SEMESTER EXAMINATIONS

Question format for **15 Marks**:

Subject/ Code

F.M. =15 **Time** = 1 Hr. Exam Year

General Instructions:

i. **Group A** carries very short answer-type compulsory questions.
ii. **Answer 1 out of 2** subjective/ descriptive questions given in **Group B**.
iii. Answer in your own words as far as practicable.
iv. Answer all subparts of a question in one place.
v. Numbers in the right indicate full marks for the question.

Group A

1. [5x1=5]
   i. .....
   ii. .....
   iii. .....
   iv. .....
   v. .....

Group B

2. ..... [10]
3. ..... [10]

Note: There may be subdivisions in each question asked in Theory Examination.

Question format for **20 Marks**:

Subject/ Code

F.M. =20 **Time** = 1 Hr. Exam Year

General Instructions:

i. **Group A** carries very short answer-type compulsory questions.
ii. **Answer 1 out of 2** subjective/ descriptive questions given in **Group B**.
iii. Answer in your own words as far as practicable.
iv. Answer all subparts of a question in one place.
v. Numbers in the right indicate full marks for the question.

Group A

1. [5x1=5]
   i. .....
   ii. .....
   iii. .....
   iv. .....
   v. .....
2. ..... [5]

Group B

3. ..... [10]
4. ..... [10]

Note: There may be subdivisions in each question asked in the Theory Examination.

Question format for **50 Marks**:

Subject/ Code

F.M. =50 **Time** = 1.5 Hrs. Exam Year

General Instructions:

i. **Group A** carries very short answer-type compulsory questions.
ii. **Answer 3 out of 5** subjective/ descriptive questions given in **Group B**.
iii. Answer in your own words as far as practicable.
iv. Answer all subparts of a question in one place.
v. Numbers in the right indicate full marks for the question.

Group A

1. [5x1=5]
   i. .....
   ii. .....
   iii. .....
   iv. .....
   v. .....

Group B

2. ..... [15]
3. ..... [15]
4. ..... [15]
5. ..... [15]
6. ..... [15]

Note: There may be subdivisions in each question asked in the Theory Examination.

Question format for **60 Marks**:

Subject/ Code

F.M. =60 **Time** = 3 Hrs. Exam Year

General Instructions:

vi. **Group A** carries very short answer-type compulsory questions.
vii. **Answer 3 out of 5** subjective/ descriptive questions given in **Group B**.
viii. Answer in your own words as far as practicable.
ix. Answer all subparts of a question in one place.
x. Numbers in the right indicate full marks for the question.

Group A

1. [5x1=5]
   vi. .....
   vii. .....
   viii. .....
   ix. .....
   x. .....
2. ..... [5]
3. ..... [5]

Group B

4. ..... [15]
5. ..... [15]
6. ..... [15]
7. ..... [15]
8. ..... [15]

Note: There may be subdivisions in each question asked in the Theory Examination.

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Question format for **75 Marks**:

Subject/ Code

F.M. =75 **Time** = 3 Hrs. Exam Year

General Instructions:

i. **Group A** carries very short answer-type compulsory questions.
ii. **Answer 4 out of 6** subjective/ descriptive questions given in **Group B**.
iii. Answer in your own words as far as practicable.
iv. Answer all subparts of a question in one place.
v. Numbers in the right indicate full marks for the question.

Group A

1. [5x1=5]
   i. .....
   ii. .....
   iii. .....
   iv. .....
   v. .....
2. ..... [5]
3. ..... [5]

Group B

4. ..... [15]
5. ..... [15]
6. ..... [15]
7. ..... [15]
8. ..... [15]
9. ..... [15]

Note: There may be subdivisions in each question asked in the Theory Examination.

Question format for **100 Marks**:

Subject/ Code

F.M. =100 **Time** = 3 Hrs. Exam Year

General Instructions:

i. **Group A** carries very short answer-type compulsory questions.
ii. **Answer 4 out of 6** subjective/ descriptive questions given in **Group B**.
iii. Answer in your own words as far as practicable.
iv. Answer all subparts of a question in one place.
v. Numbers in the right indicate full marks for the question.

Group A

1. [10x1=10]
   i. ..... vi. .....
   ii. ..... vii. .....
   iii. ..... viii. .....
   iv. ..... ix. .....
   v. ..... x. .....
2. ..... [5]
3. ..... [5]

Group B

4. ..... [20]
5. ..... [20]
6. ..... [20]
7. ..... [20]
8. ..... [20]
9. ..... [20]

Note: There may be subdivisions in each question asked in the Theory Examination.

SEMESTER I

I. MAJOR COURSE –MJ 1 (R1):

BASIC MATHEMATICAL PHYSICS & MECHANICS

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100	Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Course Learning Outcomes:

On successful completion of this course the student should know:

1. Revise the knowledge of calculus. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.
2. Learn the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.
3. In the laboratory course, learn the fundamentals of the C and C++ programming languages and their applications in solving simple physical problems involving differentiations, integrations, differential equations as well as finding the roots of equations.
4. Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. He / she will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
5. Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.
6. Understand simple principles of fluid flow and the equations governing fluid dynamics.
7. Apply Kepler's law to describe the motion of planets and satellite in circular orbit ,through the study of law of Gravitation.
8. Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
9. Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
10. Describe special relativistic effects and their effects on the mass and energy of a moving object.
11. appreciate the nuances of Special Theory of Relativity (STR)
12. In the laboratory course, the student shall perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.

Skills to be learned:

1. Training in calculus will prepare the student to solve various mathematical problems.
2. He/she shall develop an understanding of how to formulate a physics problem and solve given mathematical equation risen out of it.
3. Learn the concepts of elastic in constant of solids and viscosity of fluids.
4. Develop skills to understand and solve the equations of central force problem.
5. Acquire basic knowledge of oscillation.
6. About inertial and non-inertial systems and special theory of relativity.

Course Content:

The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

Calculus: Review of Calculus (Differential and Integral), First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Particular Integral, Taylor and binomial series **(8 Lectures)**

Vector Calculus: Vector Differentiation:- Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field and their physical interpretation. Del and Laplacian operators. Vector identities.

Vector Integration: Line, surface and volume integrals of Vector fields. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). **(15 Lectures)**

Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. **(7 Lectures)**

Elasticity: Elastic constants and inter relation between Elastic constants. Twisting torque on a Cylinder or Wire and Twisting couple. **(3 Lectures)**

Flexure of Beam: Bending of beam, Cantilever. **(3 Lectures)**

Surface Tension: Introduction to surface tension and surface energy. Excess pressure inside a curved membrane. Determination of surface tension by Jaeger's and Quinke's methods. Temperature dependance of surface tension. **(6 Lectures)**

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube and corrections. **(2 Lectures)**

Central Force Motion: Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). **(3 Lectures)**

Oscillations: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, Sharpness of resonance; Power dissipation and Quality Factor. **(4 Lectures)**

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass- Energy equivalence. Relativistic Doppler effect, frequency and wave number. **(9 Lectures)**

Reference Books:

1. Concepts of Electromagnetic Theory, K. Mamta, Raj Kumar Singh and J. N. Prasad, 1/e, 2021, Wiley/I. K. International Publishing House, New Delhi.
2. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn.,Elsevier.
3. Mathematical Physics, P. K. Chattopadhyaya, 2/e, New Age International Publisher.
4. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning.
5. Differential Equations, George F. Simmons, 2007, McGraw Hill.
6. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
7. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book.
8. Advanced Engg. Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning.
9. Mathematical Physics, Goswami, 1st edition, Cengage Learning.
10. Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press.
11. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
12. Essential Mathematical Methods, K. F. Riley & M. P. Hobson, 2011, Cambridge Univ. Press.
13. Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company.
14. An introduction to Mechanics, D. Kleppner, R. J. Kolenkow, 1973, McGraw-Hill.
15. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
16. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
17. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
18. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
19. Undergraduate Mechanics, Arun Kumar, J. P. Agarwal and Nutan Lata, Pragati Prakashan.
20. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

Additional Books for Reference

1. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
2. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley.
3. Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning.
4. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

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1/12/25 Rajesh Kumar 01-12-25

Sumit Kr. Roy 01/12/2025

01/12/25 S. Chakraborty 1/12/25 01.12.25

II. SKILL ENHANCEMENT COURSE- SEC 1 (R1):
ELECTRICAL CIRCUITS AND NETWORK SKILLS

Marks: 75 (ESE: 3Hrs) = 75	Pass Marks: Th (ESE) = 30

(Credits: Theory-03) **45 Hours**

Course Objectives:

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode

Course Contents:

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC and DC. Familiarization with multimeter, voltmeter and ammeter. **5 Lectures)**

Understanding Electrical Circuits: Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real and complex power components of AC source. Power factor. **(5 Lectures)**

Electrical Drawing and Symbols:
Drawing symbols. Blueprints. Reading of Electrical Circuit Schematics. Ladder diagrams. Power circuits. Control circuits. Tracking the connections of elements and identify current flow and voltage drop.

(5 Lectures)

Generators and Transformers:
DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. **(5 Lectures)**

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of AC motor. **(8 Lectures)**

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources **(5 Lectures)**

Electrical Protection:- Interfacing DC or AC sources to control elements (relay protection device) **(4 Lectures)**

Electrical Wiring: Different types of conductors and cables. Basics of Wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable, crimps, terminal blocks, **(8 Lectures)**

Laboratory Exercises:

1. Use of multimeter, voltmeter and ammeter.
2. To observe current and voltage drop across the DC circuit elements.
3. To track the connections of elements and identify current flow and voltage drop.
4. To observe the working of transformer under no load and full load conditions.
5. Use of diode as half wave, full wave and bridge rectifier.
6. To observe the response of inductor and capacitor with DC or AC sources.
7. To understand the importance of interfacing DC or AC sources to relay protection device.
8. To prepare an extension board with more than one input terminal (3 pin socket) and check it's working.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
5. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning.
6. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill.
7. Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning.
8. Engineering Electromagnetic, Willian H. Hayt, 8th Edition, 2012, McGraw Hill.
9. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer.

COURSES OF STUDY FOR FYUGP IN "PHYSICS" MINOR

ASSOCIATED CORE COURSE-MN A (R1) **Either may be opted in Sem-I or Sem-II**

I. ASSOCIATED CORE COURSE- MN A: INTRODUCTORY PHYSICS

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 50 (ESE Theory: 3Hrs)+ 25 (ESE Practicals) = 100	Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-03+ Practical-01): **45 Hours (Theory)+30 hours (Practical)**

Course Learning Outcomes:

At the end of the course the student is expected to learn and assimilate the following.

1. A brief idea about different branches of Physics in higher education.
2. Basic knowledge of the key principles of Physics
3. Overall understanding of the key units such as vector calculus, mechanics, electricity and magnetism, waves and optics, thermal physics, ~~modern physics~~, electronics and special theory of relativity.
4. Understanding the inter-relation and applicability of different topics in physics

Skills to be learned:

1. Learn basics of different topics in physics
2. Learn the physics of vector calculus, mechanics, electricity and magnetism, waves and optics, thermal physics, electronics, and relativity
3. Learn the inter-relation between different topics and their applications in physics.

Section-A: ASSOCIATED CORE COURSE- MN A: Theory

45 Hours

Vector Calculus

Scalar and Vector fields. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities.

(4 lectures)

Mechanics

Review of Newton's Laws of Motion. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Torque. Angular momentum of a system of particles. Principle of conservation of angular momentum. Moment of Inertia. Kinetic energy of rotational motion involving both translation and rotational motion. Elastic constants and interrelation between them.

(6 lectures)

Electricity and Magnetism

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Electrostatic potential. Potential and Electric Field due to a dipole. Magnetic force between current elements and definition of Magnetic Field **B**. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current loop as a magnetic dipole and its dipole moment (Analogy with electric dipole). Ampere's circuital Law and its application to (1) Solenoid and (2) Toroid. Magnetic force on (1) a point charge (2) a current carrying wire (3) between the current elements. Torque on a current loop in a uniform magnetic field. Introduction to Maxwell's Equations (in free space)

(10 lectures)

Waves and Optics

Longitudinal and Transverse waves. Plane progressive (travelling) waves. Wave equation. Particle and wave velocities. Differential Equation. Velocity of Transverse vibrations of stretched strings. Newton's formula for velocity of sound. Laplace's Correction. Interference of light, Division of amplitude and wavefront. Young's double slit experiment. Elementary idea about diffraction of light

(8 lectures)

Thermal Physics

Thermodynamic equilibrium, Zeroth law of thermodynamics, First Law of Thermodynamics and its differential form, Internal energy,

Different thermodynamic processes and calculation of work done, Reversible and Irreversible process with examples. Heat Engines. Carnot engine & efficiency. Carnot cycle, Refrigerator & coefficient of performance, 2nd Law of Thermodynamics.

(8 lectures)

Elements of Modern Physics and Special Theory of Relativity

Introduction to Wave-particle duality. Concept of De-Broglie wavelength. Postulates of Special Theory of Relativity.

(2 lectures)

Basic Electronics

P-N Junction Diode and Bipolar junction transistor. CC, CB and CE Configurations. Relation between α and β. Characteristics of CE configuration. DC Load line and Q-point. Active, Cut off and Saturation Regions. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. Octal and Hexadecimal numbers. AND, OR and NOT Gates. NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. De Morgan's Theorems. Boolean Laws. Binary Addition. 1's and 2's complement. **(7 lectures)**

01/12/2025

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1 Dec. 2025

1/12/25

Rajesh Kumar
01-12-2025

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Sumit Kr. Roy
01/12/2025

S Chakrabarti
1/12/25

01/12/25

II. ASSOCIATED CORE COURSE- MN A PR:
PHYSICS MINOR-A PRACTICAL

Marks: Pr (ESE: 6Hrs)= 25	Pass Marks: Pr (ESE) = 10

(Credits : Practicals -01) **30 Hours**

Instructions to Question Setter for

End Semester Examination (ESE)

There will be one Practical Examination of 6 Hrs duration. Evaluation of the Practical Examination will be as per the following guidelines:

Experiment = 15 marks
Practical record Notebook = 05 marks
Viva-voce = 05 marks

Practicals:

1. Measurement of diameter of the given cylinder using vernier calipers.
2. Measurement of diameter of the given wires using screw gauge.
3. Measurement of diameter of a capillary using travelling microscope.
4. To determine radius of circular aperture using He-Ne laser source.
5. To determine 'g' by bar pendulum.
6. Verification of truth tables of Basic Logic Gates.
7. Determination of high resistance using moving coil galvanometer.
8. To determine the coefficient of thermal conductivity of a bad conductor by Lee's disc method.

Reference Books;

1. Concepts of Electromagnetic Theory, K. Mamta, Raj Kumar Singh and J. N. Prasad, 1st Edn. 2021, I. K. International Publishing House, New Delhi.
2. Mathematical Physics, B. D. Gupta.
3. Mathematical Physics, B. S. Rajput.
4. Mathematical Physics, H. K. Dass.
5. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
6. Waves and Acoustics, P. K. Chakraborty and Satyabrata Chowdhury.
7. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill.
8. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill.
9. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
10. A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, 1958, Indian Press.
11. Digital Electronics, Floyd.
12. Digital Computer Electronics, Malvino
13. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
14. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India.
15. A first course in Electronics, Khan and Dey, PHI.
16. Basic Electronics, Arun Kumar.

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01/12/25 Sumit Ku. Roy 01/12/2025 1/12/25 Rajesh Kumar 01-12-25 01.12.25

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NAAC: B+

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EXTERNAL EXAMINERS

Dr. Sanjay Kumar Dey	P.G. Dept. of Physics, Ranchi University, Ranchi	9431931063
Dr. R. K. Singh	P.G. Dept. of Physics, Ranchi University, Ranchi	9431359955
Dr. Achint Kapoor	P.G. Dept. of Physics,Ranchi University,Ranchi (Retd.)	9431931062
Dr. Ashalata Sinha	Ex Head, PG Dept. of Physics RU	9234874370
Dr. B. Prajapati	Gossner College, Ranchi	9431178538
Dr. B.L. Bhakta	Gossner College, Ranchi	7654600100
Dr. Vinita Sharan	Head,University Dept.of Physics, RU(Retd.)	9430790476
Dr. R. K. Bharti	Dept of Physics, Marwari College, Ranchi (Retd.)	7070408838
Dr. S. K. Gorai	BIT Mesra, Ranchi	9431391330
Dr. S. N. Paul	Dept of Physics, Marwari College, Ranchi (Retd.)	9934134068
Dr. Satish Chandra Gupta	Ranchi university, Ranchi (Retd.)	9431178538
Dr. Anupam Kumar	Dept of Physics, DSPMU, Ranchi	9430735008
Dr. N. R. Roy	University Dept.of Physics(Retd.)	9431102959
Dr. Rajiv Asthana	Gossner College, Ranchi	9708544194
Prof. D. Dey	Ex-Head, Dept. of Physics, SXC, Ranchi	9431175241
Mr. Manish Kr Sinha	Dept of Physics, BIT Mesra	9471116707
Dr. S. R. Kumar	Dept. of Physics, NIFFT, Hatia	8986654893
Dr. Shrawan Kumar	Physics Dept., G.L.A. College, DaltonGanj.	9431554211
Dr. Rakho Hari	Physics Dept., St. Columba's College, Hazaribagh	9431387183
Dr. D. K. Giri	P G Dept. of Physics, VBU, Hazaribagh	9470365859
Dr. Syantan Sil	Physics Dept., S.S.L.N.T. College, Dhanbad.	9835947775
Prof. Sarang Medekar	Centre for Applied Physics, Central Univ. of Jharkhand, Brambe, Ranchi.	9431382715
Dr. (Prof.) S.N.Singh	Ex-VC. N. P. University, Medini Nagar (Retd.)	9431586302
Dr. D. Singh	Centre for Applied Physics, CUJ, Brambe, Ranchi	8809323825
Dr. S. K. Rout	Dept. of Applied Physics, BIT Mesra	9471555277
Dr. Sanat Mukherjee	Dept. of Physics, BIT Mesra	9431363464
Dr. D. K. Mallick	Dept. of Computer Science, BIT Mesra	8987597281
Dr. S. N. Singh	H.O.D. Information Management, XISS, Ranchi	9431109081
Dr. Namita Singh	Dept of Physics, DSPMU, Ranchi	9431140704
Dr. Subhash Mukherjee	Head, Dept. of Physics, Yogda College, Ranchi	9939338396
Dr. Raghubar Singh	Dept. of Physics, Chas college, Chas	9431480161
Ms Amrita Singh	Patna women's college, Patna	7273077793
Dr. B. K. Jaiswal	J. N. College, Dhurwa, Ranchi (Retd.)	9431583448
Dr. N. K. Rana	J. N. College, Dhurwa	9955334175
Mr. Santosh Rajwar	RLSY College- RU	9102822498
Mr. Pintu Kumar Yadav	Udai Pratap Autonomous College, MGKV, Varanasi,UP	8521230870
Dr. Asha Prasad	Ranchi Womens College, Ranchi	9006749689
Dr. Jay Prakash Sharma	DSPMU, Ranchi	9931864529

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1/12/25 Sumit Kr. Roy 01/12/2025 01-12-2025 01.12.2025 1/12/25

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Dr. B.P.Akhauri	S.S. Memorial College, Ranchi	9939322702
Dr. Arun Kumar (Pandey)	P.G. Dept. of Physics, Ranchi University, Ranchi	7004714762
Dr. Priti Minz	Ranchi Womens College, Ranchi	9934320685
Mr. Rajesh Kumar	Deoghar College Deoghar, SKMU	7352949118
Dr. Amrita	Dept. of Physics Patna Women's College, Patna	9334161253
Dr. Sanjay Kumar	Dept. of Physics Patna University, Patna	9413674416
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Dr. Nusrat Ahmad (Retd.)	Dept of Physics SXC, Ranchi	9308332133
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Dr. Sumit Kumar Roy	Dept of Physics SXC, Ranchi	9835342618
Dr. Mitesh Chakraborty	Dept of Physics SXC, Ranchi	7209398731
Dr. Rajesh Kumar	Dept of Physics SXC, Ranchi	8986638381
Dr. Ravi Kumar B.	Dept of Physics SXC, Ranchi	8456950531
Dr. Rakesh Raja	Dept. of Computer Science, SXC, Ranchi	9931639669
Smt Swagata Chakraborty	Dept. of Physics SXC Ranchi	9304372620

Approved in the Board of Studies Meeting held on 01-12-2025.

1/12/25

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Sumit Kr. Roy 01/12/2025

Rajesh Kumar 01-12-2025

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S. Chakraborty 1/12/25