Date: 10.05.2025

Notice

In response to letter BBMKU/DSW/R/694/2025, dated 07.05.2025, regarding the submission of the New FYUGP syllabus as per State University of Jharkhand Regulation 2024 to the concerned office, a meeting of the **Board of Studies** is scheduled on **14.05.2025 (Wednesday), at 12:30 p.m.** in the University Department of Physics, BBMK University, Dhanbad, to discuss and finalize the following agenda items:

1. Preparation of New FYUGP syllabus for UG, Semesters **I to VIII** as per State University of Jharkhand Regulation 2024, effective from the academic session 2025-29 onwards.

All respected members are requested to be present.

10.05.2025

(Dr. Rajendra Pratap)
Head
Head, University Dept. of Physics
BBMK University, Dhanbad

University Department of Physics
BBMK University, Dhanbad

10/05/25

10/5/2025

10/05/2025

Sayantan Li
10/05/2025

Date: 14.05.25

Resolution of the Board of Studies Meeting University Department of Physics, BBMKU, Dhanbad.

In reference to letter no. BBMKU/DSW/R/694/2025, dated 07.05.2025, regarding the submission of the new Four-Year Undergraduate Programme (FYUGP) syllabus as per the State University of Jharkhand Regulation 2024, a meeting of the Board of Studies (BoS) of Physics was held on 14.05.2025 (Wednesday) at 12:30 PM under the chairmanship of Dr. Rajendra Pratap, Head of the Department, in the University Department of Physics, BBMKU, Dhanbad.

The following members were present in the meeting:

1. Dr. Rajendra Pratap - Chairman 14.05.2025
2. Dr. D. K. Giri - Member 14/05/25
3. Dr. Ajay Prasad - Member 14/05/25
4. Dr. K. Bandyopadhyay - Member 14/05/2025
5. Dr. Uma Mageswari - Member 14/5/2025
6. Dr. Sayantan Sil - Member Sayantan Sil 14.05.2025

After thorough discussion and deliberation, the following resolution was passed unanimously:

Resolution:

The Board of Studies of the University Department of Physics hereby recommends the newly prepared FYUGP syllabus for Undergraduate Semesters I to VIII, in accordance with the State University of Jharkhand Regulation 2024, for implementation from the academic session 2025-2029, subject to approval.

It is further resolved to submit the syllabus to the Registrar, BBMKU, Dhanbad, for necessary consideration and approval by the Academic Council, followed by its implementation from the academic session 2025 onwards.

The meeting concluded with a vote of thanks proposed by Dr. D.K. Giri.

14.05.2025 Chairman
Board of Studies
University Department of Physics
BBMKU, Dhanbad.

14/05/25

14/05/2025

14/05/25

14/05/2025

Sayantan Sil
14/05/2025

FYUGP

PHYSICS HONOURS/ RESEARCH
&
ASSOCIATED CORE COURSE
&
ELECTIVE COURSE
&
MDC (MULTIDISCIPLINARY COURSE)

FOR UNDER GRADUATE COURSES UNDER

BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY, DHANBAD

Implemented from
Academic Session 2025-2029

Members of Board of Studies of FYUGP Syllabus as per Guidelines of the Binod Bihari Mahto Koyalanchal University, Dhanbad

1. Dr. Rajendra Pratap -Chairman
   Head, University Department of Physics,
   BBMK University, Dhanbad

2. Dr. Dilip Kumar Giri, -Member
   Assistant Professor University Department of Physics,
   BBMK University, Dhanbad

3. Dr. Ajay Prasad, -Member
   Associate Professor (Retd.), Department of Physics,
   PKRM College, Dhanbad

4. Dr. K. Bandyopadhyay, -Member
   Associate Professor (Retd.), University Department of Physics,
   BBMK University, Dhanbad

Two experts from UG

5. Dr. Umamageswari, -Member
   Associate Professor Department of Physics,
   B.S. City College, Bokaro

6. Dr. Sayantan Sil, -Member
   Assistant Professor Department of Physics,
   PKRM College, Dhanbad

Table 1 A: Credit Framework for the first three years of FYUGP:

Academic Level	Level of Courses	Semester	MJ; Discipline Specific Courses – Core or Major (60)	AC; Associated core courses from discipline/ Interdisciplinary/ vocational (8)		ELC; Elective courses may be opted from four paths [Follow table 4, 5 & 6] (16)	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) & (ii) Social awareness (2)	RC; Research Courses (12)	AMJ; Advanced Courses instead of Research (12)	Total Credits	IAP; Internship/Apprenticeship/ Project/ Vocational course/ Dissertation (4)
	1	2	3 (80)	4 (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	
		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	4
		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)												120	+4

14.05.2025

Session 2025-2029 onwards

14/5/25 14/05/25

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Table 1 B: Credit Framework for various pathways in the fourth year of FYUGP:

Academic Level	Level of Courses	Semester	MJ: Discipline Specific Courses – Core or Major (20)	AC: Associated core courses from discipline/ interdisciplinary/ vocational (8)	ELC: Elective courses opted in Semester III from four paths of Table- 4, 5 & 6 (8)	MDC: Multidisciplinary Courses (From a pool of Courses) (0)	AEC: Ability Enhancement Courses (Modern Indian Language and English) (0)	SEC: Skill Enhancement Courses (0)	VAC: Value-Added Courses (0)	IKS: (i) Indian Knowledge System (0) & (ii) Social awareness (0)	RC: Research Courses (12)	AMJ: Advanced Courses in place of Research (12)	Total Credits	IAP: Internship/ Apprenticeship/ Project/ Vocational course/ Dissertation (4)
	1	2	3 (60)		4(32)	5	6	7	8	9	10	11	12	13
			Honours with Research											
Level 6	Level 400-499 Advanced courses	VII	4+4+4	-	4	-	-	-	-	-	4	-	20	---
		VIII	4+4	-	4	-	-	-	-	-	8	-	20	
		Exit Point: Bachelor's Degree with Hons. with Research											OR	
OR						Honours								
Level 6	Level 400-499 Advanced courses	VII	4+4+4	-	4	-	-	-	-	-	-	4	20	---
		VIII	4+4	-	4	-	-	-	-	-	-	4+4	20	
		Exit Point: Bachelor's Degree with Hons.												

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Sayantan Sil 14/05/2025

SEMESTER WISE COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME

2025 onwards

Table 2: 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	20
	VAC-1	Value Added Course- 1	2	
	IKS-1	Indian Knowledge System-1/Social Awareness Activities	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	20
	VAC-2	Value Added Course-2	2	
	IKS-2	Social Awareness Activities/ Indian Knowledge System-1	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	20
	SEC-3	Skill Enhancement Course-3	3	
	MDC-3	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	20
	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	20
	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 10 (Disciplinary/ Interdisciplinary Major)	4	
VI	ELC-4	Elective courses from discipline/ Interdisciplinary/ vocational	4	20
	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

Table 3A: 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
VIIA	ELC-5	Elective courses from Discipline/Interdisciplinary/vocational	4	20
	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	
	RC-1	Research proposal – Planning & Techniques (Disciplinary/Interdisciplinary Major)	4	
VIIIA	ELC-6	Elective courses from Discipline/Interdisciplinary/vocational	4	20
	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 (IAP) of 4 Credits	160	160

Table 3B: 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
VIIB	ELC-5	Elective courses from Discipline/Interdisciplinary/vocational	4	20
	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	
	MJ-19	Major paper 19 (Disciplinary/Interdisciplinary Major)	4	
VIIIB	ELC-6	Elective courses from Discipline/Interdisciplinary/vocational	4	20
	MJ-20	Major paper 20 (Disciplinary/Interdisciplinary Major)	4	
	AMJ-1	Advanced Major Paper-1 (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 (IAP) of 4 Credits	160	160

Abbreviations:

AEC	Ability Enhancement Courses
SEC	Skill Enhancement Courses
IAP	Internship/Apprenticeship/ Project
IKS	Indian Knowledge System
MDC	Multidisciplinary Courses
ELC	Elective Courses
MJ	Major Disciplinary/interdisciplinary Courses
AC	Associated core courses from discipline/ Interdisciplinary/ vocational
AMJ	Advanced Major Disciplinary/interdisciplinary Courses
RC	Research Courses
JOC	Skill based Job Oriented Courses

AEC (Ability enhancements courses)- 2 Credits

- *Full marks – 50, Pass Marks – 20*
- *In AEC the students of all faculties will have to select either Hindi or English in Semester -1 and those students who have opted Hindi will have to select English as AEC in Semester -2 and vice versa. For 3rd and 4th semester student can opt Sanskrit, Urdu, Bengali, English, Hindi or TRL.*
- *In 4th semester there will be AEC-3 will include Language and Communication Skill in Hindi and English.*
- *No internal examination will be conducted*

VAC (Value added Courses)- 2 Credits

- *Full marks – 50, Pass Marks – 20*
- *For 1st semester – "Understanding India"* ; For 2nd Semester - "Health, Wellness, Yoga & Sports".
- *For 4th Semester – "Environmental Studies"*
- *No internal examination will be conducted*

SEC (Skill Enhancement Courses) – 3 Credits

- *Full Marks – 75, Pass Marks – 30*
- *Digital Education or Mathematical & Computational Thinking Analysis is selected as SEC. Student will have to select or opt either of the two subjects for semester – I, II and III in no case both subjects will be allowed to opt.*
- *No internal examination will be conducted*

MDC (Multidisciplinary Courses) – 3 credits

- *Full Marks – 75, Pass Marks – 30*
- *A student will study three different subjects in the multidisciplinary courses during first three semesters.*
- *No internal examination will be conducted*

Indian Knowledge System (IKS) & Awareness Module

*The **National Education Policy 2020 (NEP 2020)** integrates the **Indian Knowledge System (IKS)** into education at all levels. A **2-credit IKS course** introduces students to India's cultural, scientific, and philosophical heritage.*

*A **2-credit Awareness Module** covers social ethics and common rules, balancing broad and in-depth topics. **Part 1 (10 hours)** includes road safety, diversity, cleanliness, financial management, and basic first aid.*

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Part 2 (20 hours) *focuses on a single topic like civic education, drug abuse, gender norms, or sustainable development.*

Universities are encouraged to experiment and revise course content, with credits awarded through alternative activities like quizzes, workshops, group presentations, and community projects.

UGC mandates that at least 5% of UG programme credits be dedicated to IKS, with 50% integrated into the student's major. The FYUGP curriculum includes 9 credits for IKS, comprising a 2-credit common course, a 3-credit multidisciplinary course, and 4 credits of IKS content within a major paper.

Common Course

- *Full marks – 50, Pass Marks – 20*
- *For 1st Semester (IKS-1)– "Indian Knowledge System-1/Social Awareness Activities"*
- *For 2nd Semester (IKS-2) – "Social Awareness Activities/Indian Knowledge System-1"*
- *No internal examination will be conducted.*

Major Paper having IKS

- *In the 4th Semester, Major Paper 5 shall be IKS.*
- *Full marks – 100: Internal-15 (Written-10+ Class Performance and Attendance-5), End Semester Examination Theory-60, Practical-25*
  Pass Marks Theory– 30: (Internal-6+ End Semester Examination-24), Pass Marks Practical-10.
- *No internal examination will be conducted for the practical paper.*

AC (Associated Core Courses) – 4 credits

- *Full Marks Theory (Internal + End Semester)– (15+60), Pass Marks –30; Full Marks Practical-25, Pass Marks-10.*
- *A student will study two different subjects in the Associated Core courses during the first and second semesters.*
- *No internal examination will be conducted for the practical paper.*

ELC (Elective Courses) – 4 credits

- *Full Marks Theory (Internal + End Semester)– (15+60), Pass Marks –30; Full Marks Practical-25, Pass Marks-10.*
- *A student will study two different subjects in the Elective courses from the third to the eighth semesters.*
- *No internal examination will be conducted for the practical paper.*

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Table 4: Suggested list of Associated Core (AC) for SCIENCE Discipline

S.N.	Major (MJ)	Associated Core (AC)
1	Botany	Chemistry
		Zoology
2	Zoology	Chemistry
		Botany
3	Chemistry	Physics /Botany
		Mathematics/Zoology
4	Physics	Mathematics/Statistics
		Chemistry
5	Mathematics	Chemistry/Computer Science
		Physics/ Statistics/Economics
6	Statistics	Mathematics
		Computer Science/Physics
7	Geology	Chemistry /Physics
		Geography

SEMESTER WISE COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME 2025 onwards

Table 5: Semester-wise Course Code and Credit Points and Marks distribution of Associated core courses

S.N.	Semester	Paper	Credits	Full Marks		Pass Marks	
				Theory (Internal+ End Sem)	Practical End Sem.	Theory (Internal+ End Sem	Practical
1.	I/II	AC-1/AC-2	3+1	15+60	25	30	10

- **For internal examinations,* **the written examination will carry 10 marks, and class performance and attendance will carry 5 marks.**
- **No internal or mid-semester examination** will be conducted for **practical papers.**

Table 6: Semester wise Course Code and Credit Points and Marks distribution of Elective courses

S.N.	Semester	Paper	Credits	Full Marks		Pass Marks	
				Theory (Internal+ End Sem)	Practical End Sem.	Theory (Internal+ End Sem	Practical
1.	III/IV	ELC-1/ELC-2	3+1	15+60	25	30	10
2.	V/VI	ELC-3/ELC-4	3+1	15+60	25	30	10
3.	VII/VIII	ELC-5/ELC-6	3+1	15+60	25	30	10

- **For internal examinations,* **the written examination will carry 10 marks, and class performance and attendance will carry 5 marks.**
- **No internal or mid-semester examination** will be conducted for **practical papers.**

SEMESTER WISE COURSES IN PHYSICS FOR FYUGP 2025 onwards

Table 7: Semester wise Papers and Examination Structure for Physics Major during the First Three Years of FYUGP :

Year	Semester	Physics Major		Examination Structure				Pass Marks		
		Code	Papers	Credits	Internal (Mid Semester) Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical (F.M.)	Internal Theory (Mid Sem.)	End Sem. Theory	End sem. Practical
1st	I	MJ-1: Theory	Mathematical Physics-I	3	15 (10+5)*	60	-	6	24	-
		MJ-1: Practical	Practical	1	-	-	25	-	-	10
	II	MJ-2: Theory	Mechanics & Waves	3	15 (10+5)*	60	-	6	24	-
		MJ-2: Practical	Practical	1	-	-	25	-	-	10
EXIT POINT: UNDERGRADUATE CERTIFICATE										
2nd	III	MJ-3: Theory	Electricity & Magnetism	3	15 (10+5)*	60	-	6	24	-
		MJ-3: Practical	Practical	1	-	-	25	-	-	10
		MJ-4: Theory	Optics	3	15 (10+5)*	60	-	6	24	-
		MJ-4: Practical	Practical	1	-	-	25	-	-	10
	IV	MJ-5: Theory	Indian Knowledge System	3	15 (10+5)*	60	-	6	24	-
		MJ-5: Practical	Practical	1	-	-	25	-	-	10
		MJ-6: Theory	Electromagnetic Theory	3	15 (10+5)*	60	-	6	24	-
		MJ-6: Practical	Practical	1	-	-	25	-	-	10
		MJ-7: Theory	Mathematical Physics-II	3	15 (10+5)*	60	-	6	24	-
		MJ-7: Practical	Practical	1	-	-	25	-	-	10
EXIT POINT: UNDERGRADUATE DIPLOMA										
3rd	V	MJ-8: Theory	Mathematical Physics-III	3	15 (10+5)*	60	-	6	24	-
		MJ-8: Practical	Practical	1	-	-	25	-	-	10
		MJ-9: Theory	Thermal Physics	3	15 (10+5)*	60	-	6	24	-

	MJ-9: Practical	Practical	1	-	-	25	-	-	10
	MJ-10: Theory	Statistical Mechanics	3	15 (10+5)*	60	-	6	24	-
	MJ-10: Practical	Practical	1	-	-	25	-	-	10
	MJ-11: Theory	Analog Electronics	3	15 (10+5)*	60	-	6	24	-
	MJ-11: Practical	Practical	1	-	-	25	-	-	10
	MJ-12: Theory	Digital Electronics	3	15 (10+5)*	60	-	6	24	-
	MJ-12: Practical	Practical	1	-	-	25	-	-	10
	MJ-13: Theory	Elements of Modern Physics	3	15 (10+5)*	60	-	6	24	-
VI	MJ-13: Practical	Practical	1	-	-	25	-	-	10
	MJ-14: Theory	Quantum Mechanics and Applications	3	15 (10+5)*	60	-	6	24	-
	MJ-14: Practical	Practical	1	-	-	25	-	-	10
	MJ-15: Theory	Classical Dynamics	3	15 (10+5)*	60	-	6	24	-
	MJ-15: Practical	Practical	1	-	-	25	-	-	10
EXIT POINT: BACHELOR'S DEGREE									

- **For internal examinations,* the **written examination will carry 10 marks, and class performance and attendance will carry 5 marks.**
- **No internal or mid-semester examination** will be conducted for **practical papers.**

Table 8 A: Fourth Year Papers and Examination Structure for Physics Major with Bachelor's Degree (Honours with Research):

Year	Semester	Physics Major		Examination Structure				Pass Marks		
		Code	Papers	Credits	Internal (Mid Semester) Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical (F.M.)	Internal Theory (Mid Sem.)	End Sem. Theory	Endsem. Practical
4th	VII	MJ-16: Theory	Research Methodology	4	25 (20+5)*	75	-	10	30	-
		MJ-17: Theory	Solid State Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-17: Practical	Practical	1	-	-	25	-	-	10
		MJ-18: Theory	Nuclear and Particle Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-18: Practical	Practical	1	-	-	25	-	-	10
		RC-1	Research Proposal-Planning & Techniques (Disciplinary / Interdisciplinary Major)	4	25	75	-	10	30	-
	VIII	MJ-19: Theory	Atomic and Molecular Physics (Quantum Approach) and Laser Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-19: Practical	Practical	1	-	-	25	-	-	10
		MJ-20: Theory	Advanced Mathematical Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-20: Practical	Practical	1	-	-	25	-	-	10
		RC-2	Research Internship & Dissertation/Thesis	8	-	200	-	-	80	40
EXIT POINT: BACHELOR'S DEGREE (HONOURS with RESEARCH)										

- **For internal examinations,* the written examination will carry 10 marks, and class performance and attendance will carry 5 marks.
- No internal or mid-semester examination will be conducted for practical papers.

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Table 8 B: Fourth Year Papers and Examination Structure for Physics Major with Bachelor's Degree (Honours):

Year	Semester	Physics Major		Examination Structure				Pass Marks		
		Code	Papers	Credits	Internal (Mid Semester) Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical (F.M.)	Internal Theory (Mid Sem.)	End Sem. Theory	End sem. Practical
4th	VII	MJ-16: Theory	Advanced Mathematical Physics-I	3	15 (10+5)*	60	-	6	24	-
		MJ-16: Practical	Practical	1	-	-	25	-	-	10
		MJ-17: Theory	Solid State Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-17: Practical	Practical	1	-	-	25	-	-	10
		MJ-18: Theory	Nuclear and Particle Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-18: Practical	Practical	1	-	-	25	-	-	10
		MJ-19: Theory	Atomic and Molecular Physics (Quantum Approach) and Laser Physics	3	15 (10+5)*	60	-	6	24	-
		MJ-19: Practical	Practical	1	-	-	25	-	-	10
	VIII	MJ-20: Theory	Advanced Mathematical Physics-II	3	15 (10+5)*	60	-	6	24	-
		MJ-20: Practical	Practical	1	-	-	25	-	-	10
		AMJ-1: Theory	Advanced Quantum Mechanics	3	15 (10+5)*	60	-	6	24	-
		AMJ-1: Practical	Practical	1	-	-	25	-	-	10
		AMJ-2: Theory	Advanced Theoretical Physics-I (Electrodynamics & Statistical Mechanics)	3	15 (10+5)*	60	-	6	24	-
		AMJ-2: Practical	Practical	1	-	-	25	-	-	10
		AMJ-3: Theory	Advanced Theoretical Physics-II (Condensed Matter Physics & Nuclear and Particle Physics)	3	15 (10+5)*	60	-	6	24	-
		AMJ-3: Practical	Practical	1	-	-	25	-	-	10

EXIT POINT: BACHELOR'S DEGREE (HONOURS)

- **For internal examinations,* the written examination will carry 10 marks, and class performance and attendance will carry 5 marks.
- No internal or mid-semester examination will be conducted for practical papers.

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Table 9: Semester wise Papers and Examination Structure for Associated Core Course in Physics

Semester	Code	Minor Papers	Credits	Full Marks		Pass Marks	
				Theory (Internal+ End Sem)	Practical End Sem	Theory (Internal+ End Sem	Practical End Sem
I/II	AC Theory	Mechanics	3	15(10+5) +60	-	30	
	AC Practical	Mechanics	1	-	25	-	10

- *For internal examination*, the **written examination will carry 10 marks**, and **class performance and attendance will carry 5 marks.**
- **No internal or mid-semester examination** will be conducted for **practical papers.**

Table 10: Semester wise Papers and Examination Structure for Elective Course in Physics

Semester	Code	Minor Papers	Credits	Full Marks		Pass Marks	
				Theory (Internal+ End Sem)	Practical End Sem	Theory (Internal+ End Sem	Practical End Sem
III/IV	ELC -1 Theory	Electricity & Magnetism	3	15(10+5) +60	-	30	
	ELC -1 Practical	Electricity & Magnetism	1	-	25	-	10
V/VI	ELC -2 Theory	Thermal Physics and Statistical Mechanics	3	15(10+5) +60	-	30	-
	ELC -2 Practical	Thermal Physics and Statistical Mechanics	1	-	25	-	10
VII/VIII	ELC -3 Theory	Waves & Optics	3	15(10+5)+60	-	30	-
	ELC-3 Practical	Waves & Optics	1	-	25	-	10

- *For internal examinations*, the **written examination will carry 10 marks**, and **class performance and attendance will carry 5 marks.**
- **No internal or mid-semester examination** will be conducted for **practical papers.**

14/5/25 14/5/25 14/05/2025

General Instructions

1. The **Semester Internal Theory Examination** will be of **1-hour duration**.
2. There shall be **only one Practical Examination of 3-hour duration** in each semester for each paper separately.
3. **One external** and **one internal examiner** will conduct the Practical Examinations.
4. There will be **only one Semester Internal Examination** in **Major, Minor, and Research Courses**, which will be organized at the **college/institution level**.
5. Out of **100 marks**, the **Semester Internal Theory Examination** (each of 1 hour) will carry **15 marks** for **practical subjects** and **25 marks** for **non-practical subjects**.
6. The **15 marks** in the Theory Examination of practical subjects may include **10 marks** from the **Written Examination/Assignment/Project/Tutorial**, wherever applicable, and **5 marks** based on **attendance/overall class performance** during the semester.
7. The **25 marks** in the Theory Examination of non-practical subjects may include **20 marks** from the **Written Examination/Assignment/Project/Tutorial**, wherever applicable, and **5 marks** based on **attendance/overall class performance** during the semester.
8. To convert **attendance into marks**, a **suggestive range** is provided below:
   - Attendance up to 45%: 1 mark
   - 45% < Attendance ≤ 55%: 2 marks
   - 55% < Attendance ≤ 65%: 3 marks
   - 65% < Attendance ≤ 75%: 4 marks
   - Attendance above 75%: 5 marks

SEMESTER-WISE PAPERS FOR PHYSICS MAJOR DURING THE FIRST THREE YEARS OF FYUGP

MAJOR PAPERS

SEMESTER I

PHYSICS MJ-1 THEORY: MATHEMATICAL PHYSICS-I

Credits: 03 Lectures: 45

Marks: 75 (End Semester Examination=60, Semester Internal Examination = 10 (Theory), Class Performance & Attendance =05) Pass Marks (Internal + End Semester) = 30

Instructions to Question Setters

Semester Internal Examination (SIE) – 10 Marks:

The question paper will be divided into two groups: Group A and Group B.

Group A: *Consists of five very short answer-type questions, each carrying 1 mark. All five questions are compulsory.*

Group B: *Contains two descriptive-type questions, each carrying 5 marks. Candidates are required to answer only one question from this group.*

End Semester Examination (ESE) – 60 Marks:

The question paper will be divided into two groups: Group A and Group B.

Group A (Compulsory): *Question 1: Five very short answer-type questions of 1 mark each. Questions 2 and 3: Short answer-type questions, each carrying 5 marks.*

Group B: *Contains five descriptive-type questions, each carrying 15 marks. Candidates are required to answer any three questions from this group.*

Note: *Questions in the theory papers may have subdivisions.*

COURSE OBJECTIVE

- The emphasis of course is to equip students with the mathematical tools required in solving problem of interest to physicists.
- To expose students to fundamental computational physics skills and hence enable them to solve a wide range of physics problems.
- To help students develop critical skills and knowledge that will prepare them not only for doing fundamental and applied research but also prepare them for a wide variety of careers.

COURSE LEARNING OUTCOMES

- Revise the knowledge of calculus, vectors and vector calculus. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.
- Draw and interpret graphs of various functions.
- Solve first order differential equations and apply it to physics problems solve linear second order homogeneous and non-homogeneous differential equations with constant coefficients.
- Calculate partial derivatives of function of several variables Understand the concept of gradient of scalar field and divergence and curl of vector fields.
- Perform line, surface and volume integration and apply Green's, Stokes' and Gauss's Theorems to compute these integrals.
- Apply curvilinear coordinates to problems with spherical and cylindrical symmetries.
- Understand Dirac-delta function and its properties.

- Revise the knowledge of calculus, vectors, vector calculus, probability and probability distributions. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.

SKILLS TO BE LEARNED

- Training in calculus will prepare the student to solve various mathematical problems.
- He/she shall develop an understanding of how to formulate a physics problem and solve the given mathematical equation arising out of it.

COURSE CONTENT

Differential Equations: First Order and Second Order Differential Equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with Constant Coefficients. Wronskian and general solution. **(7 Lectures)**

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. **(4 Lectures)**

Vector Calculus: Scalar and Vector Fields. Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities. **(10 Lectures)**

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface, and volume elements. Line, surface, and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems, and their applications. **(10 Lectures)**

Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl, and Laplacian in Cartesian, Spherical, and Cylindrical Coordinate Systems. **(5 Lectures)**

Dirac Delta function and its properties: Definition of Dirac delta function. Representation as a limit of a Gaussian function and rectangular function. Properties of the Dirac delta function. **(5 Lectures)**

Introduction to probability: Independent random variables; Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance. Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing. **(4 Lectures)**

Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn. Elsevier.
2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning.
3. Differential Equations, George F. Simmons, 2007, McGraw Hill.
4. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
5. Mathematical methods for Scientists and Engineers. D.A. McQuarrie, 2003, Viva Book.
6. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
7. Mathematical Physics, Goswami, 1st edition, Cengage Learning.
8. Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press.
9. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
10. Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press.
11. Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company.
12. Mathematical Physics, B.S. Rajput, Pragati Prakashan, 21st Edition, 2009.
13. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
14. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.

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MJ-1: Practical

Credit: 01 Lectures: 30(15X2)

Instructions to Question Setters

End Semester Examination (ESE): 25 Marks

There will be one Practical Examination of 3 hours 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

Note: No internal or mid-semester examination will be conducted for the practical paper

The aim of this Lab is not just to teach computer programming and numerical analysis, but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- The course will consist of lectures (both theory and practical) in the Lab
- Evaluation not done on the programming, but based on formulating the problem
- Aim at teaching students to construct the computational problem to be solved
- Students can use any one of the operating systems, Linux or Microsoft Windows

Topics	Description with Applications
Introduction and Overview	Computer architecture and organization, memory and Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If-statement, If-else Statement, Nested if Structure, Else-if Statement, Ternary Operator, Goto Statement, Switch Statement, Unconditional and Conditional Looping, While Loop, Do-While Loop, FOR Loop, Break and Continue Statements, Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs:	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, valueof pi (π)

Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equations, solving $\alpha = \tan\alpha; I = I_0\left(\frac{\sin\alpha}{\alpha}\right)^2$ in optics.
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. *sin θ, cos θ, tan θ, etc.*
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop
Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Attempt the following problems using the RK 4 order method: • Solve the coupled differential equations $\frac{dx}{dt} = y + x - \frac{x^3}{3}; \frac{dy}{dx} = -x$ or four initial conditions x(0) = 0, y(0) = -1, -2, -3, -4. Plot x vs y for each of the four initial conditions onthe same screen for $0 \le t \le 15$ The differential equation describing the motion of a pendulum is $\frac{d^2\theta}{dt^2} = -\sin(\theta)$. The pendulum is released from rest at an angular displacement α, i.e. $\theta(0) = \alpha$ and $\theta(0) = 0$. Solve the equation for α= 0.1, 0.5 and 1.0 and plot θ as a function of time in the range $0 \le t \le 8\pi$. Also plot the analytic solution valid for small θ, $\{\sin(\theta)\} = \theta$.

Reference Books:

1. Introduction to Numerical Analysis, S. S. Sastry, PHI Learning Pvt. Ltd., 5th ed., 2012.
2. Schaum's Outline of Programming with C++, J. Hubbard, McGraw-Hill, 2000.
3. Numerical Recipes in C: The Art of Scientific Computing, W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, Cambridge University Press, 3rd ed., 2007.
4. A First Course in Numerical Methods, U. M. Ascher and C. Greif, PHI Learning, 2012.
5. Elementary Numerical Analysis, K. E. Atkinson, Wiley India Edition, 3rd ed., 2007.
6. Numerical Methods for Scientists and Engineers, R. W. Hamming, Courier Dover Publications, 1973.
7. An Introduction to Computational Physics, T. Pang, Cambridge University Press, 2nd ed., 2006.
8. Computational Physics, D. Walker, Scientific International Pvt. Ltd., 1st ed., 2015.

SEMESTER II

PHYSICS-MJ-2 THEORY: MECHANICS & WAVES

Credits: 03 Lectures: 45

Marks: 75 (End Semester Examination=60; Semester Internal Examination=10; (Theory) Class Performance=5 &Attendance=05); Pass Marks (Internal+End Semester) = 30

Instructions to Question Setters

Semester Internal Examination (SIE) – 10 Marks:

The question paper will be divided into two groups: Group A and Group B.

Group A: *Consists of five very short answer-type questions, each carrying 1 mark. All five questions are compulsory.*

Group B: *Contains two descriptive-type questions, each carrying 5 marks. Candidates are required to answer only one question from this group.*

End Semester Examination (ESE) – 60 Marks:

The question paper will be divided into two groups: Group A and Group B.

Group A (Compulsory): *Question 1: Five very short answer-type questions of 1 mark each. Questions 2 and 3: Short answer-type questions, each carrying 5 marks.*

Group B: *Contains five descriptive-type questions, each carrying 15 marks. Candidates are required to answer any three questions from this group.*

Note: *Questions in the theory papers may have subdivisions.*

COURSE OBJECTIVE

- The emphasis of this course is to enhance the understanding of the basics of mechanics.
- This course also includes the ideas of superposition of harmonic oscillations, leading to physics of travelling and standing waves and also acoustics of buildings, growth and decay of sound.
- By the end thiscourse, students should be able to solve the seen or unseen problems/numerical in mechanics and waves and also have an in depth understanding of mechanics, wave phenomena and acoustics.

COURSE LEARNING OUTCOME

After going through the course, the student should be able to

- Understand the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation.
- Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.
- Understand simple principles of fluid flow and the equations governing fluid dynamics.
- Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation.
- Explain the phenomena of simple harmonic motion and the properties of systemsexecuting such motions.
- Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting ina merry-go-round experiences an outward pull.
- Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems.

- Understand the principle of superposition of waves, so thus describe the formation ofstanding waves.
- Explain several phenomena we can observe in everyday life that can be explained aswave phenomena.
- Use the principles of wave motion and superposition of waves.
- Recapitulate and learn the special theory of relativity- postulates of the special theory ofrelativity, Lorentz transformations on space-time and other four vectors, four-vector notations, space-time invariant length, length contraction, time dilation, mass-energy relation, Doppler effect, light cone and its significance, problems involving energy- momentum conservations.

SKILLS TO BE LEARNED

- Learn the concepts of elasticity of solids and viscosity of fluids.
- Develop skills to understand and solve the equations of Newtonian gravity and centralforce problem.
- Learn about inertial and non-inertial systems.
- Acquire basic knowledge of oscillation.
- Learn about superposition of two Collinear Harmonic Oscillations.
- Superposition of two Perpendicular Harmonic Oscillations.
- Lear about Wave Motion in general.
- Learn about Velocity of Waves.
- Learn about acoustics of buildings, growth and decay of sound.
- Acquire knowledge of Superposition of Two Harmonics Waves.
- Develop the basic concepts of special theory of relativity and its applications to dynamical systems of particles.

COURSE CONTENT

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames. **(2 Lectures)**

Elasticity: Relation between Elastic constants, Twisting torque on a Cylinder or Wire. **(2 Lectures)**

Flexure of Beam: Bending of beam, Cantilever-loaded at one end and loaded at middle. **(3 Lectures)**

Surface Tension: Ripples and Gravity waves, Determination of surface tension by Jaeger's and Quincke's methods. Temperature dependance of surface tension. **(3 Lectures)**

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

Motion under Central Force: 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: *SHM:* 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. **(5 Lectures)**

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Coriolis force and centrifugal force. Effect of centrifugal force due to rotation of the earth. Coriolis force on a freely falling body. Geographical effects of Coriolis force (qualitative). **(3 Lectures)**

Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. **(3 Lectures)**

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. **(2 Lectures)**

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. **(3 Lectures)**

Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. **(2 Lectures)**

Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N-Harmonic Waves. **(5 Lectures)**

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events, Length contraction, Time dilation. Relativistic transformation of velocity, acceleration, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Mass-less Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics (inelastic collisions and Compton effect). Transformation of Energy and Momentum. **(7 Lectures)**

Reference Books:

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
5. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
6. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
7. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
8. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
9. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
10. Relativistic Mechanics, Satya Prakash & K. P. Gupta, Pragati Prakashan, 2019.

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.

PHYSICS-MI-2: PRACTICAL

Credit: 01 Lectures: 30(15X2)

Instructions to Question Setters

End Semester Examination (ESE): 25 Marks

There will be one Practical Examination of 3 hours 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

Note: No internal or mid-semester examination will be conducted for the practical paper

1. To measure the volume of a sphere/cylinder using vernier caliper.
2. To measure the diameter of a thick wire using screw gauge.
3. To determine the Height of a Building using a Sextant.
4. To study the random error in observations.
5. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
6. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
7. To determine the Young's Modulus of a Wire by suitable method.
8. To determine the Modulus of Rigidity of a Wire by suitable method.
9. To determine the elastic Constants of a wire by Searle's method.
10. To determine the value of g using Bar Pendulum.
11. To determine the value of g using Kater's Pendulum.
12. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2–T law.
13. To study Lissajous Figures.

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn., 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick,2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. B.Sc. Practical Physics, N. N. Ghosh, Bharati Bhawan Publishers.
7. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company, 19th Edition, 1995, Reprint 2014.

ASSOCIATED CORE COURSE

ASSOCIATED CORE COURSE IN PHYSICS

SEMESTER I/SEMESTER II

PHYSICS-AC-1 THEORY: MECHANICS

Credits: 03 Lectures: 45

Marks: 75 (End Semester Examination = 60 + Semester Internal Examination = 10 (Theory) + Class Performance & Attendance = 05) Pass Marks (Internal + End Semester) = 40

Instructions to Question Setters

Semester Internal Examination (SIE) – 10 Marks:

The question paper will be divided into two groups: Group A and Group B.

Group A: Consists of five very short answer-type questions, each carrying 1 mark. All five questions are compulsory.

Group B: Contains two descriptive-type questions, each carrying 5 marks. Candidates are required to answer only one question from this group.

End Semester Examination (ESE) – 60 Marks:

The question paper will be divided into two groups: Group A and Group B.

Group A (Compulsory): Question 1: Five very short answer-type questions of 1 mark each. Questions 2 and 3: Short answer-type questions, each carrying 5 marks.

Group B: Contains five descriptive-type questions, each carrying 15 marks. Candidates are required to answer any three questions from this group.

Note: Questions in the theory papers may have subdivisions.

COURSE OBJECTIVE

- This course begins with the review of Vectors and Differential equations and ends with the Special Theory of Relativity. Students will also appreciate the Gravitation, Elasticity, Surface tension, Viscosity and Oscillations.
- The emphasis of this course is to enhance the basics of mechanics. By the end of this course, students should be able to solve the seen or unseen problems/numericals in vectors, differential equations and mechanics and some properties of matter.

COURSE LEARNING OUTCOMES

Upon completion of this course, students are expected to understand the following concepts which would help them to appreciate the application of the fundamental concepts to the analysis of simple, practical situations related to the real world:

- Understand the role of vectors and coordinate systems in Physics.
- Learn to solve Ordinary Differential Equations: First order, Second order Differential Equations with constant coefficients.
- Understand laws of motion and their application to various dynamical situations.
- Apply Kepler's law to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.
- Explain the phenomenon of simple harmonic motion.
- Understand special theory of relativity - special relativistic effects and their effects on the mass and energy of a moving object.

- In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, vernier callipers, travelling microscope) student shall embark on verifying various principles learnt in theory. Measuring 'g' using Bar Pendulum, Kater's pendulum and measuring elastic constants of materials, viscous properties of liquids etc.

SKILLS TO BE LEARNED

- Learn the concepts of vector calculus.
- Learn the concepts of elasticity of solids and viscosity of fluids.
- Develop skills to understand and solve the equations of Newtonian gravity and central force problem.
- Acquire basic knowledge of oscillation.
- Have an understanding of basic concepts of Special Theory of Relativity.

COURSE CONTENT

Vector Analysis: Triple Scalar product, Triple Vector product, gradient, divergence, Curl and their physical significance, scalar and vector fields, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem. **(10 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. **(4 Lectures)**

Central force field: Motion of a particle in a central force field –two body problem. Kepler's Laws and their deduction. **(4 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. **(4 Lectures)**

Elasticity: Elastic constants and their interrelations, Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion, Torsional pendulum. **(8 Lectures)**

Fluids: Surface Tension: Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of liquid with temperature. **(8 Lectures)**

Special Theory of Relativity: Galilean transformations. Postulates of Special Theory of Relativity. Lorentz transformation, Length contraction, Time dilation, Relativistic addition of velocities. **(7 Lectures)**

Reference Books:

1. Mathematical Physics, H K Das and Dr. Rama Verma, S. Chand and Company Limited.
2. Mathematical Physics, B D Gupta, Vikash Publishing House, 4th edition.
3. Mathematical Physics, B.S. Rajput, Pragati Prakashan, 21st Edition, 2009.
4. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jonesand Bartlett Learning.
5. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
6. University Physics, F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986, Addison-Wesley.
7. Mechanics Berkeley Physics, v.1; Charles Kittel, et. al. 2007, Tata McGraw-Hill.

8. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley.
9. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
10. Elements of Properties of Matter, D. S. Mathur, S. Chand Publication.
11. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
12. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
13. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
14. Feynman Lectures, Vol. I, R.P. Feynman, R.B. Leighton, M.Sands, 2008, Pearson Education
15. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
16. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
17. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
18. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

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.

PHYSICS AC-1: Practical

Credit: 01 Lectures: 30(15X2)

Instructions to Question Setters

End Semester Examination (ESE): 25 Marks

There will be one Practical Examination of 3 hours 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*

Note: No internal or mid-semester examination will be conducted for the practical paper

1. To measure the diameter of a thick wire using a vernier caliper.
2. To measure the diameter of a thick wire using screw gauge.
3. To measure the diameter of a thick wire using a travelling microscope.
4. To study the random error in observations.
5. To study the Motion of a Spring and calculate (a) the Spring constant, (b) g.
6. To determine the Coefficient of Viscosity of water by the Capillary Flow Method (Poiseuille's method).
7. To determine the Young's Modulus of a Wire by a suitable method.
8. To determine the Modulus of Rigidity of a Wire by a suitable method.
9. To determine the elastic Constants of a wire by Searle's method.
10. To determine the value of g using the Bar Pendulum.
11. To determine the value of g using Kater's Pendulum.

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal
4. B.Sc. Practical Physics, N. N. Ghosh, Bharati Bhawan Publishers.
5. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company, 19th Edition, 1995, Reprint 2014.
6. Engineering Practical Physics, S. Panigrahi & B. Mallick,2015, Cengage Learning India Pvt. Ltd.
7. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

MDC (Multidisciplinary Course): PHYSICS

SEMESTER I/SEMESTER II/SEMESTER III

MDC-1/2/3: PHYSICS

(Credits: Theory-03 Lectures-45)

Marks: 75 (End Semester Examination: 75) No Semester Internal Examination Pass Marks: 30

Instructions to Question Setter for

End Semester Examination (ESE) – 75 Marks:
The question paper will be divided into two groups: Group A and Group B.
Group A (Compulsory): *Question 1: Five very short answer-type questions of 1 mark each. Questions 2 and 3: Short answer-type questions, each carrying 5 marks.*
Group B: *Contains six descriptive-type questions, each carrying 15 marks. Candidates are required to answer any four questions from this group.*
Note: *Questions in the theory papers may have subdivisions.*

Unit I Motion
Velocity, acceleration, momentum, inertia, force, laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, weightlessness. **(6 lectures)**

Unit II Properties of Matter
Different phases of matter, surface tension, capillary rise, viscosity-Poiseuille's formula, Heat, temperature, different temperature scales: degree Celsius, Fahrenheit and Kelvin, idea of transverse and longitudinal waves. **(9 Lectures)**

Unit III Light & lenses
Reflection, refraction, total internal reflection, dispersion, diffraction, interference, scattering (elementary ideas only), blue colour of sky, twinkling of stars. Mirage, rainbow, concave and convex lenses, focal length, power of a lens, refractive index, defects of the eye- myopia, hypermetropia, presbyopia and astigmatism and their correction by lens. **(11 Lectures)**

Unit IV Electricity & Magnetism
Electricity: Voltage and current, Ohm's law, idea of combination of resistance in series and parallel, Electric power (E Bill), calculation of energyrequirement of electric appliances, transformer, generator.
Magnetism: Electromagnetic induction-super conductivity-Meissner effect (qualitative idea), Maglev train. **(10 Lectures)**

Unit V Our Universe
Galaxies- Stars, Planets & satellites – solar system, lunar and solar eclipses, evolution of stars, black holes (basic concept). Artificial satellites: Geo stationary and Polar satellites. **(9 Lectures)**

Reference Books:

1. Physics text books for class 11th and 12th NCERT, New Delhi, revised editions 2022.
2. Concepts of Physics, Part-I and Part-II, H. C. Verma, 2020, Bharati Bhawan.
3. Elements of Properties of Matter, D. S Mathur,2010, S. Chand & Co.
4. Fundamentals of Physics with Applications, Arthur Beiser, 2010, Tata McGraw-Hill publishing Co. Ltd.
5. Optics by Ajay Ghatak, New Delhi, 1998 Tata McGraw-Hill publishing Co. Ltd.
6. Electricity and Magnetism, A. S. Mahajan, A. A. Rangwala, 2017 McGraw Hill, New Delhi.
7. An Introduction to Astrophysics, Baidyanath Basu, Tanuka Chattopadhyay, Sudhindra Nath Biswas, Second Edition, 2010, PHI Learning Private Limited.

Additional Books for reference:

1. Mechanics (in SI units) - (Berkley Physics course-volume 1), Charles Kittel, Walter D knight etc, Tata McGraw Hill publication, 2017, second edition
2. Fundamental of General Properties of Matter, H.R Gulati, R Chand and Co, Fifthedition (1977).
3. A Text book of Optics by Subrahmanyam N., BrijLal and M. N. Avadhanulu.

FORMAT OF QUESTION PAPER FOR SEMESTER INTERNAL EXAMINATIONS

Question format for 10 Marks:

Subject/ Code

F.M. =10 Time=1Hr. 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 sub parts of a question at one place.
v. Numbers in right indicate full marks of the question.

Group A

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

Group B

2. ..... [5]
3. ..... [5]

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

Question format for 20 Marks:

Subject/ Code

F.M. =20 Time=1Hr. 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 sub parts of a question at one place.
v. Numbers in right indicate full marks of 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 Theory Examination.

FORMAT OF QUESTION PAPER FOR END-SEMESTER UNIVERSITY EXAMINATIONS

Question format for 50 Marks:

Subject/ Code

F.M. =50 Time=2Hrs. 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 sub parts of a question at one place.
v. Numbers in right indicate full marks of 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 Theory Examination.

Question format for 60 Marks:

Subject/ Code

F.M. =60 Time=3Hrs. 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 sub parts of a question at one place.
v. Numbers in right indicate full marks of 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]

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

Question format for 75 Marks;

Subject/ Code

F.M. = 75 Time=3Hrs. 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 sub parts of a question at one place.
v. Numbers in right indicate full marks of 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 Theory Examination.