

अभिषद
Senate

25वीं बैठक के कार्यवृत्त
**Minutes of
25th Meeting**

02 September 2025 (Friday) at 3.00 PM
(Hybrid Mode)

Board Room, Permanent Campus, IISER Berhampur

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Indian Institute of Science Education and Research Berhampur
Senate

Minutes of the 25th Meeting
02 September 2025 (Tuesday) at 3:00 pm
Board Room, IISER Berhampur

The 2025-3/25th meeting of the Senate, IISER Berhampur was held on 02 September 2025 (Tuesday) at 3:00 pm in the Boardroom (through Hybrid Mode). The following members were present:

1.	Prof. Ashok Kumar Ganguli, Director, IISER Berhampur	Chairperson
2.	Prof. Tara Chandra Kandpal, Former Professor, Department of Energy Science & Engineering and Former Dy Director, IIT Delhi (attended online)	Member
3.	Prof. K George Thomas, Professor of Chemistry, IISER Thiruvananthapuram (attended online)	Member
4.	Prof. Prosenjit Mondal, HoD, Biological Sciences and Dean of Academic Affairs & Faculty Affairs	Member
5.	Prof. Joydip Mukhopadhyay, HoD, EES and Dean (International Relations)	Member
6.	Prof. Debendra Kumar Mohapatra, Dean (R&D) (attended online)	Member
7.	Dr. Bodhisatta Nandy, Associate Professor, Dean, Student Affairs and DUGC Biological Sciences	Member
8.	Dr. Thirupathi Barla, Associate Dean, Academic Affairs	Member
9.	Dr. Ritabrata Sengupta, Associate Professor, HoD, Computer Science (attended online)	Member
10.	Dr. Prem Prakash Pandey, Associate Professor, HoD, Mathematical Sciences	Member
11.	Dr. Shashi Bhushan Singh, Associate Professor, HoD, Physical Sciences	Member
12.	Dr. Malay Kumar Rana, Associate Professor, HoD, Chemical Sciences	Member
13.	Dr. Nihar Kanta Patra, Librarian	Member
14.	Dr. R Selvi Bharathavikru, Associate Professor, Associate Dean, Outreach	Member

15.	Dr. Victor Mukherjee, Assistant Professor, Physical Sciences	Member
16.	Dr. Shikha Gandhi, Associate Professor, Chemical Sciences (attended online)	Member
17.	Dr. Arunkumar Krishnan, Assistant Professor, Biological Sciences (attended online)	Member
18.	Dr. Kasi Viswanatham Gopajosyula, Associate Professor, Warden	Member
19.	Shri Aditya Aryan, Student Representative-UG	Member
20.	Dr. Prosenjit Daw, Associate Professor, Coordinator, Academic Affairs (PG)	Special Invitee
21.	Dr. Chandan Maity, Coordinator, Academic Affairs (Scholarship and Fellowship)	Special Invitee
22.	Shri Pradeep Kumar Ray, Registrar	Secretary

The following members could not attend the meeting and leave of absence has been given to them:

1.	Dr. Jose Sebastian, Associate Professor, Coordinator, Academic Affairs (UG)	Special Invitee
2.	Shri Pratyush Pani, Student Representative-Ph.D.	Member
3.	Prof. Reetika Khera, Professor of Economics, IIT Delhi	Member

The agenda as circulated were taken up in the meeting and minutes of the 25th meeting are as under: -

25.1	The Chairperson of the Senate extended a warm welcome to all Senate members and invitees to the 25th meeting of the Institute's Senate. The Chairperson congratulated all the faculty and staff for the successful conduct of the 5th Convocation of the Institute held on 09 August 2025 and informed that the Hon'ble Minister of Education has expressed his happiness and pleasure with the Institute's performance. Further, he mentioned that important approvals from the Ministry were accorded including sanction of teaching and non-teaching posts. The Chairperson has also observed that the Office of Academic Affairs has improved significantly and work flow was streamlined in the last 2 years and there is much more scope for improvement to achieve in consonance with an Institute of National Importance stature. Thereafter, the following agenda items were taken up for the discussion with his permission.
25.1.1	Confirmation of Minutes of the 24th Meeting of the Senate held on 01 August 2025

	The minutes of the above meeting were shared with the Senate members through email on 02 August 2025. The comments dated 02 August, 2025 as received from Prof. Tara Chandra Kandpal was incorporated in the minutes. The revised minutes were circulated to all members on 03 August 2025. Further, no comments were received. The Senate resolved to confirm the said minutes.																																		
25.1.2	Report on Action Taken on Decisions of the 23rd Meeting held on 30 April 2025 and 24th Meeting held on 01 August 2025																																		
	The Senate noted the action taken by the Institute on the resolutions of the 23rd and 24th meetings of Senate: <i>23rd Meeting held on 30 April 2025:</i> <table border="1"> <thead> <tr> <th>S.No.</th><th>Items</th><th>Action Taken</th></tr> </thead> <tbody> <tr> <td>23.2.1</td><td>Renaming of BS-MS programme in Earth and Environmental Sciences to 'BS-MS programme in Geological Sciences' for Geological Sciences major students</td><td>Implemented</td></tr> <tr> <td>23.2.2</td><td>Concept note and credits structure of Pre-major</td><td>In progress</td></tr> <tr> <td>23.2.3</td><td>Academic Calendar for Semester - I of AY 2025-26</td><td>Implemented</td></tr> <tr> <td>23.2.4</td><td>MS Degree Nomenclature for iPhD students exiting after 03 years</td><td>In progress</td></tr> <tr> <td>23.2.5</td><td>Proposed changes in PhD Admission Guidelines</td><td>In progress</td></tr> <tr> <td>23.2.6*</td><td>Issuance of B.Sc. and M.Sc. equivalent degree certificates to BS-MS Students</td><td>Being implemented</td></tr> </tbody> </table> * The Senate deliberated on the issue of equivalent certificates as proposed in the 23rd meeting of Senate held on 30 Apr 2025. The Dean of Academic Affairs informed that the similar certificates are being issued by other IISERs. For the benefit of students of the Institute, in applying for higher education and recruitment, the Senate resolved to approve issuance of the equivalent certificates. <i>24th Meeting held on 01 August 2025:</i> <table border="1"> <thead> <tr> <th>S. No.</th><th>Items</th><th>Action Taken</th></tr> </thead> <tbody> <tr> <td>24.2.1</td><td>Date for 5th Convocation of the Institute.</td><td>Implemented</td></tr> <tr> <td>24.2.2</td><td>To consider and recommend to the BoG for the award of various medals to BS-MS students during the 5th Convocation</td><td>Implemented</td></tr> <tr> <td>24.2.3</td><td>To consider and recommend to the BoG for award of BS-MS, MS degree and Ph.D. Degree</td><td>Implemented</td></tr> </tbody> </table>		S.No.	Items	Action Taken	23.2.1	Renaming of BS-MS programme in Earth and Environmental Sciences to 'BS-MS programme in Geological Sciences' for Geological Sciences major students	Implemented	23.2.2	Concept note and credits structure of Pre-major	In progress	23.2.3	Academic Calendar for Semester - I of AY 2025-26	Implemented	23.2.4	MS Degree Nomenclature for iPhD students exiting after 03 years	In progress	23.2.5	Proposed changes in PhD Admission Guidelines	In progress	23.2.6*	Issuance of B.Sc. and M.Sc. equivalent degree certificates to BS-MS Students	Being implemented	S. No.	Items	Action Taken	24.2.1	Date for 5th Convocation of the Institute.	Implemented	24.2.2	To consider and recommend to the BoG for the award of various medals to BS-MS students during the 5th Convocation	Implemented	24.2.3	To consider and recommend to the BoG for award of BS-MS, MS degree and Ph.D. Degree	Implemented
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	24.2.4	Proposal for Establishment of New Department: Department of Humanities and Social Sciences	To be further discussed
25.2	Discussion Items		
25.2.1	Concept note, credits structure and curriculum for 1st two years of Pre-major for BSMS Programme		
	The Credit definition as part of the BSMS Pre-major proposal was approved by the Senate in its 23rd meeting (Resolution No. 23.2.2) held on 30 Apr 2025 to be implemented from AY 2025-26 Semester-I onwards. As per the suggestions of the Senate regarding the credit structure, including the course contents, number of pre-major options, and other modalities, the Academic Development Committee (ADC) in its meetings held on 25 July 2025 and 21 Aug 2025 extensively discussed and recommended its inputs to be presented to the Senate. The Dean of Academic Affairs presented the proposal of the ADC, which was prepared in line with the Senate recommendation. The Senate discussed at length and resolved to approve the Concept Note, Credit Structure and Curriculum (a combined document is enclosed as Annexure-1) for the 5-Year BS-MS Dual Degree Programme to be implemented from AY 2025-26 Semester-I onwards.		
25.2.2	Proposal for awarding MS by Research Degree to the iPhD students exiting after 03 years		
	The Senate vide Resolution No 23.2.4 in its 23rd meeting held on 30 Apr 2025 approved the renaming of the MS Degree awarded to iPh.D. students exiting the program after 03 years as MS (Research) with the following comments: 1. A concept note is to be prepared with course contents, credit requirements along with thesis course code, evaluation parameters etc. in comparison with the MS degree. 2. A committee may be constituted by the Chairperson Senate to review the existing provisions and suggest required amendments to streamline the award of degree. 3. The proposal may be deliberated in IAAC for the award of MS (Research) and the same may be presented to the subsequent Senate meeting for approval. The IAAC in its 22nd Meeting held on 28 August 2025, discussed the proposal submitted by the duly constituted committee and recommended the same to the Senate for consideration. The Senate suggested the following to be incorporated in the draft proposal: • The degree to be awarded be called as MS (Research) instead of MS (by Research) as mentioned in the proposal document • The duration may be six registered semesters instead of three years. • iPh.D. students be mentioned instead of Research Scholars while referring to the students exiting iPh.D. programme after six registered semesters. • The PI mentioned be referred to as supervisor. • The word 'Thesis' be replaced with 'Project'		

	- The project report submitted be evaluated by internal examiners and the proposal for evaluation by the external examiners is redundant as the Institute is autonomous and empowered to do so. - The iPh.D. student who is not meeting the required CPI criteria may be issued notice after the I semester and be terminated from the programme after the II semester if the CPI requirement is not met. The Senate resolved to approve the award of MS (Research) degree to iPh.D. students exiting after six registered semesters of iPh.D. program. Accordingly, the iPh.D. manual will be amended with the following: (i) At Section 11: The subject line "Exit with MS degree (Exit option)" will be replaced by "Exit Options" (ii) At Section 11 a. "(With MS Degree)" will be inserted after the subject line "Involuntary Exit" (iii) At Section 11 b. "(With MS (Research) Degree) {see Section 11A}" will be inserted after the subject line "Voluntary Exit" (iv) Section 11A "Guidelines for Exit with MS (Research) Degree" (<i>details placed at Annexure-2</i>) will be inserted after Section 11.										
25.2.3	Academic Calendar for Semester - I of AY 2025-26 for BSMS 2025 batch										
	The Senate resolved to approve the Academic Calendar for Semester-I of AY 2025-26 for BSMS 2025 batch placed at Annexure-3 .										
25.2.4	Proposal for a new non-graded course on Research Methodology for Ph.D. students										
	The Senate, in its 21st Meeting held on 29 July 2024, has approved offering a compulsory non-graded course on Research Methodology for Ph.D. students joining August 2024 onwards. The detailed course content was presented in the IAAC. The IAAC deliberated on the proposal and recommended it to the Senate. The Senate deliberated on the matter and the following recommendations were proposed by the members: - The number of hours allotted is very low and the same may be 14-28 hours. - A detailed lecture plan needs to be prepared. The Senate resolved to approve the new course i.e. Research Methodology (placed at Annexure-4 after incorporation of above suggestions) to be offered to Ph.D. students.										
25.2.5	Ratification Items: The Senate ratified the following items approved by the Chairperson, Senate with the comments/suggestion mentioned towards the end of the list of items: <table border="1"> <thead> <tr> <th>S. No.</th><th>Item</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Minutes of the 24th Meeting of the Senate held on 01 August 2025</td></tr> <tr> <td>2.</td><td>Withdrawal from the PhD programme of Mr. Sibaji Das (2410501)</td></tr> <tr> <td>3.</td><td>Request for One-Time Approval - CDS307 - Architecture and Operations of Computing Systems</td></tr> <tr> <td>4.</td><td>Issuance Ph.D. Provisional Certificate- Ms. Susmita Mukherjee (Roll No. 1810502) and Prabhupada Dixit (Roll No. 1920503)</td></tr> </tbody> </table>	S. No.	Item	1.	Minutes of the 24th Meeting of the Senate held on 01 August 2025	2.	Withdrawal from the PhD programme of Mr. Sibaji Das (2410501)	3.	Request for One-Time Approval - CDS307 - Architecture and Operations of Computing Systems	4.	Issuance Ph.D. Provisional Certificate- Ms. Susmita Mukherjee (Roll No. 1810502) and Prabhupada Dixit (Roll No. 1920503)
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not satisfactory, the matter will be referred to the Senate for a decision on cancellation of registration or continuation for further work.

- (iv) The viva-voce board may also recommend revisions to be made in the final version of the project report after taking into consideration, suggestions of the examiners who evaluated the project and the discussion at the viva-voce examination. The Chairman of the viva voce board shall forward the project report to the Academic section certifying that the revisions recommended by the viva-voce board, if any, have been incorporated in the copy of the project report along with the report of the viva-voce board.
 - (v) All students shall submit a digitally authenticated soft copy of the final form of the MS project report to the Academic Progress Committee after the viva voce board recommends the award of the degree.
8. **Award of MS (Research):** On the recommendation of the Academic Progress Committee, the Senate, and with the approval of the Board of Governors of the Institute, the iPh.D. student will be awarded the MS (Research) degree.

Academic Calendar 2025
BS-MS 2025 Batch (1st Year BS-MS)

*Odd Semester (September - December 2025)	
Event	Schedule
Commencement of Classes	Sep 10 (Wed)
Invenio (SAC event)	Sept 13-14
Class Committee Meeting	In the week of Oct 13 -16
Mid-semester examination	Oct 27-31 (Mon- Fri)
SRS	Nov 25 - 30 (Tue - Sat)
Last day of instruction	Dec 08 (Mon)
End-semester examination	Dec 09-13 (Tue-Sat)
Winter vacation (1 st Year BS-MS Students)	Dec 15- Jan 04
Make-up examination	Dec 17-18 (Wed - Thu)
Last date for showing evaluated answer scripts	Dec 19 (Fri)
Grade moderation day	Dec 19 (Fri)
Last date for grade submission and conversion of 'I' grade	Dec 20 (Sat)
Winter vacation for faculty (Offering Courses for 1 st Year BS-MS)	Dec 20, 2025 (Sat) - Jan 04, 2026 (Sun)

Lectures on the following days will be held with the schedule of the days mentioned against them:

Time Table Adjustment Sem I	
Wednesday Time Table will be followed	27 Sept (Sat)
Thursday Time Table will be followed	Oct 11 (Sat)
Friday Time Table will be followed	Oct 25 (Sat)
Tuesday Time Table will be followed	1 Nov (Sat)
Wednesday Time Table will be followed	Nov 22 (Sat)

Proposal of a New Course

Course Title	Research Methodology		
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☒ 700 ☐	Semester: Odd ☐ Even ☐ Either semester ☒	
Course Type (tick (✓) in relevant option)	Open Elective/PhD		
Department:	Academic Affairs_PG		
Credits with LTP structure:	0 (Lecture: 1 + Tutorial: 0 + Fieldwork: 0 + Self-study)		
Course number:	RM 601		
For:	BS-MS (Dual Degree) ☐ Integrated Ph.D. ☒ Ph.D. ☒		
Name of faculties who can teach the course:	Faculty from each department will offer this course to deliver the basic understanding of the Research methodology, in addition some common instructor will also cover some general topics.		
Will the course require participation of visiting faculty: Yes / No			
Pre-requisites, if any	Nil		
Course code(s)			
Objective(s) and Expected Learning Outcomes:			
Objectives: This course is designed to introduce fundamental principles and important aspects of scientific research. Mainly this course provides a broad knowledge on methods of research, data analysis, report writing, presentation, protecting intellectual property and ethical practices. Expected Learning Outcome: After completion of this course, the students will be able to understand research methods, develop the skills of writing of research reports, develop ethical practices in research, and discuss research information within the scientific community and society.			
Course Content:			
1. What is research: The concept and objectives of research, types of research, research hypothesis, research and theory, conceptual and theoretical Models. Types and Methods of Research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. 2. Research planning or experimental design: Necessity to define research problem, research gap, working hypothesis, planning process, research design. Planning of Research: The planning Process, Selection of a Problem for Research, Formulation of the Selected Problems, Measurement, Research Design/Plan. Lab and biosafety for the relevant department (Mainly experimental research work): Safe laboratory practices, biosafety levels, biological hazard information, labels, signs and storage of chemical and biological reagents, Classes and types of biosafety cabinets, inactivation and disposal of biological products, waste management, and incident response, report and risk management. 3. Data collection and analysis and Research ethics: Meaning and Importance of Data, Basics of statistics, data processing and analysis strategies and tools, hypothesis testing, interpretation of data. Ethical issues, citation and acknowledgement, plagiarism, reproducibility and accountability. 4. Literature search, collection, storage and citation: Importance of literature review in defining a problem, literature review, online tools, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis 5. Writing research reports, Science journals and the peer-review process: Types of reports (articles, reviews, progress reports and thesis), formats, planning of report writing. Figure preparation and manipulation. Effective use of English language in scientific papers. Types of journals, publication process, peer-review process, meaning of impact factor, H-index, etc. 6. Presentation skills and Science popularization and outreach: Preparation of slides for talks, preparation of posters, design of research paper Presentation types and skills. Media coverage, lectures in public forums, circulation of scientific ideas and provoking thoughts, and the pros abs cons of these activities. 7. IPR: Intellectual property rights and patent law, commercialization, copyright, trademarks, royalty, trade-related aspects of intellectual property rights, and a few case studies.			
Lecture Outline:			
Module No	Topic	No. of Hours (1 Lecture = 1 hour)	
1	What is research	1	
2	Research planning or experimental design	3	

3	Data collection and analysis and Research ethics	3
4	Literature search, collection, storage and citation	3
5	Writing research reports, Science journals and the peer-review process	2
6	Presentation skills and Science popularization and outreach	1
7	IPR	1
Total number of contact hours		14 hours

Brief Description of Tutorial Activities: Not Applicable

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: Not Applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): **Not Applicable**

Suggested Reading:

1. The Craft of Research. 4th edition by Wyne C. Booth, Colomb, William, University of Chicago Press.
2. Doing Your Research Project. A Guide for First-time Researchers. By Judith Bell, Stephen Waters, publishers: McGraw-Hill Education (2014).
3. Research Methodology: A Step-By-Step Guide For Beginners, by Ranjit Kumar, Publisher: Sage South Asia (2011).
4. Research Methodology: Methods and Techniques, by C. R Kothari, Publisher: New Age International (2004).
5. The Dissertation Journey, by Laura Hyatt, Carol Roberts, Publisher: Corwin (2023).
6. How to Write a Scientific Paper: An Academic Self-Help Guide for PhD Students, by Jari Saramaki (2018).
7. WIPO Intellectual Property Handbook (Web resources).
8. The WHO Laboratory Biosafety Manual (LBM), 4th edition (online).

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz etc), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute PhD manual).

Name and Signature of course proposers: **Coordinator PG, Academic Affairs**

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Concept Note

Pre-major Credit Structure at IISER Berhampur (BSMS Programme)

1. Introduction

The 5-year BSMS (Bachelor of Science - Master of Science) Integrated Programme at IISER Berhampur is designed to provide a rigorous foundation in science while incorporating flexibility for interdisciplinary learning, and the choice of choosing three pre-majors to minimize the burden and focus on chosen pre-majors. This document outlines the credit structure, curriculum phases, and academic policies governing the programme.

2. Programme Structure

The BSMS programme is divided into four phases, each with distinct academic objectives.

Phase 1: Foundation Year (Semesters I–II)

- Objective: Build a strong foundation in core sciences and humanities.
- Courses:
 - Core Sciences: Biology, Chemistry, Physics, Mathematics, Earth & Environmental Sciences.
 - Humanities & Social Sciences (HSS) / Computer Science.
- Credits: A total of 39 credits will be offered during the foundation year (19+20).

Phase 2: Pre-Major Year (Semesters III–IV)

- Objective: Exposure to three pre-major disciplines for informed specialization.
- Structure: A student must choose three pre-major subjects from the five major subjects (Biology, Chemistry, Physics, Mathematics, Earth & Environmental Sciences).
- Credits:
 - 23 credits per semester will be offered (7 credits (6 theory + 1 practical) in each stream of three pre-majors+2 credits in HSS/CDS).
 - Departments may adjust credit distribution for subjects without practicals.

Phase 3: Major Years (Semesters V–VIII)

- Objective: Specialization in a chosen major with electives and optional minors.
- A student must choose one of the five major subjects (Biology, Chemistry, Physics, Mathematics, Earth & Environmental Sciences) to get a major degree.

- Credits:
 - A student has to register for a minimum of 18 credits (compulsory + elective(s)) and upto a maximum of 21 credits (overload courses are permitted as per institutional rules).
- Each Department must offer at least one open elective (3 credits) per semester, and among the minimum 18 credits, every student must choose one open elective from any department (including his/her own major department).
- The departments can distribute the remaining 15 credits as per their requirements.

Phase 4: Dissertation Phase (Semesters IX–X)

- Objective: Independent research with flexibility for external learning.
- Credits: 36 credits for Dissertation Phase (18 credits per semester).

3. Credit System

A Semester consists of 14 weeks and should accommodate at least 42 contact hours for theory and laboratory courses.

Each course will be assigned some credits based on the contact hours per week.

A. Theory Courses

- 1 credit = 1 contact hour per week.
For theory courses one credit indicates an instruction of 1 contact-hour per working week (14 contact-hours per semester).

B. Tutorial:

- 1 credit = 1 contact hour/week.
For Tutorial one credit indicates an effort of 1 contact-hour per working week (14 contact-hours per semester).

C. Practical Courses

- 1st/2nd-year labs: 1 credit = 3 contact hours/week (e.g., 3-hour weekly sessions).
- 3rd/4th-year labs: one Full-day session (At least 8 contact hours) /week = 3 credits.

L-T-P-C Notation L-T-P => Lecture – Tutorial – Practicals – Credits Credit structure of each course is given in L-T-P form (e.g. 2–1–0). The numbers corresponding to L, T and P denote the contact hours per week for Lecture, Tutorial and Practical respectively.

Foundation	Semester-I		Biology	Chemistry	Physics	Mathematics	EES		HSS-1	HSS-2	Total sem credit	Cumulative credits
		Theory	3	3	3	3	3		1	1		
		Practical/ (Bridge course for maths)	1	0	0	1	0		0	0		
		Total	4	3	3	4	3		1	1	19	19
		Winter break										
	Semester-II		Biology	Chemistry	Physics	Mathematics	EES	CS				
		Theory	3	3	3	3	3	2				
		Practical/ (Bridge course for maths)	0	1	1	0	0	1				
	Total	3	4	4	3	3	3			20	39	
Summer break												
Pre-major	Semester-III		Pre-major I	Pre-major II	Pre-major III	CS						
		Theory	6	6	6	1						
		Practical	1	1	1	1						
		Total	7	7	7	2					23	62
		Additional remark: For subjects with no practicals, 7 credit can be distributed across theory courses.										
		Winter break										
	Semester-IV		Pre-major I	Pre-major II	Pre-major III	HSS						
		Theory	6	6	6	2						
		Practical	1	1	1							
		Total	7	7	7	2					23	85
	Additional remark: For subjects with no practicals, 7 credit can be distributed across theory courses.											
Summer break												
Major	Semester-V		Major compulsory	Major Elective	Open Elective					Minor (if opted)		
		Theory	Department specific distribution of courses (15-being dept specific)							Min. 3, Max. 8 credit		
		Practical										
		Total	Minimum 18 credits (15 for Departmental Core/Electives +3 Open Elective, which can be departmental/outside departmental). A student has to register for a minimum of 18 credits (compulsory + elective(s)) and up to a maximum of 21 credits. (overload courses are permitted as per institutional rules).							18	103	
		Winter break										
	Semester-VI		Major compulsory	Major Elective	Open Elective					Minor (if opted)		
		Theory	Department specific distribution of courses							Min. 3, Max. 8 credit		
		Practical										
		Total	Minimum 18 credits (15 for Departmental Core/Electives +3 Open Elective which can be departmental/outside departmental), A student has to register for a minimum of 18 credits (compulsory + elective(s)) and up to a maximum of 21 credits. (overload courses are permitted as per institutional rules).							18	121	
		Summer break										
	Semester-VII		Major compulsory	Major Elective	Open Elective					Minor (if opted)		
		Theory	Department specific distribution of courses							Min. 3, Max. 8 credit		
		Practical										
		Total	Minimum 18 credits (15 for Departmental Core/Electives +3 Open Elective which can be departmental/outside departmental), A student has to register for a minimum of 18 credits (compulsory + elective(s)) and up to a maximum of 21 credits (overload courses are permitted as per institutional rules).							18	139	
		Winter break										
	Semester-VIII		Major compulsory	Major Elective	Open Elective					Minor (if opted)		
		Theory	Department specific distribution of courses							Min. 3, Max. 8 credit		
		Practical										
		Total	Minimum 18 credits (15 for Departmental Core/Electives +3 Open Elective which can be departmental/outside departmental), A student has to register for a minimum of 18 credits (compulsory + elective(s)) and up to a maximum of 21 credits (overload courses are permitted as per institutional rules).							18	157	
	Summer break											
Dissertation	Semester-IX	Dissertation phase										
											18	175
		Mid-term assessment										
	Semester-X	Dissertation phase									18	193

Revised 5-Year* BS-MS Dual Degree Programme
INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH BERHAMPUR

(Effective from the batch of 2025 onwards)
(*Two-years course detailed provided below)

BS-MS Dual Degree Programme at IISER Berhampur

The **Indian Institute of Science Education and Research Berhampur (IISER-BPR)** offers a **five-year integrated BS-MS Dual Degree Programme**, blending rigorous academic training with cutting-edge research. It is designed to nurture scientific curiosity and interdisciplinary thinking. The program prepares students for careers in research, industry, and academia.

Program Highlights

- **Comprehensive Curriculum:** Core training in Physics, Chemistry, Biology, Mathematics, and Earth and Environmental Sciences with flexibility to specialize.
- **Research-Driven Learning:** Hands-on projects, summer internships, and a master's thesis under faculty guidance.
- **Interdisciplinary Approaches:** Encourages exploration across scientific disciplines.
- **Electives & Advanced Courses:** Tailor the students' academic journey with specialized subjects.

With a balance of **theory and experimentation**, IISER Berhampur's BS-MS program equips students to tackle real-world scientific challenges.

SEMESTER I

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	BS101	Biology I: Basic properties of living organisms	Theory	3	0	0	3
2	BS103	Introductory Biology laboratory	Laboratory	0	0	3	1
3	CH101	General Chemistry I	Theory	3	0	0	3
4	PS101	Fundamentals of Physics I	Theory	3	0	0	3
5	MS101	A Potpourri of Mathematics	Theory	3	0	0	3
6	MS103	Writing Mathematics	Theory	1	0	0	1
7	ES101	Introduction to Earth System Science	Theory	2	1	0	3

8	HS101	Basic Communication Skills	Theory	1	0	0	1
9	HS103	Fundamentals of Physical Education & Well-Being	Practical*		0	3	1
Total credits							19

- *There will be some theory classes for this course.

SEMESTER II

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	BS102	Biology II: Flow of Biological Information	Theory	3	0	0	3
2	CH102	General Chemistry II	Theory	3	0	0	3
3	CH104	General Chemistry Laboratory	Laboratory	0	0	3	1
4	PS102	Fundamentals of Physics II	Theory	3	0	0	3
5	PS104	Physics Laboratory I	Laboratory	0	0	3	1
5	MS102	Calculus Of One Variable	Theory	3	0	0	3
7	ES102	Introduction to Environmental Science	Theory	2	1	0	3
8	CS102	Introduction to Programming with Python	Theory and Laboratory	2	0	3	3
Total credits							20

SEMESTER III

One has to choose three pre-major disciplines (of 7 credits each) and a mandatory course, Introduction to Data Analytics; Concepts and Applications (CS201 of 2 credits), totalling 23 credits, from the following department specific course basket.

Premajor in Biological Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	BS201	Biology III: Introduction to Evolution, Ecology and Ethology	Theory	3	0	0	3

2	BS203	Biology IV: Fundamentals of Cell and Molecular Biology	Theory	3	0	0	3
3	BS205	Biology pre-major lab I	Laboratory	0	0	3	1
Total credits							7

Premajor in Chemical Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	CH201	Organic Chemistry I	Theory	3	0	0	3
2	CH203	Inorganic Chemistry I	Theory	3	0	0	3
3	CH205	Synthetic Chemistry Laboratory	Laboratory	0	0	3	1
Total credits							7

Premajor in Physical Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	PS201	Classical Mechanics	Theory	3	0	0	3
2	PS203	Mathematical Methods I	Theory	3	0	0	3
3	PS205	Physics Laboratory II	Laboratory	0	0	3	1
Total credits							7

Premajor in Mathematical Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	MS201	Linear Algebra	Theory	3	1	0	4
2	MS203	Introduction to Probability and Statistics	Theory	3	0	0	3
Total credits							7

Premajor in Earth and Environmental Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	ES201	Principles of Mineralogy	Theory	2	1	0	3
2	ES203	Principles of Structural Geology	Theory	2	1	0	3

3	ES211	Foundation Mineralogy-Petrology Lab	Laboratory	0	0	3	1
Total credits							7

Compulsory Courses in Computer Science

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	CS201	Introduction to Data Analytics: Concepts and Applications	Theory and Laboratory	1	0	3	2
Total credits							2

SEMESTER IV

One has to choose three pre-major disciplines (of 7 credits each) and a mandatory HS course (of 2 credits), totalling 23 credits, from the following department specific course basket.

Premajor in Biological Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	BS202	Biology V: Microbiology & Immunology	Theory	3	0	0	3
2	BS204	Biology VI: Basic Biochemistry	Theory	3	0	0	3
3	BS206	Biology pre-major lab II	Laboratory	0	0	3	1
Total credits							7

Premajor in Chemical Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	CH202	Introduction to Spectroscopic Methods in Chemistry	Theory	3	0	0	3
2	CH204	Physical Chemistry I	Theory	3	0	0	3
3	CH206	Laboratory for Physical Methods in Chemistry	Laboratory	0	0	3	1

Total credits	7
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Premajor in Physical Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	PS202	Quantum Mechanics I	Theory	3	0	0	3
2	PS204	Electricity and Magnetism	Theory	3	0	0	3
3	PS206	Physics Laboratory III	Laboratory	0	0	3	1
Total credits							7

Premajor in Mathematical Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	MS202	Groups And Symmetry	Theory	3	0	0	3
2	MS204	Multivariable Calculus	Theory	3	1	0	4
Total credits							7

Premajor in Earth and Environmental Sciences

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	ES202	Plate Tectonics	Theory	2	1	0	3
2	ES204	Fundamentals of Climate and Conservation Science	Theory	2	1	0	3
3	ES212	Geological Maps and Structural Problems	Laboratory	0	0	3	1
Total credits							7

Compulsory Courses in HSS

S. No.	Course Code	Course Name	Course Type	LTP Structure (in hrs)			Credits
				L	T	P	
1	HS 202	Technical Writing & Communication Skills	Theory	2	0	0	2
Total credits							2

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology I: Basic properties of living organisms				
Course Level (tick (✓) in relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course code:	BS101				
Name of faculties who can teach the course:	Any faculty member in the Department of Biological Sciences				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	None				
Course code(s)					
Learning Objectives:					
The course is aimed at teaching the students the basics properties of biological organisms. Such properties include the definition of life itself, the multi-level organization, relating structure and functioning of an organism, the way they reproduce, the way they communicate with the outside environment, and the way they maintain the internal condition within the body as a steady state. The course also introduces how Biologists study living entities.					
Expected Learning Outcomes:					
After completing the course, a student should be able to: 1. Define life as an interconnected physiological and biological interaction that is capable of showing self-replication, and evolution through natural selection. 2. Understand and appreciate different levels of biological organization. 3. Understand that all life forms are connected through evolutionary ancestry, and understand scientific theories on how life originated on earth. 4. Classify all life forms in a five-kingdom classification system. 5. Understand the chemical building blocks of living organisms. 6. Visualize cells as a building block of life, and the internal structure and function at a basic level. 7. How living organisms reproduce – a basic property of all living beings. 8. Understand the basics of an organism's interaction with the outside environment for survival and reproduction, the basic properties of population growth, population interactions within a community, and appreciate the true importance of biodiversity. 9. Understand the basic concept of homeostasis – a steady state that is essential to life, how organisms maintain this steady state under constantly varying environmental conditions such as temperature – and that this ability has a limit 10. Ask biologically relevant questions, pose scientific hypotheses, and design simple experiments to test such hypotheses					
Course Content:					
1. Excitement and relevance of Biology with a few examples 2. Definition and properties of life 3. Origin and evolution of living organisms 4. Concept of tree of life 5. Chemical basis of life: Biological macromolecules 6. Cell as the building blocks of life 7. Perpetuation of life 8. Organisms and their environment 9. Chemical and neuronal coordination:					

10. How Biologists work: science of Biology, and a few key philosophical issues

Lecture Outline:

Module No.	Topic	No. of Hours
1	Excitement and relevance of Biology. A few examples.	1
2	Definition and properties: i. Life in its basic form. Basic life processes. ii. Different levels of organization: Cells, Tissues, Organs, and organisms	1
3	Origin and evolution of living organisms: Theories of origin of life. Evolution (descent with modification) and adaptation (evolution by natural selection).	1
4	Concept of tree of life. The broad classification of the living world	6 + 2* *(1 discussion session after every 3 lecture hrs = 2 discussion hours)
5	Chemical basis of life: Biological macromolecules: i. Protein ii. Lipid iii. Carbohydrate iv. Nucleic acids	6 + 2* *(1 discussion session after every 3 lecture hrs = 2 discussion hours)
6	Cells - the building blocks of life: i. Types and functions, Cell Theory ii. Structural components of cells and their function iii. Prokaryotic cell and Eukaryotic cell iv. Structure and functions of cell organelles v. Mitosis and the preservation of characters through generations. (Mention Meiosis as another type of cell division that will be discussed later)	6 + 2* *(1 discussion session after every 3 lecture hrs = 2 discussion hours)
7	Perpetuation of life: i. Reproduction in unicellular organisms. ii. Reproduction in multicellular organisms: Sexual and asexual modes of reproduction. Formation of gametes and Meiosis.	2 + 1* *(1 discussion hours)
8	Organisms and their environment: i. Determination of distribution of organisms: physical limits, habitat, niche ii. Population, community, and ecosystems iii. Basic principles of population growth iv. Community structure: population interactions, diversity v. Biodiversity and climate change	4 + 1* *(1 discussion hours)
9	Coordination and homeostasis: i. Concept of homeostasis through thermoregulation in multicellular organisms ii. Chemical and neuronal coordination: Hormones and their roles in chemical coordination between a variety of processes. The idea of the nervous system and neurons.	3 + 1* *(1 discussion hours)

	Perception, processing and action - three aspects of the nervous system.	
10	How Biologists work: - Asking questions, formulating hypotheses, testing hypotheses, interpretation and arriving at a conclusion. Use of two examples of biological investigations to this effect. - Importance of evolutionary thinking. Emergent properties: A critical review of reductionism in the study of Biology through a few examples.	2 +1* *(1 discussion hours)

Brief Description of Tutorial Activities:

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities: Not applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): N/A

Suggested Reading:
Textbooks:

- Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- Campbell, N. A., Reece, J. B., Ury, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014) *Biology: A Global Approach*. 10th Ed.

Reference books:

- Lehninger, A. L. (2017). *Lehninger Principles of Biochemistry: David L. Nelson, Michael M. Cox*. New York: Recording for the Blind & Dyslexic. 7th Ed.
- Freeman, S., & Herron, J. C. (2013). *Evolutionary analysis*. 5th Ed.
- Hill, R. W., Wyse, G. A., Anderson, M., & Anderson, M. (2016). *Animal physiology*. Sunderland, MA: Sinauer associates. 4th Ed.
- Pechenik, J. (2014). *Invertebrates*. McGraw Hill: Singapore. 7th Ed.
- Kardong, K. V. (2018). *Vertebrates: comparative anatomy, function, evolution*. New York: McGraw-Hill. 8th Ed.
- Odum, E. P., & Barrett, G. W. (2017). *Fundamentals of ecology*. 5th Ed.
- Alberts, B., Heald, R., Johnson, A., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2022). *Molecular biology of the cell*. WW Norton & Company. 7th Ed.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

a) Assessment will be based on written tests and assignments based on the course instructor(s)' preference.

b) Written tests:

- Mid-semester examination on modules taught up to the time of the mid-semester.
- End-semester examination on all modules

- iii. Quiz and class tests: One or more quizzes may be conducted by the instructor at any time of the semester. The course instructor may also conduct surprise quiz

c) Final grading will be as per the guidelines mentioned in the BS-MS manual.

d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines:

Depending on the class feedback, topics will be covered in doubt clearing and discussion sessions. Suggested frequency of such sessions – one after every 3 or 4 classes of a module such that in the entire semester there are around 32 lectures, and 10 doubt clearing sessions. Each session will be an interactive session where students can clear doubts, solve dummy problems, and discuss background information that might be important for those who did not have Biology as a subject during their higher secondary education.

Name and Signature of course proposers:



(Bodhisatta Nandy)



(Jose Sebastian)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	Convener, DPGC	HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology II: Flow of Biological information				
Course Level (tick (✓) in relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	42	0	0	3	
Course code:	BS102				
Name of faculties who can teach the course:	Any faculty member in the Department of Biological Sciences				

Will the course require participation of visiting faculties: Yes / No	
Prerequisites, if any	None
Course code(s)	

Learning Objectives:

The course is aimed at teaching the students the basics of biological information flow, central dogma of molecular biology, and fundamentals of developmental biology. Students will be able to appreciate how information flow works in biological systems and its guiding principles. It will enable the students to appreciate the organization of biological information and its faithful propagation across generations, at cellular and organismal levels, thus enabling the perpetuation of life. A deeper understanding of the central dogma of molecular biology will allow the students to appreciate the intricate mechanisms that are involved in deciphering the information stored in the DNA and its conversion into proteins to execute cellular activities/functions. Introduction to developmental biology topics allow the students to familiarize with the key concepts and mechanisms that guide organismal development from embryo to adulthood. Developmental gene expression driving cell fate determination and symmetry breaking will be discussed.

Expected Learning Outcomes:

After completing the course, a student should be able to:

1. Understand biological information flow, principles, and mechanisms.
2. Understand the basics of genetics, genes, chromosomes and genome organization.
3. Appreciate the intricate coordination involved in information flow from genes to proteins.
4. Understand fundamentals of DNA replication and gene expression regulation.
5. Understand processes such as horizontal gene transfer, evolution of new traits etc.
6. Appreciate the basics of developmental biology.
7. Understand embryonic development, formation of germ layers and body axis.
8. Appreciate the importance of gene expression regulation in development.

Understand the connection between development and evolution and the consequences of genetic mutations.

Course Content:

A. Basics of transmission genetics

1. Mendelian Genetics
2. Linkage and mapping
3. Epistasis, and other complexities in Genotype-phenotype
4. Chromosomal theory of inheritance
5. Genes: A concept and its physical form, chemical nature of genes
6. How genome is packaged: Nucleosome
7. Bacterial genome and its organization, horizontal gene transfer in multi-drug resistance evolution
- B. Central dogma of Molecular Biology
 8. Transmission of information
 9. Expression of information
 10. Brief overview of regulation of gene expression (genetic and epigenetic)
- C. Embryonic development
 11. Overview of the process fertilization and early development of a zygote
 12. Formation of germ layers, and body axis
 13. Organ formation (a very brief overview, referring to a classical case study)
 14. Importance of gene expression in development
- D. Connecting Development and Evolution: Mutations and their consequences
 15. Introduction to modularity and parsimony at the DNA sequence and cellular level driving diversity in body forms.
 16. Enhancers and their regulation in development
 17. Developmental Constraints in body forms

Lecture Outline:

Module No.	Topic	No. of Hours
1	Mendelian Genetics: Particulate inheritance vs. blending and importance of Mendel's experiments, Mendel's laws of inheritance. Concepts of allele, locus, and allelic interactions	3 + 1* *(1 discussion hours)
2	Linkage and mapping: two loci model only, map distance, linkage groups	2 + 1* *(1 discussion hours)
3	Epistasis, and other complexities in Genotype-phenotype	1
4	Chromosomal theory of inheritance: Chromosomal behaviour during meiotic cell division and continuity of ploidy; connecting chromosomes to linkage group	1
5	Genes: A concept and its physical form, chemical nature of genes: DNA as genetic material (experimental proofs)	1
6	How genome is packaged: Nucleosome	1 + 1* *(1 discussion hours)
7	Bacterial genome and its organization, horizontal gene transfer in multi-drug resistance evolution	2 + 1* *(1 discussion hours)
8	Transmission of information: DNA replication in prokaryotes (as model) and a brief discussion of the differences seen in Eukaryotes	3 + 1* *(1 discussion hours)
9	Expression of information: Brief overview of transcription and translation in prokaryotes (as a model), a brief discussion of the differences seen in Eukaryotes	5 + 1 *(1 discussion hours)
10	Brief overview of regulation of gene expression (genetic and epigenetic)	2
11	Overview of the process fertilization and early development of a zygote	3 + 1* *(1 discussion hours)

12	Formation of germ layers, and body axis	2 + 1* *(1 discussion hours)
13	Organ formation (a very brief overview, referring to a classical case study)	1
14	Importance of gene expression in development	2 + 1* *(1 discussion hours)
15	Introduction to modularity and parsimony at the DNA sequence and cellular level driving diversity in body forms.	1
16	Enhancers and their regulation in development	1
17	Developmental Constraints in body forms	1 + 1* *(1 discussion hours)

Brief Description of Tutorial Activities:

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities: Not applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Textbooks:

- Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- Lodish, Harvey F. (2008) *Molecular cell biology*. Macmillan, 8th Ed.

Reference books:

- Watson, James D. (2017) *Molecular biology of the gene*. Pearson Education. 7th Ed.
- Gilbert, Scott F. and Barresi, Michael J. F. (2017) *Developmental Biology*. Oxford Univ. Press. 7th edition
- Pierce, B. A. (2012). *Genetics: A conceptual approach*. Macmillan. 7th Ed.
- Alberts, B., Heald, R., Johnson, A., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2022). *Molecular biology of the cell*. WW Norton & Company. 7th Ed.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

a) Assessment will be based on written tests, and assignments based on the course instructor(s)' preference.

b) Written tests:

- Mid-semester examination on modules taught up to the time of the mid-semester.
- End-semester examination on all modules
- Quiz and class tests: One or more quiz may be conducted by the instructor at any time of the semester. The course instructor may also conduct surprise quiz

c) Final grading will be as per the guidelines mentioned in the BS-MS manual.

d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines:

Each discussion class will be an interactive session where students can clear doubts, solve dummy problems, and discuss background information that might be important for those who did not have Biology as a subject during their higher secondary education.

Name and Signature of course proposers:



(Bodhisatta Nandy)



(Jose Sebastian)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.



Convener, DUGC	Convener, DPGC	HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	BIO103 Introductory Biology laboratory				
Course Level (tick (✓) in relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. Ph.D. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course code:	BS103				
Name of faculties who can teach the course:	Any faculty member in the Department of Biological Sciences				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	None				
Course code(s)					
Learning Objectives:					
The laboratory based practical course is aimed at supplementing the theory courses – BIO101 and BIO102. The fourteen modules in this course covers essential concepts taught in the theory courses. While the first session familiarizes a student with a typical Biology lab, in each of the remaining modules, one key experimental method/approach is taught. The main broad objective of this course is to solidify the theoretical knowledge gained in the first-year theory courses by giving it a firm footing of practical understanding.					
Expected Learning Outcomes:					
After completing the course, a student should be able to: 1. Work in a typical Biology wet-lab 2. View cells and tissues of different kinds under a microscope 3. Confirm the presence of biological macromolecules such as, protein, carbohydrate, lipid in a sample 4. Quantify protein and nucleic acid content in a sample 5. Differentiate different animal and plant groups 6. Apply the concept of natural selection on biological and non-biological systems 7. Handle fruit flies for experiments, and identify genetic mutants 8. Perform monohybrid and dihybrid crosses to infer genetic nature of a mutant 9. Relate theoretical concept of cell division with the real cellular level events 10. Isolate crude (genomic) DNA from a tissue sample, and visualize methods such as PCR and Gel electrophoresis 11. Have a first-hand experience of what is referred to as gene regulation 12. Visualize early embryonic development in an animal model 13. Understand individual pattern formation					
Course Content:					
Part I:					
1. Introduction to Biology lab: various instruments and how to use them 2. Microscopic observation: Cells (animal, plant), tissue section (animal and plant), gram staining of bacteria 3. Chemical test of protein, lipid, and carbohydrates (qualitative detection) 4. Quantitative test: protein and nucleic acid estimation using bradford method 5. Identification of different animal, and plant groups 6. Natural selection game					

Part II:

1. Study of *Drosophila*, and mutants
2. Monohybrid and dihybrid cross and proof of Mendel's laws
3. Cell division and visualization of chromosome: Mitosis using Onion root tip, Meiosis using grasshopper or *Drosophila* testes, polytene chromosome in *Drosophila* salivary gland
4. Genomic DNA isolation and DNA quantification
5. Polymerase chain reaction and Gel electrophoresis
6. Demonstration of gene expression: lac Z staining in *E. coli*. Heat shock response in *Drosophila*
7. Study of developmental stages in a Chicken embryo: study of initial cleavages (developmental disc), primitive groove and primitive streak, late developmental stage
8. Human fingerprint analysis: patterns and forms

Lecture Outline: Not applicable

Module No.	Topic	No. of sessions

Brief Description of Tutorial Activities: Not applicable

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities: Not applicable

Experiment No:	Topic	No. of Hours
1	Introduction to Biology lab: various instruments and how to use them	3
2	Microscopic observation: Cells (animal, plant), tissue section (animal and plant), gram staining of bacteria	3
3	Chemical test of protein, lipid, and carbohydrates (qualitative detection)	3
4	Quantitative test: protein and nucleic acid estimation using Bradford method	3
5	Identification of different animal, and plant groups	3
6	Natural selection game	3
7	Study of <i>Drosophila</i> , and mutants	3
8	Monohybrid and dihybrid cross and proof of Mendel's laws	3
9	Cell division and visualization of chromosome: Mitosis using Onion root tip, Meiosis using grasshopper or <i>Drosophila</i> testes, polytene chromosome in <i>Drosophila</i> salivary gland	3
10	Genomic DNA isolation and DNA quantification	3
11	Polymerase chain reaction and Gel electrophoresis (demonstration only)	3
12	Demonstration of gene expression: lac Z staining in <i>E. coli</i> . Heat shock response in <i>Drosophila</i>	3
13	Study of developmental stages in a Chicken embryo: study of initial cleavages (developmental disc), primitive groove and primitive streak, late developmental stage	3
14	Human fingerprint analysis: patterns and forms	3

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Manuals:

- i. Course manual shared by the instructor
- ii. Lakhota SC and Ranganath HA (2024) Experiments with Drosophila for Biology Courses. Indian Academy of Sciences, Bengaluru). 2nd Ed.
- iii. Sambrook, J., & Russell, D. W. (2001). Molecular Cloning: a Laboratory Manual. Cold Spring Harbor. 4th Ed.

Reference books:

- i. Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- ii. Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- iii. Campbell, N. A., Reece, J. B., Ury, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. *Biology: A Global Approach*. 10th Ed.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

- a) Assessment will be based on:
- i. Continuous assessment throughout the semester
 - ii. One or more quiz
 - iii. Viva-voce
 - iv. Submission of laboratory report and other report(s)
 - v. Attendance and regularity (optional)
- d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines: None

Name and Signature of course proposers:


(Bodhisatta Nandy)


(Jose Sebastian)

Similarity with the existing courses, if any: Core course. Not applicable.

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	Convener, DPGC	HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology III: Introduction to Evolution, Ecology and Ethology				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	42	0	0	3	
Course code:	BS201				
Name of faculties who can teach the course:	Bodhisatta Nandy				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	None				
Learning Objectives: The course is aimed at teaching the students the basics three fundamental subject areas of Biological Sciences – Evolutionary Biology, Ecology and Ethology. The course is thus divided into these three modules. Each of these modules are designed to cover the basics of these subjects – focusing on the key concepts. The module on evolution introduces the concept of organic evolution and discusses the evidences in support of the theories, direct case studies, and also busts a few common myths about the process of evolution. In addition, the course also introduces evolution as a population genetic phenomenon. After covering the basic mechanisms of evolution, it introduces the concept of speciation – the process through which new species are formed from pre-existing species. The module ends with the idea of a quantitative trait and its evolution, a subject widely applicable to almost all occurrences of evolution around us. The module on Ecology introduces Population, Community, and Ecosystem as three levels of Ecological processes – all key to understand abundance and distributions of organisms across the globe. It finally introduces Biodiversity, its importance, and the threats it is facing. The third module, on Ethology, introduces the science of Animal Behaviour. The module covers questions such as, how do animals communicate, find habitat to live, find suitable mate, and show parental care. The broader aim of this module is to teach the students the essence of how intricately evolution has shaped behavioural traits.					
Expected Learning Outcomes: After completing the course, a student should be able to: 1. Define evolution, and put natural selection in the context of the fundamental process that explains intricate fitness of an organism to its environment. 2. Defend evolution as a universal concept and definitive property of all biological entity – with citable examples in real life 3. Conceptualize a biological population as a gene pool – describing it with allele and genotype frequencies 4. Test if a population is in evolutionary stasis or is evolving 5. Solve one locus – two allele problems on selection, predict trajectory of an allele given a stable environment 6. Relate non-adaptive evolutionary processes with population size, and random events, solve problems on mutation rate, and gene flow 7. Define species and relate speciation with all evolutionary processes 8. Explain the existence of genetic variation, or directional or disruptive selection on human traits (or any other organism), predict the evolution of traits such as crop yield, activity, longevity etc. 9. Model population growth under density independent and dependent conditions 10. Model and describe growth of a population with age structure 11. Relate life history with population growth and other ecologically relevant events 12. Explain what limits distribution of an organism 13. Understand the intricacies of species interactions that stabilize an ecological community 14. Model ecosystem as a functional unit in an ecological system 15. Construct questions structured in a typical how and why dichotomy – frame corresponding hypotheses, and design simple experiment to test them 16. Differentiate between inherited and non-inherited behaviour 17. Relate animal communications, habitat selection, mate choice to its environment 18. Explain animal cooperation with evolutionary and ecological theories					

Course Content:**A. Principles of Evolution**

1. Evolution and Natural selection recalled
2. Evidences of evolution
3. Evolution in action - case studies
4. Common myths about evolution
5. Hardy-Weinberg equilibrium
6. Mechanism of Adaptive evolution
7. Other mechanism of evolutionary changes: Genetic drift, mutation, gene flow
8. Origin of species
9. Introduction to quantitative traits, heritability, different modes of selection on quantitative traits

B. Ecology

10. Population Ecology: population growth, competition, age structure, and life history
11. Community and Ecosystem ecology: Niche model, Species interactions
12. Wildlife and Conservation ecology: Biodiversity and its types, threats and benefits, Indian context

C. Behaviour

13. Introduction to Ethology
14. Instinctive and learnt behaviour, inheritance of behaviour
15. Communication
16. Optimality models in Animal Behaviour
17. Habitat selection and migration
18. Mating system and mate choice, parental care
19. Cooperation and conflict in animals, social animals
20. Ecology and Evolution in human welfare

Lecture Outline:

Module No.	Topic	No. of Hours
A. Primer to Evolution		--
1	Evolution and Natural selection recalled	1
2	Evidences of evolution	1
3	Evolution in action: Two case studies - Finches of Galapagos island, a pathogen evolving resistance to antibiotic / antiviral therapy	1
4	Common myths about evolution	1
5	Hardy-Weinberg equilibrium	1 + 1* *(1 discussion hours)
6	Mechanism of Adaptive evolution: Basic models of selection	4 + 1* *(1 discussion hours)
7	Other mechanism of evolutionary changes: Genetic drift, mutation, gene flow	2 + 1* *(1 discussion hours)
8	Origin of species: species concept and speciation	2
9	Introduction to quantitative traits, heritability, different modes of selection on quantitative traits	2
B. Primer to Ecology		--
1	<u>Population Ecology</u> : Exponential and logistic growth models, intraspecific competition, age-structured population and its growth, life history, human population growth.	4 + 1* *(1 discussion hours)
2	<u>Community and Ecosystem ecology</u> : Species interactions - Niche model of interspecific competition, consumption (herbivory,	4 + 1* *(1 discussion hours)

	predation, parasitism), mutualism, examples of ecological community.	
3	<u>Wildlife and Conservation ecology:</u> Biodiversity and its types, threats and benefits, uniqueness of India in terms of global Biodiversity distribution, tiger and elephant conservation in India as case studies.	2
C. Primer to Ethology		--
1	What do ethologists study? Timbergen's experiments with parasitoid wasps	1
2	Instinctive and learnt behaviour, inheritance of behaviour	1
3	Communication	1
4	Optimality models in Animal Behaviour	1
5	Habitat selection and migration	1
6	Mating system and mate choice, parental care	2 + 1* *(1 discussion hours)
7	Cooperation and conflict in animals, social animals	2 + 1* *(1 discussion hours)
D. Ecology and Evolution in human welfare		1
Brief Description of Tutorial Activities:		
Module No.	Topic	No. of Hours
Brief Description of Laboratory Activities: Not applicable		
Experiment No:	Topic	No. of Hours
Justification for a need of modification (If applicable): N/A		
Suggested Reading:		
<u>Textbooks:</u>		
i. Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). <i>Life: The science of biology</i> . Macmillan. 9 th Ed.		
ii. Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). <i>Biological science</i> . Pearson Higher Ed. 6 th Ed.		
iii. Campbell, N. A., Reece, J. B., Ury, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014) <i>Biology: A Global Approach</i> . 10 th Ed.		
<u>Reference books:</u>		
i. Freeman, S., & Herron, J. C. (2013). <i>Evolutionary analysis</i> . 5 th Ed.		
ii. Odum, E. P., & Barrett, G. W. (2017). <i>Fundamentals of ecology</i> . 5 th Ed.		
iii. Alcock, J. (2009). <i>Animal behavior: An evolutionary approach</i> . Sinauer associates. 10 th Ed.		
Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):		
a) Assessment will be based on written tests, and assignments based on the course instructor(s)' preference.		
b) Written tests:		
i. Mid-semester examination on modules taught up to the time of the mid-semester.		
ii. End-semester examination on all modules		
iii. Quiz and class tests: One or more quiz may be conducted by the instructor at any time of the semester. The course instructor may also conduct surprise quiz		
c) One or more assignments will be given on advanced level numerical problems and model building		
d) Final grading will be as per the guidelines mentioned in the BS-MS manual.		
e) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.		

Additional Guidelines:

Each discussion class will be an interactive session where students can clear doubts, solve dummy problems, and discuss background information that might be important for those who did not have Biology as a subject during their higher secondary education.

Name and Signature of course proposers:


(Bodhisatta Nandy)


(Jose Sebastian)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	 Convener, DPGC	 HoD
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Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Coordinator/Dean, Academic Affairs

Recommended / Not Recommended for the approval/ratification by the Senate

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology V: Microbiology & Immunology				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	42	0	0	3	
Course code:	BS202				
Name of faculties who can teach the course:	Pravat Parida				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	None				
Learning Objectives: The course is aimed at introducing Microbiology and Immunology to students. In microbiology, students will be given a history of microbiology starting from the first observations of Antonie Van Leeuwenhoeck. The diversity of microbes along with characterization of viruses, bacteria, fungi will be introduced along with the mechanisms of their growth and propagation. Beneficial microbes and their interactions with other organisms will be covered along with the microbial nutritional requirements. Finally, host-pathogen interactions leading to certain diseases will be covered along with the control measures. In Immunology, a brief overview of the various cells and tissues in the vertebrate immune system will be given. Mechanisms leading to adaptive and innate immunity will be covered along with the pathogen or antigen sensing mechanisms. A brief introduction to immune receptor(s) structures will be done along with the interaction strategies with the diverse antigens. Finally, T-cell biology along with concepts of self-tolerance and graft rejection will be covered.					
Expected Learning Outcomes: After completing the course, a student should be able to: 1. Classify microbes into bacteria, viruses, fungi and protozoa 2. Infer simple interactions between microbes in microbial communities 3. Infer interaction microbes with animals and plants 4. Theoretically list out the diverse nutritional requirements for growing microbes, and apply the same to culturing microbes. 5. Comment on how pathogenic microbes cause certain diseases, and propose potential (simple) intervention strategies 6. Grasp the mechanism of emergence of antimicrobial resistance, and propose potential (simple) ways to control. 7. Comment on the diversity in immune cells in vertebrate immune system 8. Describe, broadly and briefly, how different immune cells operate in innate and adaptive immune systems in humans 9. Understand and apply the concept of immunological memory in the design of vaccines					

10. Relate diverse immune receptor classes with their actions
11. Develop rudimentary ideas of applying T-cell biology in healthcare applications

Course Content:

A. Microbiology

1. Overview and History of Microbiology.
2. Microbial diversity
3. Microbial reproduction and growth.
4. Microbial nutrition
5. Microbial interactions
6. Microbial pathogens and control measures.
7. Importance and application of microbiology, Epidemic, Pandemic, and Multidrug resistant microbes.

B. Immunology

8. Introduction to vertebrate immune system
9. Foundations of Immunology - overview, cells, key players, and their generation
10. Natural and adaptive immune responses
11. Antibody Structure and B Cell Receptor
12. Antigen Recognition and Antibody Antigen Interaction
13. T Cell Biology and Immune Regulation

Lecture Outline:

Module No.	Topic	No. of Hours
1	Overview and History of Microbiology	1
2	Microbial diversity: General characteristics of different groups Acellular microorganisms (Viruses), Bacteria, Algae, Fungi, Protozoa	4 + 1* (1 discussion hours)
3	Microbial reproduction and growth: Binary fission, Budding, Fragmentation, Sporulation Factors influencing the growth of microorganisms	3 + 1* (1 discussion hours)
4	Microbial nutrition: Growth medium (selective, differential, enrichment, complete, synthetic and minimal medium)	2
5	Microbial interactions: Commensalism, Amensalism, Symbiosis, Parasitism & Predation	2
6	Microbial pathogens and control measures	2
7	Importance and application of microbiology, Epidemic, Pandemic, and Multidrug resistant microbes	3 + 1* (1 discussion hours)
Introduction to vertebrate immune system		
8	Foundations of Immunology 1) Overview of the immune system: Organs, cells, and key molecular players 2) Hematopoiesis: Differentiation of stem cells into immune and blood cells	4
9	Natural and adaptive immune responses 1) Innate immune responses: Physical and chemical barriers to microbial entry 2) Pattern and Pattern recognition receptors and immediate defense 3) Adaptive immune responses: Specificity, memory, and clonal expansion	4 + 1* (1 discussion hours)
10	Antibody Structure and B Cell Receptor 1) Structure and function of immunoglobulins and B Cell Receptors (BCR)	3 + 1* (1 discussion hours)

	2) Antibody classes and their functional specialization	
11	Antigen Recognition and Antibody Antigen Interaction 1) Nature of antigens and epitopes 2) Antigen-antibody binding: Principles and diagnostics (e.g., agglutination, precipitation)	3 + 1* *(1 discussion hours)
12	T Cell Biology and Immune Regulation 1) MHC Class I and II: Structure, function, and polymorphism 2) T Cell Receptors (TCR), MHC restriction, and thymic selection 3) Concepts of self-tolerance and graft rejection	4 + 1* *(1 discussion hours)

Brief Description of Tutorial Activities:

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities: Not applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Textbooks:

- Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- Campbell, N. A., Reece, J. B., Ury, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014) *Biology: A Global Approach*. 10th Ed.

Reference books:

- Punt, Jenni et al. (2019) *Kuby Immunology*. Eighth edition. New York: W.H. Freeman/Macmillan Learning.
- Wiley, Joanne M., et al. (2014) *Prescott's Microbiology*. Ninth edition., McGraw-Hill,

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

a) Assessment will be based on written tests, and assignments based on the course instructor(s)' preference.

b) Written tests:

- Mid-semester examination on modules taught up to the time of the mid-semester.
- End-semester examination on all modules
- Quiz and class tests: One or more quiz may be conducted by the instructor at any time of the semester. The course instructor may also conduct surprise quiz

c) Final grading will be as per the guidelines mentioned in the BS-MS manual.

d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines:

Each discussion class will be an interactive session where students can clear doubts, solve dummy problems, and discuss background information that might be important for those who did not have Biology as a subject during their higher secondary education.

Name and Signature of course proposers:



(Bodhisatta Nandy)



(Vinay Bulusu)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.



Convener, DUGC	Convener, DPGC	HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology IV: Fundamentals of Cell and Molecular Biology				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	42	0	0	3	
Course code:	BS203				
Name of faculties who can teach the course:	R. Selvi Bharathvikru, Prosenjit Mondal, Pravat Parida, Jose Sebastian				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	None				
Learning Objectives: The course is aimed at teaching the students the basics of cell biology and fundamentals of molecular biology. Students will be able to appreciate how cells are organized and the importance of cellular activities. Learn about different cell organelles, their structure and functions etc. This course will enable the students to appreciate the basics of cell membrane organization and its importance along with processes such as membrane trafficking- how are they regulated etc. A deeper understanding molecular biology will allow the students to appreciate how organisms faithfully replicate genetic information and decipher information stored in the DNA. They will also learn the differences between replication, transcription and translation between prokaryotes and eukaryotes. A detailed understanding of various mechanisms involved in gene expression regulation will enable the students to appreciate how cell choreograph various cellular activities and functions. How they perceive and respond to external cues and signals.					
Expected Learning Outcomes: After completing the course, a student should be able to: 1. Understand basics of cell biology 2. Understand cell organelles and their structure and functions. 3. Appreciate the detailed organization and function of cell membrane. 4. Understand fundamentals of membrane trafficking 5. Understand cell cycle 6. Learn the basics of DNA replication in prokaryotes and eukaryotes 7. Understand transcription and post-transcription mechanisms 8. Learn mechanisms of translation and post-translation 9. Appreciate the mechanisms of gene expression regulation 10. Understand RNA replication, types, mechanisms etc.					
Course Content: 1) A Tour of the Cell: The fundamental Units of Life, Cell organelles structures and their functions					

- 2) Membrane Structure and Function
- 3) Cell signalling and transport across cell membranes
- 4) Membrane trafficking
- 5) Cell cycle
- 6) DNA replication.
- 7) Transcription and processing of RNA.
- 8) Translation and post-translational modifications.
- 9) Protein targeting and sorting.
- 10) RNA replication, reverse transcription.

11) Regulation of gene expression.

Lecture Outline:

Module No.	Topic	No. of Hours
1	A Tour of the Cell: The fundamental Units of Life, Cell organelles structures and their functions	4 + 1* *(1 discussion hours)
2	Membrane Structure and Function	3
3	Cell signalling and transport across cell membranes	3 + 1* *(1 discussion hours)
4	Membrane trafficking	3
5	Cell cycle	3 + 1* *(1 discussion hours)
6	DNA replication.	4 + 1* *(1 discussion hours)
7	Transcription and processing of RNA.	3 + 1* *(1 discussion hours)
8	Translation and post-translational modifications.	4 + 1* *(1 discussion hours)
9	Protein targeting and sorting.	3
10	RNA replication, reverse transcription.	2
11	Regulation of gene expression.	3 + 1* *(1 discussion hours)

Brief Description of Tutorial Activities:

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities: Not applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Textbooks:

- i. Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- ii. Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- iii. Molecular Cell Biology, 8th Edition. by Harvey Lodish

Reference books:

- i. Watson, James D. Molecular biology of the gene Edition: 7th
- ii. Bruce Alberts et al., Molecular Biology of the cell 6th Edition

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

a) Assessment will be based on written tests, and assignments based on the course instructor(s)' preference.

b) Written tests:

- i. Mid-semester examination on modules taught up to the time of the mid-semester.
- ii. End-semester examination on all modules
- iii. Quiz and class tests: One or more quiz may be conducted by the instructor at any time of the semester. The course instructor may also conduct surprise quiz

c) Final grading will be as per the guidelines mentioned in the BS-MS manual.

d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines:

Each discussion class will be an interactive session where students can clear doubts, solve dummy problems, and discuss background information that might be important for those who did not have Biology as a subject during their higher secondary education.

Name and Signature of course proposers:



(Bodhisatta Nandy)



(Jose Sebastian)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				

2				
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Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology VI: Basic Biochemistry				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. Ph.D. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	42	0	0	3	
Course code:	BS204				
Name of faculties who can teach the course:	Vinay Bulusu, Vivek Tiwari, Shanti Swarup Srivastava, Pravat Parida, Arunkumar Krishnan				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	None				
Course code(s)					
Learning Objectives: The course is aimed at teaching the students the basic principles of thermodynamics and kinetics of chemical reactions and their applications in enzyme action and metabolic networks. Students will be able to appreciate how thermodynamically unfavorable reactions can be driven by coupling mechanisms to highly exergonic reactions like ATP hydrolysis and reactions with large negative free energy change. Regulation of enzyme activity by allosteric mechanisms will enable the students to appreciate how homeostasis can be maintained beyond genetic control. Metabolic pathways encompassing catabolism and anabolism will be discussed making students understand how biochemical reactions operate to generate energy or build macromolecules. Finally, with the availability of genome sequences across all kingdoms of life, students will be exposed to bioinformatic concepts to explore these sequences using various tools and concepts for comparative analysis.					
Expected Learning Outcomes: After completing the course, a student should be able to: 1. Describe thermodynamic principles of reactions, and apply to metabolism in biological systems 2. Relate mechanism of enzyme action with reaction rates and design simple strategies to speed up a reaction. 3. Understand allostery and its invaluable contribution to reducing the costs associated with transcription and translation. 4. Navigate metabolic networks with a logical perspective. 5. Understand different databases of sequences. 6. Use various bioinformatic concepts to understand gene duplication events and speciation. 7. Carry out gene prediction and annotation (simple)					
Course Content: A. Fundamentals of Biochemistry: 1. Thermodynamics and Bioenergetics					

2. Enzyme kinetics
3. Enzyme Catalytic mechanisms
4. Metabolic Regulation and Allostery

B. Physiological Biochemistry:

5. Basic concepts of metabolism
6. Catabolism and anabolism, energy generation and storage
7. Glycolysis, citric acid cycle, oxidative phosphorylation
8. Pentose phosphate pathway
9. Gluconeogenesis, glycogen metabolism
10. Fatty acid metabolism
11. Amino acid metabolism

C. Introduction to Computational Biology

12. The central dogma in the era of big data
13. Genome and genome structure
14. Introduction to genome sequencing and annotation
15. Introduction to comparative genomics
16. Gene prediction and functional annotation

Lecture Outline:

Module No.	Topic	No. of Hours
1	Thermodynamics and Bioenergetics: Laws of thermodynamics, principle of equilibrium, Le Chateliers principle, Transition state theory, phosphoryl transfer reactions and ATP.	4 + 1* *(1 discussion hours)
2	Enzyme kinetics: Michaelis-Menten Kinetics, Regression analysis of kinetic data, Kinetic Models, Steady state and Rapid equilibrium.	2 + 1* *(1 discussion hours)
3	Enzyme Catalytic mechanisms: Acid-Base catalysis, Covalent catalysis and metal ion catalysis.	2 + 1* *(1 discussion hours)
4	Metabolic Regulation and Allostery: Design principles of metabolism, pathway regulation, Hill Equation, models of allostery including sequential model, concerted model and ensemble model.	5 + 2* *(1 discussion session after every 3 lecture hrs = 2 discussion hours)
5	Basic concepts of metabolism	2
6	Catabolism and anabolism, energy generation and storage	3 + 1* *(1 discussion hours)
7	Glycolysis, citric acid cycle, oxidative phosphorylation	3 + 1* *(1 discussion hours)
8	Pentose phosphate pathway	2
9	Gluconeogenesis, glycogen metabolism	2
10	Fatty acid metabolism	2
11	Amino acid metabolism	2
12	The central dogma in the era of big data: DNA, RNA, protein sequences, different data formats and diverse biological databases (NCBI, UniProt, PDB, Ensembl)	1

13	Genome and genome structure: What is a genome? Basic genome structure in prokaryotes vs. eukaryotes	1
14	Introduction to genome sequencing & annotation, Orthologs, paralogs, gene families	1
15	Introduction to comparative genomics: Why comparative genomics: synteny, conservation, divergence	1
16	Gene prediction & functional annotation (Why it is important and how it is done)	1

Brief Description of Tutorial Activities:

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities: Not applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Textbooks:

- Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- Campbell, N. A., Reece, J. B., Ury, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014) *Biology: A Global Approach*. 10th Ed.

Reference books:

- Lehninger, A. L. (2017). *Lehninger Principles of Biochemistry: David L. Nelson, Michael M. Cox*. New York.
- Irwin H Segel (2010) *Biochemical Calculations How to Solve Mathematical Problems in General Biochemistry*. 2nd Ed.
- Stryer L (2002) *Biochemistry*. W.H. Freeman & Co Ltd. 5th Ed.
- Koonin EV, Galperin MY. (2003) *Sequence - Evolution - Function: Computational Approaches in Comparative Genomics*. Boston: Kluwer Academic.
- Saitou, N (2018) *Introduction to Evolutionary Genomics*. Springer. 2nd Ed.
- Ohno, S. (2013). *Evolution by gene duplication*. Springer Science & Business Media.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

a) Assessment will be based on written tests, and assignments based on the course instructor(s)' preference.

b) Written tests:

- Mid-semester examination on modules taught up to the time of the mid-semester.
- End-semester examination on all modules

- iii. Quiz and class tests: One or more quiz may be conducted by the instructor at any time of the semester. The course instructor may also conduct surprise quiz

c) Final grading will be as per the guidelines mentioned in the BS-MS manual.

d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines:

Each discussion class will be an interactive session where students can clear doubts, solve dummy problems, and discuss background information that might be important for those who did not have Biology as a subject during their higher secondary education.

Name and Signature of course proposers:


(Bodhisatta Nandy)


(Vinay Bulusu)

Similarity with the existing courses, if any: Nil.

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of

CoAA/DoAA and Director/Chairperson Senate.

	
Convener, DUGC	Convener, DPGC
	HoD

For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology pre-major lab I				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Name of faculties who can teach the course:	R. Selvi Bharathvikru, Prosenjit Mondal, Pravat Parida, Jose Sebastian, Bodhisatta Nandy				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	None				
Course code(s)					
Learning Objectives: The practical course is aimed to provide hands-on experience and training for the students in various aspects of ecology, evolution, cell biology and molecular biology. The course will start with a training on basic microscopy. Cell biology lab sessions will allow the students to be familiar with fundamentals of cell biology and Immuno-histochemistry techniques. In the molecular biology part, students will prepare competent cells, estimate their efficiency and use these cells for learning bacterial transformation procedures. This will be followed by plasmid DNA isolation, DNA visualization via Agarose gel electrophoresis, quantity and quality estimation. Students will also learn genomic DNA isolation procedures from bacteria and quality and quantity estimations. Thus, the course will enable the students to gather valuable experience and practical training in most of the routine aspects of molecular biology and cell biology, helping them to better appreciate the subject and be more curious. On the other hand, the Evolution-Ecology-Ethology part of the course will complement the theory course taught in the same semester – connecting theoretical understanding with direct practical observation. The objective is to give a solid foundation in these key aspects of Biological science, which is important for Biology students as well as students specializing in other science disciplines.					
Expected Learning Outcomes: After completing the course, a student should be able to: 1. Handle microscopes for visualizing cells and other biological samples with more independence 2. Carry out experiments using basic cell biology lab techniques including immune- histochemistry 3. Prepare competent cells under supervision 4. Carry out plasmid isolation under supervision 5. Carry out genomic DNA isolation & characterization, agarose gel electrophoresis, and visualize DNA under supervision 6. Identify the outcome of selection and genetic drift in a population 7. Identify, and quantify a quantitative trait, and design an experiment to measure its heritability 8. Conduct an experiment to demonstrate mate choice and sexual selection in an animal 9. Carry out simple ethological experiment such as, habitat preference etc. to test basic principles of ethology					

10. Generate and analyze life table data (cohort life table)
11. Carry out basic documentation of biodiversity

Course Content:

- 1) Microscopes and their use
- 2) Evolution, Ecology, Ethology lab
 - a) Demonstration of selection and drift using *Drosophila*
 - b) Quantitative trait and heritability using sternopleural bristles and sex comb in *Drosophila*
 - c) Sexual selection and mate choice using a model system
 - d) Habitat selection and optimization of resource use using an insect model
 - e) Campus biodiversity study
 - f) Preparation of *Drosophila* life table
- 3) Cell Biology lab:
 - a) Microscopic observation of different types of cells
 - b) Visualization of cell organelles
 - c) Immuno-histochemistry of tissues
- 4) Molecular Biology lab:
 - a) Competent cell preparation,
 - b) Transformation
 - c) Plasmid DNA isolation
 - d) Agarose gel electrophoresis
 - e) DNA isolation & characterization

Lecture Outline:

Module No.	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No.	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No.	Topic	No. of Hours
1	Demonstration of selection and drift using <i>Drosophila</i>	Multi-class (3)
2	Quantitative trait and heritability using sternopleural bristles and sex comb in <i>Drosophila</i>	Multi-class (3)
3	Sexual selection and mate choice using a model system	3
4	Habitat selection and optimization of resource use using an insect model	3
5	Campus biodiversity study	Multi-class (3)
6	Preparation of <i>Drosophila</i> life table	Multi-class (3)
7	Microscopes and their use	3
8	Microscopic observation of different types of cells	3
9	Visualization of cell organelles	3

10	Immuno-histochemistry of tissues	3
11	Competent cell preparation	3
12	Transformation	
13	Plasmid DNA isolation	3
14	Agarose gel electrophoresis	3
15	DNA isolation & characterization	3

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Manual:

- Course manual shared by the instructor
- Lakhotia SC and Ranganath HA (2024) Experiments with Drosophila for Biology Courses. Indian Academy of Sciences, Bengaluru). 2nd Ed.
- Sambrook, J., & Russell, D. W. (2001). Molecular Cloning: a Laboratory Manual. Cold Spring Harbor. 4th Ed.

Reference books:

- Sadava, D. E., Hillis, D. M., & Heller, H. C. (2011). *Life: The science of biology*. Macmillan. 9th Ed.
- Freeman, S., Quillin, K., Allison, L., Black, M., Taylor, E., Podgorski, G., & Carmichael, J. (2017). *Biological science*. Pearson Higher Ed. 6th Ed.
- Campbell, N. A., Reece, J. B., Ury, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. *Biology: A Global Approach*. 10th Ed.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

- a) Assessment will be based on:
- Continuous assessment throughout the semester
 - One or more quiz
 - Viva-voce
 - Submission of laboratory report and other report(s)
 - Attendance and regularity (optional)
- d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines: None

Name and Signature of course proposers:



(Bodhisatta Nandy)



(Jose Sebastian)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

	
Convener, DUGC	Convener, DPGC
	HoD

For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Biological Sciences

Course Title	Biology pre-major lab II				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit structure:	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course code:	BS206				
Name of faculties who can teach the course:	Vinay Bulusu, Vivek Tiwari, Shanti Swarup Srivastava, Pravat Parida				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	None				
Learning Objectives: The practical course is aimed at giving students hands on experience with practical experiments associated with biochemistry, microbiology and immunology. Students are expected to design enzyme assays using UV/Vis spectroscopy and estimate concentrations of biomolecules using Beer-Lambert's law. Methods involving precipitation of proteins will be shown and students are expected to understand the principles associated with these techniques. Different methods of culturing and characterizing bacteria will be taught and tests for checking antibiotic resistance following transformation of suitable plasmids will be shown. Immunological techniques of radial immunodiffusion for characterizing antigen-antibody interaction will be shown. ABO blood typing will be shown. Students should be able to understand the principles of blood typing.					
Expected Learning Outcomes: After completing the course, a student should be able to: 1. Carry out measurements using Ultraviolet Visible spectroscopy (UV/Vis) spectrophotometer 2. Design enzyme assays, and estimate kinetic parameters from enzyme assays 3. Plot graphs of the data and interpolate kinetic parameters 4. Demonstrate how addition of salt might precipitate proteins as predicted by the theory 5. Culture bacteria based on nutritional requirements 6. Design and carry out (under supervision) assays to test antibiotic resistance 7. Identify diverse immune cells by staining with Leishman's stain. 8. Carry out agglutination reaction that underlies the blood grouping 9. Demonstrate antigen antibody interaction by immune diffusion methods					
Course Content: Biochemistry lab a) Principle of Absorbance spectroscopy, Beer-Lambert's law for concentration estimation. b) Enzyme assays and kinetics: Assay Design, Specific activity calculation, estimation of					

- c) kinetic parameters.
- d) Amino acid analysis by paper chromatography and Thin layer chromatography.
- e) Principle of Salting out of proteins by ammonium sulfate precipitation.
- f) Floating leaf disc assay to demonstrate Photosynthesis.

Microbiology & Immunology lab

- g) Identification of microorganisms, staining techniques (Gram's, acid fast)
- h) Bacterial plating
- i) Tests for antibiotic resistance,
- j) Plaque assay, preparation of bacterial competent cells, transformation,
- k) Total Leukocyte Count using Leishman's Stain
- l) ABO Blood Grouping and Rh Testing
- m) Serum Separation from Whole Blood
- n) Single Radial Immunodiffusion
- o) Double Radial Immunodiffusion

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours
1	Principle of Absorbance spectroscopy, Beer-Lambert's law for concentration estimation.	3
2	Enzyme assays and kinetics: Assay Design, Specific activity calculation, estimation of kinetic parameters.	6
3	Amino acid analysis by paper chromatography and Thin layer chromatography.	3
4	Principle of Salting out of proteins by ammonium sulfate precipitation.	3
5	Principle of Salting out of proteins by ammonium sulfate precipitation.	3
6	Floating leaf disc assay to demonstrate Photosynthesis.	3
7	Identification of microorganisms, staining techniques (Gram's, acid fast)	3
8	Bacterial plating	3
9	Tests for antibiotic resistance	3
10	Plaque assay, preparation of bacterial competent cells, transformation	3
11	Total Leukocyte Count using Leishman's Stain	3
12	ABO Blood Grouping and Rh Testing	3
13	Serum Separation from Whole Blood	3
14	Single Radial Immunodiffusion	3
15	Double Radial Immunodiffusion	3

Justification for a need of modification (If applicable): N/A

Suggested Reading:

Textbooks:

1. Laboratory Manual to be made by the instructor(s).

Reference books:

1. Wilson, Keith, and John M. Walker. (2006) *Principles and Techniques of Practical Biochemistry*. 8th ed., Cambridge University Press.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

- a) Assessment will be based on:
- Continuous assessment throughout the semester
 - One or more quiz
 - Viva-voce
 - Submission of laboratory report and other report(s)
 - Attendance and regularity (optional)
- d) The course instructor will declare the tentative weightage distribution in different components of assessments on the first class.

Additional Guidelines: None

Name and Signature of course proposers:


(Bodhisatta Nandy)


(Vinay Bulusu)

Similarity with the existing courses, if any: Core course. Not applicable.

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	 Convener, DPGC
	 HoD

For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	 Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	General Chemistry I				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	CH101				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s):					
This is an introductory course that covers fundamental concepts in chemistry. The course will focus on a conceptual understanding of the principles of general chemistry.					
Expected Learning Outcome(s):					
After completing this course, the students will be well-versed in the fundamental concepts of atomic structure, periodicity of elemental properties, chemical bonding and reactivity, electronic effects of the molecules. This course will help strengthen basic concepts like electronic effects, reactive intermediates, acids/bases, and stereochemistry.					
Contents of the course:					
Polyelectronic Atomic Configuration, Periodic table and the concept of periodicity, Chemical bonding, Molecular orbital theory, Structure of solids, Electronic effects and reactive intermediates, Concept of aromaticity, Concept of acids and bases, Basic stereochemistry.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No.	Topic				No. of Hours
1.	Polyelectronic Atomic Configuration: Atomic structure as the basis for periodicity and concept of orbitals. Electronic configuration of polyelectronic atoms.				5
2.	Periodic table and the concept of periodicity: Applications of the periodic law. Effective nuclear charge; Slater's rules, screening effect. Size of atoms and ions, ionization energies; electronegativity, electron affinity; periodic properties of elements and periodic trends, diagonal relationships, inert-pair effect; Fajan's rules.				5
3.	Chemical bonding: Lewis theory; Formal charges, resonance and rationalization of structures; VSEPR theory and shapes of molecules. Applications of VSEPR theory in predicting trends in bond lengths and bond angles.				4

4.	Molecular orbital theory: Orbital mixing: sigma, pi bonding orbital diagrams of homo and hetero-diatomic molecules, concept of HOMO, LUMO and SOMO.	4
5.	Structure of solids: Crystal packing, lattice energy and Born-Haber cycle.	2
6.	Electronic effects and reactive intermediates: Dipole moment, inductive and field effects, polarizability, resonance effect, mesomeric effects, tautomerism, hyper-conjugation; arrow pushing concepts in organic chemistry, Carbocation, Carbanion, etc.	5
7.	Concept of aromaticity: Fundamental aspects of aromaticity, anti-aromaticity, and non-aromaticity.	2
8.	Concept of acids and bases: Various theories of Acids and bases; Brønsted acids and bases. Protonic acids, gas-phase vs solution behavior of acids. Lewis acidity, 'Hard' and 'Soft' Acids and Bases. Solid acids. Acidity, basicity, and pKa: Acidity, Basicity, definition of pKa, factors that influence the acidity and basicity, levelling effect, predicting acid strengths, HSAB Principle.	4
9.	Basic stereochemistry: Fischer, Newman, saw-horse, etc., projection formulae Conformational analysis of ethane, propane, butane, cyclohexane and monosaccharides. Stereoisomerism, configuration (R, S), optical isomerism in compounds with one and two chiral centers, and without an asymmetric atom, nomenclatures such as erythro, threo, α , β , endo, exo epimers, anomers, E, Z, etc., resolution of racemic compounds.	6
10.	General discussions and doubt clearing	5
Total no. of hours		42

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- 1) Housecroft, C. E., & Sharpe, A. G. (2018). Inorganic Chemistry (5th ed.). Pearson Education.
- 2) Atkins, P. W., Overton, T. L., Rourke, J. P., Weller, M. T., & Armstrong, F. A. (2010). Shriver & Atkins' inorganic chemistry (5th ed.). Oxford University Press.
- 3) House, J.E. Inorganic Chemistry, 3rd ed. Academic Press, 2020.
- 4) Kotz, J. C., Treichel, P. M., Townsend, J. R., Chemistry and Chemical Reactivity, 7th Edition, Brooks/Cole, Cengage Learning, Canada, 2010.
- 5) Chang, R., Chemistry, 9th edition, McGraw-Hill, 2006.
- 6) Clayden, J., Greeves, N., Warren, S., Wothers, S. Organic Chemistry, Oxford University Press, 2001.
- 7) Hornback, J. M. Organic Chemistry, Cengage Learning, 2006.
- 8) Sykes, P. A., A guidebook to mechanism in organic chemistry, Longman, 2008.
- 9) Nasipuri, D., Stereochemistry of Organic Compounds, 4th ED 2020.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz, etc.), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

There must be at least 6 hours of discussion and doubt clearing sessions throughout the course. If required, tutorials should be taken separately, outside the lecture hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	General Chemistry II				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. Ph.D. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	CH102				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	Nil				
Learning Objective(s): This course guides students in acquiring a comprehensive understanding of the chemistry that they experience in their daily lives, covering the fundamentals of chemistry. Students will develop fundamental understanding of key concepts such as basic reaction mechanisms, common organic reactions and rearrangements, chemical bonding, molecular structure, redox reactions, and basic aspects of nuclear chemistry. It will also impart the basic knowledge of physical chemistry such as kinetic theory of gases, transformation of energy into different forms and its relation to physical observables and provide fundamental physical concepts.					
Expected Learning Outcome(s): Upon completion of this course, the students will comprehend and recognize the core principles of three major disciplines in Chemistry, viz, Organic, Inorganic, and Physical Chemistry. It will build the foundation to understand the advanced courses in chemistry in the upcoming semesters.					
Contents of the course Basic reaction mechanisms in organic chemistry, common organic reactions. Rearrangements in organic chemistry. Bonding in non-transition metal chemistry, radioactivity and nuclear chemistry. Oxidation and Reduction. Kinetic theory of gases, basic thermodynamics, basic chemical kinetics.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No.	Topic			No. of Hours	
1.	Basic reaction mechanisms in organic chemistry: Electrophilic and radical additions to alkenes, electrophilic and nucleophilic aromatic substitutions.			3	
2.	Common organic reactions: Nucleophilic aliphatic substitutions: SN1, SN2, SNi reactions, neighboring group participation, elimination reactions: E1, E2, and E1cB reactions, aromatic nucleophilic substitution. Functional group transformations and their reaction mechanisms.			4	
3.	Rearrangements in organic chemistry: Electrophilic (Beckmann, Hofmann, Lossen, Curtius, Wolff, Schmidt, Baeyer-Villiger,			5	

	Pinacol-pinacolone, Wagner-Meerwein etc.), nucleophilic (benzilic acid, Favorskii), and radical rearrangements (Wittig, aza-Wittig). Sigmatropic rearrangements (Cope, aza-Cope, Oxy-Cope, Claisen, aza-Claisen, Eschenmoser-Claisen, vinyl cyclopropane-cyclopentene).	
4.	Bonding in non-transition metal chemistry: An overview of bonding models in inorganic chemistry, Chemical forces, Bent's rule, Application of molecular orbital theory to polyatomic molecules (localized and delocalized orbitals), Walsh diagrams, introduction to group theory/symmetry operations.	5
5.	Radioactivity and Nuclear Chemistry: The nature of radioactive radiations, detection and measurements. Theory of disintegration, disintegration series. Half-life and average life period, artificial radioactivity, applications. Nuclear fission, nuclear fusion, critical mass.	3
6.	Oxidation and Reduction: The central role of transfer of electrons in chemical processes. The importance of water splitting. Redox chemistry of extraction (Ellingham diagrams). Conversion of chemical energy into electricity. Batteries and modern state of solid state batteries, Fuel cells.	4
7.	Kinetic theory of gases: Gas Laws, equation of states, critical constants, law of corresponding states, Distribution of molecular speeds and its applications, mean-free path, compressibility factor, barometric distribution law, Heat capacity of gases, real gases and virial expansions.	5
8.	Basic Thermodynamics: Basic concept and definition of systems, surroundings, boundaries, reversible and irreversible processes, concept of heat, work, and internal energy, state and path functions, exact and inexact differentials, introduction to zero-th, first and second laws of Thermodynamics.	4
9.	Basic Chemical Kinetics: Order and molecularity of a reaction, Integrated rate laws for zero-th, 1st, 2nd and nth order reactions, half-life of various reactions, pseudo orders and molecularities, reversible, consecutive and parallel first order reactions.	3
10.	General discussions and doubt-clearing	6
Total Number of Lecture Hours		42

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- 1) Clayden, J., Greeves, N., Warren, S., Wothers, S. Organic Chemistry, Oxford University Press, 2001.
- 2) Sykes, P. A., A guidebook to mechanism in organic chemistry, Longman, 2008.
- 3) March's advanced organic chemistry, Michael B. Smith, Jerry March
- 4) Shriver and Atkins, Inorganic Chemistry, Fourth Edition, Oxford University Press, 2006.
- 5) Lee, J. D., Concise Inorganic Chemistry, Fifth Edition, Blackwell Publishing, 2006.

- 6) Huheey, J. E., Keiter, E. A., Keiter, R. L., Inorganic Chemistry-Principles of Structure and Reactivity. 4th Edn. Harper-Collins, NY, 1993.
- 7) Atkins, P. W., Paula, J. de, Keeler, J., Atkins' Physical Chemistry, Ed. 11th, Oxford University Press, 2018.
- 8) Levine, I., Physical Chemistry, Ed. 6th, McGraw Hill, 2009.
- 9) Castellan, G. W., Physical Chemistry, Ed. 3rd, Narosa Publishing House, 2004.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz, etc.), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

There must be at least 6 hours of discussion and doubt clearing sessions throughout the course. If required, tutorials should be taken separately, outside the lecture hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

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Convener, DUGC	Convener, DPGC	FIC/HoD

For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	General Chemistry Laboratory				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. Ph.D. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course Code:	CH104				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	Nil				
Learning Objective(s): This is an introductory course that imparts hands-on knowledge on the Laboratory experiments covering fundamental concepts in three major disciplines in Chemistry, viz, Inorganic, Organic and Physical Chemistry.					
Expected Learning Outcome(s): After completing this course, the students will learn experimental execution of basic chemical reactions and develop fundamental understanding on the synthesis, purification, analysis, and kinetics involved in the same. This course will improve their skill on analyzing and interpreting experimental data.					
Contents of the course: 1. Familiarization of common lab apparatus (weighing balance, burette, pipette, volumetric flask, conductometer, water bath, hot plates etc.). 2. Extraction of (i) solids in a solvent, and (ii) two miscible liquids. Purification of compounds via crystallization and sublimation. 3. Determination of the strength of acid and base/ Estimation of alkali content in commercial antacid tablets. 4. Determination of purity by melting points and TLC. 5. Crystallization of benzoic acid. 6. Estimation of % amount of calcium and magnesium in a milk sample. 7. Estimation of Iodine in Iodized common salt. 8. Chemistry of invisible ink. 9. Chemical detectives in forensic analysis. 10. Separation of naphthol, aspirin, and naphthalene. 11. Synthesis of polymer, Nylon 6-10. 12. Estimation of acetic acid in vinegar solution. 13. Preparation of pyridinium chlorochromate (PCC). 14. Determination of acid dissociation constant (pKa) of: (A) polybasic acid (H_3PO_4), (B) Monobasic Acid (CH_3COOH). 15. Kinetics of saponification of ethyl acetate using conductometry. 16. Preparation of $\text{Cu}(\text{NH}_3)_4\text{SO}_4$ and estimation of copper(II) using standard thiosulfate solution as titrant.					

Lecture Outline: (Not more than 6 lectures per module) NA

Module No	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours
1.	Familiarization of common lab apparatus (weighing balance, burette, pipette, volumetric flask, conductometer, water bath, hot plates etc.).	3
2.	Extraction of (i) solids in a solvent, and (ii) two miscible liquids. Purification of compounds via crystallization and sublimation.	3
3.	Determination of the strength of acid and base/ Estimation of alkali content in commercial antacid tablets.	3
4.	Determination of purity by melting points and TLC.	3
5.	Crystallization of benzoic acid.	3
6.	Estimation of % amount of calcium and magnesium in a milk sample.	3
7.	Estimation of Iodine in Iodized common salt.	3
8.	Chemistry of invisible ink.	3
9.	Chemical detectives in forensic analysis.	3
10.	Separation of naphthol, aspirin, and naphthalene.	3
11.	Synthesis of polymer, Nylon 6-10.	3
12.	Estimation of acetic acid in vinegar solution.	3
13.	Preparation of pyridinium chlorochromate (PCC).	3
14.	Determination of acid dissociation constant (pKa) of: (A) polybasic acid (H_3PO_4), (B) Monobasic Acid (CH_3COOH).	3
15.	Kinetics of saponification of ethyl acetate using conductometry.	3
16.	Preparation of $\text{Cu}(\text{NH}_3)_4\text{SO}_4$ and estimation of copper(II) using standard thiosulfate solution as titrant.	3
Total number of hours		42

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

Lab Manual, DCS, IISER Berhampur.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous laboratory assessment, laboratory record writing and laboratory examinations including viva-voce (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

Suggested to perform 12 Experiments out of a library of 16 experiments mentioned in the course content. Time to teach the theory parts associated with the experiments and discussions regarding the same are included in the total hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	Organic Chemistry I				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	CH201				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences with Organic Chemistry background can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any Course code(s)	Nil				
Learning Objective(s): This is an introductory course that covers fundamental concepts in organic chemistry.					
Expected Learning Outcome(s): After completing this course, students will have a thorough understanding of the stereochemistry of organic molecules and basic organic transformations by using several organic reagents. A brief introduction about natural products will provide an opportunity to learn about their importance in daily life.					
Contents of the course: Stereochemistry: conformational analysis, strain in cyclic and acyclic molecules, dynamic stereochemistry. Oxidation of alcohols, ketones and aldehydes, oxidation of C-C double bonds. Reduction of carbonyl compounds, carbon-carbon multiple bonds and other selected functional groups. Selected reagents in organic synthesis, selected functional group transformations in organic synthesis, basic concept of cross-coupling reactions. Introduction to Natural Products.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No	Topic				No. of Hours
	Stereochemistry				
1.	Conformational analysis, conformation of acyclic, cyclic, fused and bridged systems.				4
2.	Strain in cyclic and acyclic molecules including allylic strain (A1,2 and A1,3).				2
3.	Dynamic stereochemistry: Conformation and reactivity, Curtin-Hammett principle, and its applications and case studies.				3
	Oxidation of alcohols, ketones and aldehydes				
4.	Oxidation of alcohols: Chromium reagents, oxidation via alkoxysulfonium salts, Manganese reagents, other metal-based oxidants, other non-metal-based oxidants.				3

5.	Oxidation of ketones and aldehydes: Oxidation to carboxylic acids or esters, oxidation of alpha, beta-Unsaturated ketones and alpha-Hydroxy-ketones, Baeyer-Villiger oxidation of ketones.	3
6.	Oxidation of C-C double bonds: Ozonolysis, dihydroxylation (OsO ₄ , NaIO ₄ , KMnO ₄ , Pb(OAc) ₄ , Woodward-Pre'vost reaction and etc.), epoxidation (m-CPBA, peroxides, dimethyl dioxirane), aziridination, amino-hydroxylation etc.	3
	Reductions	
7.	Reduction of carbonyl compounds	3
8.	Reduction of carbon-carbon multiple bond (catalytic hydrogenation, diimide reduction)	3
9.	Reduction of other functional groups, dissolving metal reductions etc.	3
	Selected reagents in organic synthesis	
10.	Barbier and Grignard, organolithium, organosilicon, organo zinc-based organometallic reactions involving C-C bond formations	3
11.	Selected functional group transformations in organic synthesis, basic concept of cross-coupling reactions.	3
12.	Introduction to Natural Products: Historical overview of natural products in daily life: Medicinal Plants in Folklore, Medicinal Natural Products from Other Sources Used in Folklore, Primary and Secondary Metabolites (Natural Products), A few case studies.	3
13.	General discussions and doubt clearing	6
	Total number of hours	42

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Clayden, J., Greeves, N., Warren, S., Wothers, S. Organic Chemistry, Oxford University Press, 2001.
2. Hornback, J. M. Organic Chemistry, Cengage Learning, 2006.
3. Eliel, E. L., Wilen, S. H., Doyle, M. P. Basic Organic Stereochemistry, John Wiley and Sons, 2001.
4. CARRUTHERS, W., COLDHAM, I., MODERN METHODS OF ORGANIC SYNTHESIS, Cambridge University Press
5. Smith, M. B. and March, J. Advanced Organic Chemistry, Wiley Interscience, 2007.
6. Carey, F. A, Sundberg, R. J. Advanced Organic Chemistry, Part A and B, Springer, 2007.
7. Encyclopedia of Reagents for Organic Synthesis, Editor: L. Paquette, D. Crich, P. Fuchs, G. Molander.
8. Natural Products: Isolation, Structure Elucidation, History; Author(s): Prof. Dr. Dieter Sicker, Prof. Dr. Klaus-Peter Zeller, Prof. Dr. Hans-Ullrich Siehl, Prof. Dr. Stefan Berger; First published: 30 January 2019; Print ISBN:9783527341948 | Online ISBN:9783527806508 | DOI:10.1002/9783527806508; © 2019 WILEY-VCH Verlag GmbH & Co.
9. Molecules That Changed the World: A Brief History of the Art and Science of Synthesis and Its Impact on Society by K. C. Nicolaou and T. Montagnon.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz, etc.), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

There must be 5 hours of discussion and doubt clearing sessions throughout the course. If required, tutorials should be taken separately, outside the lecture hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2.				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

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Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	Introduction to Spectroscopic Methods in Chemistry				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	CH202				
Names of faculties who can teach the course	All the existing faculty members of the Department of Chemical Sciences can teach this course.				
Will the course require participation of visiting faculties: Yes/ No					
Prerequisites, if any	Nil				
Learning Objective(s):					
The course will introduce students to the basic concepts of spectroscopy, their associated instrumental techniques and working principle.					
Expected Learning Outcome(s):					
After completing this course, students will be able to analyze the data generated during the laboratory courses so as to develop the basic structural understanding of chemical compounds.					
Contents of the course:					
Introduction to spectroscopy, Microwave spectroscopy, Infrared spectroscopy, Raman spectroscopy, Electronic spectroscopy, Magnetic resonance spectroscopy, Mass spectroscopy.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No.	Topic				No. of Hours
1.	Introduction to spectroscopy: Electromagnetic spectrum, representation of spectra, resolution and sensitivity.				3
2.	Microwave spectroscopy: Basic principles of microwave spectroscopy with the classical concept of rigid rotor and its instrument details.				5
3.	Infrared spectroscopy: Basic principles of infrared spectroscopy from the classical concept of simple harmonic oscillator and its basic instrumental details.				6
4.	Raman spectroscopy: Introduction to Raman spectroscopy to stokes, antistokes and rayleigh scattering. Differences between Raman and IR spectroscopy.				5
5.	Electronic spectroscopy: Basics of UV-Visible absorption spectroscopy, fluorescence and phosphorescence spectroscopy. General details of the instruments.				6

6.	Magnetic resonance spectroscopy: Fundamental concepts of NMR & EPR spectroscopy, the concept of spin.	5
7.	Mass spectroscopy: Introduction to mass spectrometry and its use in identification of chemical compounds.	4
8.	General discussion and doubt clearing	8
	Total number of hours	42

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. C. N. Banwell, E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th Ed, Tata McGraw-Hill, New Delhi (1995).
2. D. L. Pavia, G. M. Lampman, G. S. Kriz, Introduction to Spectroscopy, 3rd Ed, Cengage, India Edition (2001).
3. W. Kemp, Organic Spectroscopy, 3rd Ed, Palgrave, New York (1991).
4. I. N. Levine, Physical Chemistry, 5th Ed, Tata McGraw-Hill, New Delhi (2007).
5. Introduction to Solid State Chemistry by A R West.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz, etc.), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

There must be at least 7-8 hours of discussion and doubt clearing sessions throughout the course (as mentioned in the lecture outline). If required, tutorials should be taken separately, outside the lecture hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content

1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	Synthetic Chemistry Laboratory				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course Code:	CH203				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences with Inorganic/ Organic Chemistry background can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s):					
This is an introductory course that imparts hands-on knowledge on Laboratory experiments covering fundamental concepts in organic and inorganic chemistry, and correlates theoretical knowledge with experiments.					
Expected Learning Outcome(s):					
After completing this course, the students will learn practical experimental execution of basic chemical reactions including synthesis, purification of simple and common inorganic and organic compounds, their analysis, and gather knowledge on the interpretation of experimental data.					
Contents of the course:					
Inorganic Chemistry Experiments:					
1. Preparation of $[\text{Ni}(\text{NH}_3)_6]^{2+}$ & Ni estimation (Complexometrical & Gravimetical).					
2. Preparation of Ni or Co-Acetylacetonate.					
3. Preparation of a Metal Complex with a Multidentate Ligand: Preparation of Polynuclear Thiourea Complex of Copper (I).					
4. Recycling of Aluminum: Preparation of Potash Alum from waste Aluminum.					
5. Estimation of Barium ion in Barium sulfate.					
6. Blueprinting: Study of Photochemical Reduction of a Ferric salt.					
7. Determination of spectrochemical order of ligands by using electronic spectroscopy of Nickel(II) coordination complexes.					
Organic Chemistry Experiments:					
1. Electrophilic aromatic substitution: Nitration of acetanilide.					
2. Beckmann rearrangement: Preparation of benzanilide from benzophenone oxime.					
3. Aldol reaction: Preparation of dibenzylideneacetone.					
4. Baylis-Hillman reaction of ethyl acrylate and benzaldehyde.					
5. Reduction of ketone: Preparation of benzhydrol by NaBH_4 reduction of benzophenone					
6. Preparation of amide: Synthesis of acetanilide from aniline					
7. The Suzuki-Miyaura reaction: Synthesis of 4-nitro-1,1'-biphenyl compound.					

Lecture Outline: (Not more than 6 lectures per module) NA

Module No	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours
1.	Nitration of acetanilide	3
2.	Preparation of benzanilide from benzophenone oxime	3
3.	Preparation of dibenzylideneacetone	3
4.	Baylis-Hillman reaction	3
5.	Preparation of benzhydrol by NaBH ₄ reduction of benzophenone	3
6.	Synthesis of acetanilide from aniline	3
7.	Preparation of [Ni(NH ₃) ₆] ²⁺ & Ni estimation (Complexometrical & Gravimetrical)	3
8.	Preparation of Ni or Co-Acetylacetonate	3
9.	Preparation of a Metal Complex with a Multidentate Ligand: Preparation of Polynuclear Thiourea Complex of Copper (I)	3
10.	Recycling of Aluminum: Preparation of Potash Alum from waste Aluminum	3
11.	Estimation of Barium ion in Barium sulfate	3
12.	Blueprinting: Study of Photochemical Reduction of a Ferric salt.	3
13.	Determination of spectrochemical order of ligands by using electronic spectroscopy of Nickel(II) coordination complexes.	3
14.	The Suzuki-Miyaura reaction: Synthesis of 4-nitro-1,1'-biphenyl compound	3
Total number of hours		42

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- 1) Practical Organic Chemistry, 5th Edition, 1989, Vogel, Arthur Israel. Vogel's textbook of practical organic chemistry
- 2) Lab Manual, DCS, IISER Berhampur.
- 3) Infrared and Raman Spectra: Inorganic and coordination Compounds, Sixth Edition Part A & B; K.Nakamoto; John Wiley & Sons, Inc., New Jersey, 2009.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous laboratory assessment, laboratory record writing and laboratory examinations including viva-voce (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

Suggested to perform 12 Experiments out of a library of 14 experiments mentioned in the course content. Time to teach the theory parts associated with the experiments and discussions regarding the same are included in the total hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2.				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
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Recommended / Not Recommended for the approval/ratification by the Senate

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	Laboratory for Physical Methods in Chemistry				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course Code:	CH204				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s):					
The objective of this course is to introduce the students to the basic physical analysis/characterization techniques, which will be useful across various branches of Chemistry as well as in other disciplines.					
Expected Learning Outcome(s):					
After completing this course, the students will gain hands-on knowledge on Laboratory experiments covering fundamental concepts in various instrumental techniques including different characterization methods such as NMR, IR, mass spectra, UV-Visible absorption etc.					
Contents of the course:					
1. Acidic and basic dissociation constants of glycine and its isoelectric point. 2. Determination of dissociation constant and equivalent conductance at infinite dilution of weak electrolyte (acetic acid) using conductometry. 3. Kinetics of the iodide-hydrogen peroxide clock reaction. 4. Potentiometric Titration of a standard solution of KCl against AgNO₃ - Determination of solubility product of AgCl. 5. Potentiometric Titration of a standard solution of AgNO₃ against mixture of halides - Determination of concentration of two salts in a given mixture. 6. First order kinetics - Acid hydrolysis of methyl acetate at different temperatures taking different concentrations of [H⁺] ions. 7. Analysis of mass spectra of simple organic molecules. 8. Functional group (carbonyl, nitro, ester, amide, alcohol, etc.) determination by IR spectroscopy. 9. UV-Visible absorption and fluorescence spectra for a standard dye molecule. 10. Identification of ¹H NMR of a small molecule (ethylbenzoate or aspirin). 11. Measurement of optical rotations of two enantiomers, <i>d</i>-tartaric acid and <i>l</i>-tartaric acid. 12. Characterization of a paramagnetic compound (CuSO₄/MnCl₂) by EPR spectroscopy. 13. Determination of redox potentials of Ferrocene through cyclic voltammetry. 14. Analysis of the crystalline structure of a compound (PXR: NaCl/KCl/PPh₃, SXRD: benzoic acid) by X-ray diffraction (powder/single crystal).					

Lecture Outline: (Not more than 6 lectures per module) NA

Module No	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours
1.	Acidic and basic dissociation constants of glycine and its isoelectric point	3
2.	Determination of dissociation constant and equivalent conductance at infinite dilution of weak electrolyte (acetic acid) using conductometry	3
3.	Kinetics of the iodide-hydrogen peroxide clock reaction	3
4.	Potentiometric Titration of a standard solution of KCl against AgNO ₃ – Determination of solubility product of AgCl	3
5.	Potentiometric Titration of a standard solution of AgNO ₃ against mixture of halides – Determination of concentration of two salts in a given mixture	3
6.	First order kinetics – Acid hydrolysis of methyl acetate at different temperatures taking different concentrations of [H ⁺] ions	3
7.	Analysis of mass spectra of simple organic molecule	3
8.	Functional group (carbonyl, nitro, ester, amide, alcohol, etc.) determination by IR spectroscopy	3
9.	UV-Visible absorption and fluorescence spectra for a standard dye molecule	3
10.	Identification of ¹ H NMR of a small molecule (ethylbenzoate or aspirin)	3
11.	Measurement of optical rotations of two enantiomers, <i>d</i> -tartaric acid and <i>l</i> -tartaric acid	3
12.	Characterization of a paramagnetic compound (CuSO ₄ /MnCl ₂) by EPR spectroscopy	3
13.	Determination of redox potentials of Ferrocene through cyclic voltammetry	3
14.	Analysis of the crystalline structure of a compound (PXR: NaCl/KCl/PPh ₃ , SXR: benzoic acid) by X-ray diffraction (powder/single crystal)	3
Total number of hours		42

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

Lab Manual, DCS, IISER Berhampur.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous laboratory assessment, laboratory record writing and laboratory examinations including viva-voce (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

Suggested to perform 12 Experiments out of a library of 14 experiments mentioned in the course content. Time to teach the theory parts associated with the experiments is included in the total hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
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Recommended / Not Recommended for the approval/ratification by the Senate

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	Physical Chemistry I				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	CH206				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences with Physical Chemistry background can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Course code(s)					
Learning Objective(s):					
To introduce students to the basic mechanisms of the transformation of energy into different forms, transformation between different physical states/phases and their relation to physical observables such as temperature, pressure, and volume.					
Expected Learning Outcome(s):					
After completing the course, students will gain knowledge regarding fundamental concepts of laws of thermodynamics, chemical equilibrium, phase equilibrium, phase rules and colligative properties, and will be able to solve related problems.					
Contents of the course:					
1st Law of thermodynamics and thermochemistry, 2nd Law of thermodynamics, concept of entropy. Introduction to 3rd law of thermodynamics. Spontaneity and equilibrium, chemical equilibrium, phase equilibrium and phase diagrams for single-component systems, phase rule, Solutions and colligative properties.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No	Topic				No. of Hours
1.	1st Law of thermodynamics and thermochemistry: Heat capacity at constant volume (c_v) and constant pressure (c_p) and their relation, Joule's experiment, Joule's coefficient for ideal and van der Waals gas, Joule-Thomson experiment, Joule-Thomson coefficient for ideal and van der Waals gas, Adiabatic changes in state, standard enthalpy of physical and chemical changes, Hess's law, Standard enthalpies of formation, temperature dependence of reaction enthalpies, calorimetry.				5
2.	2nd Law of thermodynamics: Kelvin and Clausius statement of 2nd law, Carnot cycle, Heat engine and refrigerator, efficiency of heat engine, Clausius inequality.				4
3.	Concept of entropy: Properties of entropy, entropy changes in isothermal processes, cyclic rule and its applications, entropy changes in relation to				4

	changes in the state variables, entropy as a function of temperature and volume, entropy as a function of temperature and pressure, temperature dependence of the entropy, entropy changes in an ideal gas, entropy changes in chemical reactions.	
4.	Introduction to 3rd law of thermodynamics: 3rd law of thermodynamics, entropy and probability, Boltzmann equation, entropy of mixing (using concept of microstates) and exception to the 3rd law of thermodynamics.	3
5.	Spontaneity and equilibrium: Entropy and irreversibility, general condition for spontaneity and for equilibrium, the fundamental equations of thermodynamics, Maxwell relations, thermodynamic equation of state and its applications, properties of Gibbs free energy, temperature dependence of Gibbs free energy and Gibbs-Helmholtz equation.	4
6.	Chemical equilibrium: Definition and properties of chemical potential, partial molar quantities, Gibbs free energy and entropy of mixing, chemical equilibrium in a mixture, advancement of a chemical reaction, chemical equilibrium in a mixture of ideal gases, equilibrium constant, interrelations between K_p , K_c and K_x , effect of temperature and pressure on equilibrium constant, Le Chatelier principle, Gibbs-Duhem equation.	4
7.	Phase equilibrium and phase diagrams for single-component systems: Stability of phases of a pure substance, change of chemical potential with temperature and pressure, Clapeyron equation, different kind of phase equilibria: solid-liquid, liquid-gas and solid-gas, phase diagram of single-component systems such as water, CO_2 , sulfur, Clausius-Clapeyron equation.	3
8.	Phase rule: Phase rule of single and multi-component systems: derivation and applications.	3
9.	Solutions and colligative properties: Ideal and non-ideal solutions, Raoult's law, colligative properties: freezing point depression, boiling point elevation, osmotic pressure.	6
10.	General discussions and doubt clearing	6
Total number of hours		42

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Atkins, P.W., de Paula, J., Physical Chemistry, Ed. 9th, Oxford Press, **2009**.
2. Castellan, G.W., Physical Chemistry, Ed. 3rd, Narosa Publishing House, **2004**.
3. Levine, I., Physical Chemistry, Ed. 6th, McGraw Hill, **2009**.
4. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry, Ed. 2nd, Oxford Press, **2000**.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz, etc.), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

There must be 5-6 hours of discussion and doubt clearing sessions throughout the course. If required, tutorials should be taken separately, outside the lecture hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	Fundamentals of Physics I	PS101	6 hours	14%

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Coordinator/Dean, Academic Affairs

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Chemical Sciences

Course Title	Inorganic Chemistry I				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	CH205				
Names of faculties who can teach the course	All of the existing faculty members of the Department of Chemical Sciences with Inorganic Chemistry background can teach this course.				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): The concepts related to a fundamental understanding of Inorganic Chemistry such as bonding, structure, and periodic properties of elements are covered in this basic course.					
Expected Learning Outcome(s): At the end of this course, students will gain basic knowledge of the elements, their periodic trends, and relation to observed properties. Additionally, this course will impart in-depth knowledge on structure, and bonding in inorganic compounds.					
Contents of the course: Main group Chemistry: General characteristics of s-, and p-block elements, electron-deficient molecules, hyper-valency concept, main group organometallics. Transition metal complexes: Types of ligands and stereochemistry, Preliminary idea about crystal field theory (CFT), Application of CFT to explain color and magnetism of transition metal complexes, concept of 18 electron rule among transition metal complexes, preliminary ideas about the relationship of transition metal complexes and metalloenzymes. Chemistry of f-block elements: Periodic properties of rare earth elements.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No	Topic				No. of Hours
	Main group chemistry				
1.	General characteristics of s-, and p-block elements (hydrides, oxides, and halides)				5
2.	Electron-deficient molecules, hyper-valency, concept of multi-centered bonding, and Lewis acid-base concepts.				3
3.	Main group organometallics: : Organometallic reagents involving lithium, magnesium, and aluminum.				5

	Transition metal complexes	
4.	General characteristics of transition metals and variable oxidation states. Types of ligands and stereochemistry of complexes.	3
5.	Preliminary idea about crystal field theory (CFT): splitting of d-orbital energy levels for Oh, Td, and square planar complexes	4
6	Application of CFT to explain color and magnetism of transition metal complexes, spectrochemical series.	3
7.	Concept of 18 electron rule based on MO theory among transition metal complexes,	4
8	Introduction to organometallic chemistry, different aspects of ligands and bonding modes of ligands (sigma and pi-ligands).	4
8.	Preliminary ideas about the relationship of transition metal complexes and metalloenzymes.	3
	Chemistry of f-block elements	
9.	Periodic properties of rare earth elements (RRE), extraction and separation of REE, and their applications.	3
10.	General discussion and doubt clearing	5
	Total number of hours	42

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- 1) Inorganic Chemistry, Shriver and Atkins, Fourth Edition, Oxford University Press, 2006. Concise Inorganic Chemistry, J. D. Lee, Fifth Edition, Blackwell Publishing, 2006.
- 2) Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Gaus, Third Edition, John Wiley and Sons Press, 1995.
- 3) Concepts and Models of Inorganic Chemistry, B. Douglas, D. McDaniel, J. Alexander, Wiley India (P.) Ltd., India, 2010.
- 4) Inorganic Chemistry-Principles of Structure and Reactivity. J. E. Huheey, E. A. Keiter, R. L. Keiter, 4th Edn. Harper-Collins, NY, 1993.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz etc), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute BS-MS manual).

Additional Guidelines:

There must be 5-6 hours of discussion and doubt clearing sessions throughout the course. If required, tutorials should be taken separately, outside the lecture hours.

Name and Signature of course proposer(s):

The Departmental UG Committee, DCS.

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2.				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	
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	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Earth and Environmental Sciences

Course Title	Introduction to Earth System Science				
Course Level (tick (✓) in relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐	Semester: Odd ☒ Even ☐ Either semester ☐			
Course Type (tick (✓) in relevant option)	Core ☒ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	2	1	0	3	
Course Code:	ES101				
Name of faculties who can teach the course:	Prof. Joydip Mukhopadhyay, Dr. Azhar M. Shaikh				
Will the course require participation of visiting faculties: No					
Prerequisites, if any Course code(s)	No				
Objective(s) and Expected Learning Outcomes: - To understand the scope, sub-disciplines, and interdisciplinary nature of Earth Sciences - To understand the formation, structure, and evolution of the Earth and its position in the solar system - To analyze Earth's surface and climatic processes and their long-term effects on planetary evolution - Students will become acquainted with Earth's origin, structure, and evolution, and analyze surface and climatic processes shaping its landscape over time					
Course Content: Module-1: Introduction to ESS: scope, sub-disciplines and relationship with other branches of sciences. Module-2: Origin of the Universe and stars, Synthesis of elements Module-3: Solar System- Introduction to various planets and Meteorites, Earth in the solar system, origin, differentiation. Module-4: Atmosphere: Origin of atmosphere and evolution of atmosphere Module-5: Mechanical layering of the Earth: lithosphere, asthenosphere, mantle and core.. Earth's magnetic field, Geothermal gradient and internal heat of the Earth. Module-6: Earth's Surface Processes: Weathering and Erosion. Landforms in deserts, glaciated regions and river valleys. Module-7: Geological Time scale: Age of the Earth; radioactivity and its application in determining the age of the Earth. Geological Time Scale, Life through ages and Mass Extinction. Module-8: Global warming, Ice ages and snowball Earth.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No	Topic			No. of Hours (One Lecture: one hour)	
1	Introduction to ESS - scope, sub-disciplines and relationship with other branches of sciences			2	
2	Origin of the Universe and stars, Synthesis of elements			5	
3	Solar system: - Introduction to various planets - Meteorites, - Earth in the solar system, origin, differentiation.			5	
4	Atmosphere: - Origin of atmosphere - Evolution of atmosphere			5	
5	Earth's Internal Structure : - Mechanical layering of the Earth: lithosphere, asthenosphere, mantle and core.. - Earth's magnetic field, Geothermal gradient and internal heat of the Earth			3	

6	Earth's surface processes : • Weathering and Erosion. • Landforms in deserts, • glaciated regions • and river valleys	5
7	Geological Timescale: • Radioactivity and its application in determining the age of the Earth. • Geological Time Scale • Life through ages and Mass Extinction.	5
8	Earth's climatic evolution: • Global warming • Ice ages and snowball Earth.	3

Brief Description of Tutorial/Discussion Activities:

Module No	Topic	No. of Hours
1 to 4	Origin of Universe, Solar system, Atmosphere	4
5-6	Earth's Internal Structure, Earth's surface processes	4
7-8	Geological Time Scale-Earth's Climatic Evolution	1

Brief Description of Laboratory Activities: No Lab module

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable):

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publications.

- Grotzinger, John and Jordan, Thomas H.: Understanding the Earth (7th ed.), W.H.Freeman & Co Ltd, 2014.
- Marshak, Stephen: Essentials of Geology (4th ed.), W. W. Norton & Company, Inc, 2013.
- Holmes, Arthur: Holmes Principles of Physical Geology (3rd ed.), Wiley, 1993.
- Mukerjee, P. K: Textbook of Geology, World Press Private Ltd, 2013.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

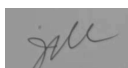
Additional Guidelines:
Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:





Pragratishya Malakar

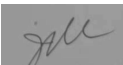
(Prof. Joydip Mukhopadhyay)

(Dr. Azhar M. Shaikh)

(Dr. Tushar M. Chakraborti)

(Dr. Pragnaditya Malakar)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	 Convener, DPGC	 FIC/HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Earth and Environmental Sciences

Course Title	Introduction to Environmental Science				
Course Level (tick (✓) in relevant option)	100 ✓ 200 300 400 500 600 700	Semester: Odd Even ✓ Either semester			
Course Type (tick (✓) in relevant option)	Core/ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS✓ Int. PhD. Ph.D.				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core Professional (Department) Core ✓ Department Elective Open Elective Minor				
Type of the course	Theory ✓ Lab Project Non-Credit				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	2	1	0	3	
Course Code:	ES102				
Name of faculties who can teach the course:	Dr. Ritika Kaushal, Dr. Pragnaditya Malakar				
Will the course require participation of visiting faculties: No					
Prerequisites, if any Course code(s)	No				

Objective(s) and Expected Learning Outcomes:

- To understand the foundational concepts and interdisciplinary nature of environmental science, including its scope, importance, and relationship with other disciplines.
- To identify and analyze various natural resources, ecosystems, and biodiversity types, along with their conservation strategies, threats, and ecological significance.
- To learn to evaluate the causes, effects, and control measures of different types of environmental pollution, understand related laws and policies in India, and assess the impact of human population growth and urban issues on the environment.
- Students will become acquainted with environmental issues and apply ecological knowledge, laws, and sustainable practices to real-world challenges.

Course Content:

- **Module-1:** Introduction, Definition, scope and importance, multi-disciplinary nature of environmental sciences.
- **Module-2:** Natural resources, renewable and non-renewable (forest, water, mineral, food, energy and land/soil).
- **Module-3:** Ecosystems: definition, concept, structure & function (producers, consumers, decomposers), energy flow, ecological succession, food chain, food web, ecological pyramids, specialised ecosystems (forest, grassland, aquatic, desert, etc.).
- **Module-4:** Biodiversity: introduction, definition, biogeographical classification of India, value of biodiversity, global to local biodiversity, India, a mega-biodiverse country, biodiversity hotspots, threats to biodiversity, concept of conservation (in-situ, ex-situ).
- **Module-5:** Environmental pollution: Definition, causes, effects and control of air, water, soil, marine, noise & thermal pollution, solid waste management, disaster management, prevention of pollution.
- **Module-6:** Social issues & the environment: unsustainable use of resources, urban issues, water (conservation, harvesting, watershed management), environmental ethics, waste-land restoration.
- **Module-7:** Environmental laws & legislations in India: environmental protection act, air act, water act, forest act, wildlife protection act, biological diversity act, implementation of laws & regulations.
- **Module-8:** Human population & environment: population explosion, food security, health, equitable sharing & justice.

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours (One Lecture: one hour)
1	Introduction: • Definition, scope and importance, • Multi-disciplinary nature of environmental sciences.	2
2	Natural Resources: • renewable and non-renewable (forest, water, mineral, food, energy and land/soil).	5

3	Ecosystems: • Definition, concept, • Structure & function (producers, consumers, decomposers), • Energy flow, • Ecological succession, food chain, food web, ecological pyramids, • Specialised ecosystems (forest, grassland, aquatic, desert, etc.).	5
4	Biodiversity: • Introduction, definition, • Biogeographical classification of India, • value of biodiversity, global to local biodiversity, • India, a mega-biodiverse country, biodiversity hotspots, threats to biodiversity, • Concept of conservation (in-situ, ex-situ).	5
5	Environmental Pollution: • Definition, causes, effects • Control of air, water, soil, marine, noise & thermal pollution, • Solid waste management, • disaster management • prevention of pollution	5
6	Social Issues & Environment: • Unsustainable use of resources, • Urban issues, water (conservation, harvesting, watershed management), • Environmental ethics, waste-land restoration	3
7	Environmental Laws: • Environmental protection act, air act, water act, forest act, wildlife protection act, • Biological diversity act, implementation of laws & regulations	2
8	Human Population & Environment : • Population explosion, food security, health, • Equitable sharing & justice.	2

Brief Description of Tutorial/Discussion Activities:

Module No	Topic	No. of Hours
2	Natural Resources	2
3-4	Ecosystem-Biodiversity	3
5	Environmental Pollution	5
6-8	Social Issues & Environment, Environmental Laws, Human Population & Environment	3

Brief Description of Laboratory Activities: No Lab module

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable):

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publications.

- Bharucha, E., Textbook for Environmental Studies for Undergraduate Courses (3rd ed.), Orient Blackswan Pvt Ltd., 2021
- Khoiyangbam, R. S. and Gupta, Navindu, Introduction to Environmental Sciences, TERI, 2012.
- Valdiya, K S. Environmental Geology, Second Ed, McGrawhill Publ. 2013
- Bell, F.G. , Environmental Geology: Principles and Practice. WileyBlackwell, 1998
- Keller, E.A., Environmental Geology (9th Edition). Pearson, 2010

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):
 Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

Additional Guidelines

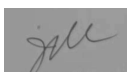
Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

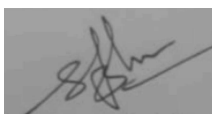
S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:



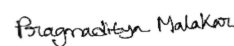
(Prof. Joydip Mukhopadhyay)



(Dr. Azhar M. Shaikh)

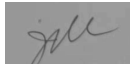


(Dr. Tushar M. Chakraborti)



(Dr. Pragnaditya Malakar)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	 Convener, DPGC	 FIC/HoD
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For Use of Academic Section

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Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Earth and Environmental Sciences

Course Title	PRINCIPLES OF MINERALOGY				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐	Semester: Odd ☒ Even ☐ Either semester ☐			
Course Type (tick (✓) in relevant option)	Core ☒ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	2	1	0	3	
Course Code:	ES201				
Name of faculties who can teach the course:	Dr. Azhar Shaikh, Professor Joydip Mukhopadhyay				
Will the course require participation of visiting faculties: No					
Prerequisites, if any	No				
Course code(s)					

Learning Objectives:

- To introduce students to the elementary ideas of mineralogy, the application of minerals, and gemology.

Learning Outcome:

At the end of this course students will be able to

- understand the physical properties and general principles of classification of rock-forming minerals
- understand the principles of physical crystallography
- understand the principles of optical behavior of minerals under polarizing microscope.

Course Content:

Module 1: Introduction to Mineralogy: Definition of mineral and crystal. Classification of Minerals.

Module 2: Rock forming minerals: Brief idea on Rock forming minerals (orthosilicates, sorosilicates, cyclosilicates, inosilicates (single-chain and double-chain silicates), phyllosilicates, and tectosilicates).

Module 3: Physical Properties of Minerals in Hand Specimen: Color, luster, form & structure, streak, hardness, fracture, cleavage, habit, specific gravity, symmetry in crystal, magnetic properties, optical properties, other special properties; few important Indian occurrences for several mineral-groups.

Module 4: Mineral Chemistry: Introduction to crystal chemistry - ionic radii and coordination number; Chemical affinity.

Module 5: Geochemical classification of elements; cosmic abundance of elements; chemical bonding, coordination polyhedra, radius ratio, and Pauling's rules.

Module 6: Major, minor and trace elements in minerals, isomorphism, polymorphism, pseudomorphism, twinning, phase transformations, and crystal defects

Module 7: Crystallography: Definition of mineral and crystal; Fundamental laws of crystallography; Hermann Mauguin Notations; Miller's Indices

Module 8: Crystal Systems and Classes

Module 9: Concept of Lattice, Space group, point group

Module 10: Introduction to optical mineralogy; Petrological microscope; orthoscopy and conoscopy techniques;

Module 11: Optical Classes of Minerals: isotropic and anisotropic minerals; Uniaxial and biaxial indicatrix;

Module 12: Principles of interference colour in minerals: interference color and order of interference, optic sign

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours (One Lecture: one hour)
1	Introduction to Mineralogy: - Definition of mineral and crystal. - Classification of Minerals	2
2	Rock-forming Minerals: Brief idea on Rock forming minerals (orthosilicates, sorosilicates, cyclosilicates, inosilicates (single-chain and double-chain silicates), phyllosilicates, and tectosilicates).	4

3	Physical Properties of Minerals in Hand Specimen: • Color, luster, form & structure, streak, hardness, fracture, cleavage, habit, specific gravity, symmetry in crystal, magnetic properties, • optical properties, other special properties; few important Indian occurrences for several mineral-groups.	2
4	Mineral Chemistry: • Introduction to crystal chemistry • Ionic radii and coordination number • Chemical affinity.	3
5	• Geochemical classification of Elements • cosmic abundance of elements • chemical bonding, coordination polyhedra, radius ratio, and Pauling's rules.	3
6	• Major, minor and trace elements in minerals, isomorphism, polymorphism, pseudomorphism, • Twinning, phase transformations, and crystal defects	2
7	Crystallography: • Definition of mineral and crystal; • Fundamental laws of crystallography; • Hermann Mauguin Notations; Miller's Indices	4
8	• Crystal Systems and Classes: 32 crystal classes	3
9	• Concept of Lattice, Space group, point group	2
10	Introduction to Optical Mineralogy: • Petrological microscope; orthoscopy and conoscopy techniques	2
11	Optical classes of minerals: • isotropic and anisotropic minerals; • Uniaxial and biaxial indicatrix	2
12	Principles of interference colour in minerals: • Interference color and order of interference, • optic sign	3

Brief Description of Tutorial/Discussion Activities:

Module No	Topic	No. of Hours
2-4	Mineral classification & Chemistry	2
7-8-9	Crystallography	4
10-11-12	Optical Mineralogy	4

Brief Description of Laboratory Activities: Laboratory: ES 211

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable):

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publications.

1. Deer, W. A., Howel, R. A., and Zussman, J., 2013 An Introduction to Rock Forming Minerals (3rd Edition), Mineralogical Society of Great Britain and Ireland.
2. Klein, C., and Butrow, B., 2008, The 23rd edition of the Manual of Mineral Science (4th Edition), John Wiley and Sons.
3. Nesse, W. D., 2011, Introduction to Mineralogy (2nd Edition), Oxford University Press.
4. Swapna Mukherjee, 2011: Applied Mineralogy: Applications in Industry and Environment, Springer.
5. Beginners guide to Gemology by P.G.Read
6. Gem Testing by S.W. Anderson

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):
 Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

Additional Guidelines:

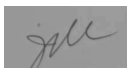
Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:



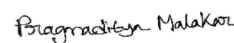
(Prof. Joydip Mukhopadhyay)



(Dr. Azhar M. Shaikh)

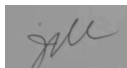


(Dr. Tushar M. Chakraborti)



(Dr. Pragnaditya Malakar)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	 Convener, DPGC	 FIC/HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
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Recommended / Not Recommended for the approval/ratification by the Senate

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Earth and Environmental Sciences

Course Title	PRINCIPLES OF STRUCTURAL GEOLOGY				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐	Semester: Odd ☒ Even ☐ Either semester ☐			
Course Type (tick (✓) in relevant option)	Core ☒ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. Ph.D. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) ☒ Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	2	1	0	3	
Course Code:	ES203				
Name of faculties who can teach the course:	Dr. Azhar Shaikh, Dr. Tushar Mouli Chakraborti, Professor Joydip Mukhopadhyay, Dr. P. Malakar				
Will the course require participation of visiting faculties: Yes					
Prerequisites, if any Course code(s)	No				

Learning Objectives:

To introduce students to the elementary idea of rock deformation and structural geology **Learning Outcome:**

Learning outcome

At the end of this course students will be able to

- understand the general principles of deformation rocks
- understand the folded rock strata and mechanisms of folding.
- understand the criteria for recognition and significance of faults in geological successions
- understand structural elements such as cleavage, schistosity, joints in deformed rock strata

Course Contents:

Module-1: Basic Structural Elements

Primary and secondary Structures, Structural elements: planar and linear structures, concept of strike and dip, rake/pitch and plunge, Concept of scale of observation of structures. Topographic maps. Outcrop patterns of different structures on 2- and 3-dimension.

Module-2: Stress and Strain

Stress - definitions, different types of stress, two and three-dimensional stress, Mohr's diagram for graphical analysis of stress; Strain - definitions, measurement of strain, Mohr's diagram for strain calculation, rheology of rocks and minerals; Concept of brittle and ductile deformation and their relation with temperature and pressure.

Module-3: Rock Failure

Fracturing, Mohr-Coulomb criteria for rock failure, classification for fractures, geometry of fracture systems in three dimensions, microscopic features of fractured surfaces, effect of confining pressure on fracturing and frictional sliding, Griffith theory of fracture, estimation of fluid pressure from dykes and quartz veins.

Module-4: Faults

Different types of faults, recognition of faults, measurement of fault displacements, fault geometry, orientation of stress fields and fault kinematics, paleo-stress from the fault slip data, fault bend folds, and fault propagation folds.

Module-5: Folds

Geometric descriptions and classification of folds, scale and attitude of folds, the elements of a fold and their measurement, order of folding, common structures associated with folding.

Module-6: Kinematics of Folding

Mechanisms of folding, buckling and shear folding of single layers, multilayer formation of kink and Chevron fold.

Module-7: Foliation and Lineation in Deformed Rocks

Different types of foliations - compositional, disjunctive, crenulation and continuous; Lineation - different types of lineation, origin and association of lineation in relation to other structures.

Module-8: Microscopic Aspects of Ductile Deformation

Mechanisms of low temperature deformation, twin gliding, diffusion and solution creep, linear crystal defects; Microscopic criteria for identification of dislocation and diffusion creep.

Module-9: Shear Zone and Progressive Deformation

Definition of shear zone, mechanism of formation of shear zone, strain in shear zone, determining the sense of shear in shear zone, concept of progressive deformation.

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours (One Lecture: one hour)
1	Basic Structural Elements: - Primary and secondary Structures, Structural elements: planar and linear structures, - concept of strike and dip, rake/pitch and plunge, Concept of scale of observation of structures. - Topographic maps, Outcrop patterns of different structures on 2- and 3-dimension.	3
2	Stress and Strain: - Stress - definitions, different types of stress, two and three-dimensional stress, - Mohr's diagram for graphical analysis of stress; - Strain - definitions, measurement of strain, Mohr's diagram for strain calculation, rheology of rocks and minerals; - Concept of brittle and ductile deformation and their relation with temperature and pressure.	4
3	Rock Failure: - Fracturing, Mohr-Coulomb criteria for rock failure, classification for fractures, geometry of fracture systems in three dimensions, - microscopic features of fractured surfaces, effect of confining pressure on fracturing and frictional sliding, - Griffith theory of fracture, estimation of fluid pressure from dykes and quartz veins.	3
4	Faults: - Different types of faults, recognition of faults, measurement of fault displacements, fault geometry, - Orientation of stress fields and fault kinematics, - Paleo-stress from the fault slip data, fault bend folds, and fault propagation folds.	3
5	Folds: - Geometric descriptions and classification of folds, - Scale and attitude of folds, the elements of a fold and their measurement, - Order of folding, common structures associated with folding.	5
6	Kinematics of Folding: - Mechanisms of folding, buckling and shear folding of single layers, - Multilayer formation of kink and Chevron fold	2
7	Foliation and Lineation in Deformed Rocks: - Different types of foliations - compositional, disjunctive, crenulation and continuous; - Lineation - different types of lineation, - Origin and association of lineation in relation to other structures	3
8	Microscopic Aspects of Ductile Deformation: - Mechanisms of low temperature deformation, twin gliding, - Diffusion and solution creep, linear crystal defects;	3

	Microscopic criteria for identification of dislocation and diffusion creep.	
9	Shear Zone and Progressive Deformation: - Definition of shear zone, mechanism of formation of shear zone, - Strain in shear zone, determining the sense of shear in shear zone, Concept of progressive deformation.	3

Brief Description of Tutorial Activities: NA		
Module No	Topic	No. of Hours
2-4	Stress strain-Rock failure	5
5	Folds	5
9	Shear Zone and Progressive Deformation	3

Brief Description of Laboratory Activities: Laboratory: EES 212		
Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable):

Suggested Readings:

1. Twiss, R. J., and Moores, E. M., 2007, Structural Geology (2nd Edition), W. H. Freeman and Company.
2. Ghosh, S. K., 1993, Structural Geology Fundamentals and Modern Developments (1st Edition), Pergamon Press.
3. Davis, H., Reynolds, S. J., and Kluth, F. C., 2012, Structural Geology of Rocks and Regions (3rd Edition), Wiley.
4. Jain, A. K., 2014, An Introduction to Structural Geology (1st Edition), Geological Society of India.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):
 Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

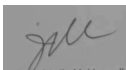
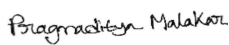
Additional Guidelines:

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:			
			
(Prof. Joydip Mukhopadhyay)	(Dr. Azhar M. Shaikh)	(Dr. Tushar M. Chakraborti)	(Dr. Pragnaditya Malakar)

Recommendation of External experts/Senate members/Subject expert(s)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Earth and Environmental Sciences

Course Title	Foundation Mineralogy-Petrology Lab				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐	Semester: Odd ☒ Even ☐ Either semester ☐			
Course Type (tick (✓) in relevant option)	Core ☒ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	0	0	3	1	
Course Code:	ES211				
Name of faculties who can teach the course:	Dr Tushar Mouli Chakraborti, Dr. Azhar M. Shaikh,				
Will the course require participation of visiting faculties: No					
Prerequisites, if any	No				
Course code(s)					

Course Objective

Students will learn the identification of minerals in hand samples (physical properties) and thin sections (optical properties) as well as identification of the crystallographic properties of the minerals.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- identify and describe properties of common rock-forming minerals in hand specimen and under microscopes
- identify and describe common rocks in hand specimen and under microscopes Learn to explain the processes responsible for the textures and metamorphic grades

Modules		Details	Class-hours
1	Study of Physical Properties of Minerals	Use of physical properties for identification of Minerals: Colour, lustre, streak, hardness, special properties	3
2	Mineral Identification	Identification of common rock-forming minerals (Quartz, feldspar, muscovite, biotite, calcite, pyroxene, olivine, amphibole, garnet).	12
3	Identification of common rocks	Granite, basalt, gabbro, dolerite, anorthosite, dunite, mica schist, slate, phyllite, granulite, sandstone, conglomerate, limestone, BIF	12
4	Optical Microscopy	Identification of common rock-forming minerals (Quartz, feldspar, muscovite, biotite, calcite, pyroxene, olivine, amphibole, garnet)	15
Total			14 hours

Reference Books

1. Mottana, A., Crespi, R., and Liborio, G., 1978, Simon and Schuster's Guide to Rocks and Minerals (6th edition), Fireside Books.
2. Nesse, W. D., 2014, Introduction to Optical Mineralogy (4th Edition), Oxford University Press.
3. Dana, J. D., 2008, Manual of Mineralogy and Petrology, Palala Press

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

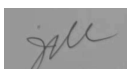
Additional Guidelines:

Similarity with the existing courses, if any:**(Similarity content is declared as per the number of lecture hours on similar topics)**

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:



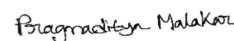
(Prof. Joydip Mukhopadhyay)



(Dr. Azhar M. Shaikh)

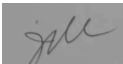


(Dr. Tushar M. Chakraborti)



(Dr. Pragnaditya Malakar)

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 Convener, DUGC	 Convener, DPGC	 FIC/HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course
Department of Earth and Environmental Sciences

Course Title	PLATE TECTONICS				
Course Level (tick (✓) in relevant option)	100 200 ☐ ✓ 300 400 ☐ 500 ☐ 600 ☐ 700 ☐	Semester: Odd Even ☐ ✓ Either semester			
Course Type (tick (✓) in relevant option)	Core-/ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	2	1	0	3	
Course Code:	ES202				
Name of faculties who can teach the course:	Prof. Joydip Mukhopadhyay, Dr. Azhar M. Shaikh, Dr. Tushar Mouli Chakraborti				
Will the course require participation of visiting faculties: YES					
Prerequisites, if any	No				
Course code(s)					

Learning Objectives:

To introduce students to the elementary idea of plate tectonics and geodynamics

Learning outcome

At the end of this course students will be able to

- understand the general principles of geodynamics
- understand the criteria for distinguish different tectonic regimes
- decipher tectonic regimes from rock records

Module-1: Plate Tectonics & Fundamental Earth process: Concept and evidences of continental Drift and plate tectonics. Introduction to lithospheric plates and plate boundaries. Supercontinent Cycles. Introduction to Earthquake and earthquake belts, Volcanoes, Concept of isostasy.

Module-2: Internal Structure of the Earth: Different layers of Earth, velocity of s- and p-waves through Earth's interior-velocity-depth profile, mineralogical and phase change through depth

Module-3: The Dynamic Earth: Continental drift, seafloor spreading, continental reconstructions, geologic evidence for continental drift, paleoclimatology, paleontologic evidence for continental drift, paleomagnetism, transform faults, concept of mantle plumes and igneous activities.

Module-4: The Framework of Plate Tectonics: Distribution of earthquakes in relation to plate motion, relative and absolute plate motions, hotspots, direct measurement of relative plate motions, finite plate motions, stability of triple junctions, present-day triple junctions.

Module-5: The Mechanism of Plate Tectonics: Contracting Earth hypothesis, expanding Earth hypothesis, driving mechanisms of plate tectonics, mantle drag mechanism, edge-force mechanism, evidence for convection in the mantle, the mechanism of the supercontinent cycle.

Module 6: Distribution of Plates: World Distribution tectonic plates and its significance

Module-7: Tectonic regimes of Indian subcontinent: Physiographic divisions of India, Tectonic domains of Indian subcontinent

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours (One Lecture: one hour)
1	Plate Tectonics & Fundamental Earth process: • Concept and evidence of continental Drift and plate tectonics. • Introduction to lithospheric plates and plate boundaries. • Supercontinent Cycles. • Introduction to Earthquake and earthquake belts, Volcanoes, • Concept of isostasy	5
2	Internal Structure of the Earth: • Different layers of Earth, • Velocity of s- and p-waves through Earth's interior-velocity-depth profile, • Mineralogical and phase change through depth	4

3	The Dynamic Earth: - Continental drift, seafloor spreading, - continental reconstructions, - geologic evidence for continental drift, paleoclimatology, paleontologic evidence for continental drift, - Paleomagnetism - transform faults, concept of mantle plumes and igneous activities.	5
4	The Framework of Plate Tectonics: - Distribution of earthquakes in relation to plate motion, - Relative and absolute plate motions, - Hotspots, direct measurement of relative plate motions, - Finite plate motions, - Stability of triple junctions, present-day triple junctions.	5
5	The Mechanism of Plate Tectonics: - Contracting Earth hypothesis, expanding Earth hypothesis, - Driving mechanisms of plate tectonics, mantle drag mechanism, edge-force mechanism, - Evidence for convection in the mantle, - The mechanism of the supercontinent cycle.	5
6	Distribution of Plates and Indian subcontinent: World Distribution tectonic plates and its significance	2
7	Tectonic regimes of Indian subcontinent: Physiographic divisions of India, Tectonic domains of Indian subcontinent	2

Brief Description of Tutorial/Discussion Activities:

Module No	Topic	No. of Hours
1-3	Plate Tectonics & Fundamental Earth process Internal Structure of the Earth The Dynamic Earth	5
4-5	The Framework of Plate Tectonics The Mechanism of Plate Tectonics	5
6-7	Distribution of Plates and Indian subcontinent	4

Brief Description of Laboratory Activities: Laboratory: in EES 212

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable):

Suggested Readings:

1. Kearey, P., Klepeis, K.A., and Vine F. J., 2009, Global Tectonics (3rd Edition), John Wiley and Sons.
2. Donald, L. G., and Turcotte, S., 2000, Geodynamics (3rd Edition), Cambridge University Press.
3. Fowler, C. M. R., 2005, The Solid Earth: An Introduction to Global Geophysics (2nd Edition), Cambridge University Press

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

Additional Guidelines:
Similarity with the existing courses, if any: Nil
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:

(Prof. Joydip Mukhopadhyay)

(Dr. Azhar M. Shaikh)

(Dr. Tushar M. Chakraborti)

(Dr. Pragnaditya Malakar)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD

For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur**Proposal of a New Course****Department of Earth and Environmental Sciences**

Course Title	FUNDAMENTALS OF CLIMATE AND CONSERVATION SCIENCE				
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course Type (tick (✓) in relevant option)	Core ☒ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	2	1	0	3	
Course Code:	ES204				
Name of faculties who can teach the course:	Dr. Ritika Kaushal, Dr. Pragnaditya Malakar				
Will the course require participation of visiting faculties: Yes					
Prerequisites, if any Course code(s)	No				

Learning Objectives:

- To introduce students to the concepts of climate science and environmental science

Learning Outcome:

After attending the course the students will be able to

- understand the basic principles of climate science
- solve basic numerical with major parameters of atmospheric circulations
- apply principles of conservation science

Course contents:**Module 1: Introduction to Climate Science**

Fundamentals of Global Climate: Sun, Earth, and the Atmosphere: Sun-Earth relationship, solstices and equinoxes, motion of Earth,

Module 2: Atmosphere: Vertical thermal structure of the atmosphere, composition of the atmosphere: dry air, water vapor (Vertical profiles of temperature, wind, pressure, water vapor, and microphysical processes in the atmosphere). Electromagnetic radiation, Atmospheric thermodynamics.

Module 3: Earth's Energy Balance: Earth's energy balance and Natural Climate Variability (El Niño and the Southern Oscillation). Climate System and Interaction among Components: (Atmosphere, oceans, sea ice, and land surface; feedback) mechanisms.

Module 4: Biodiversity and Conservation Biology

Principles of Biodiversity: Definitions, components, and levels of biodiversity; genetic, species, and ecosystem diversity. Threats to Biodiversity: Habitat loss, climate change, invasive species, pollution, overexploitation. Conservation Genetics: Genetic diversity, population genetics, inbreeding depression, genetic drift, gene flow, and conservation implications.

Module 5: Conservation Strategies and Policies Protected Areas and Reserve Design

Types of protected areas, principles of reserve design, zoning, landscape ecology, and corridors. Habitat Restoration and Management: Restoration ecology principles, rewilding, species reintroduction, and ecosystem management approaches. Conservation Policy and Legislation: National and international conservation laws, conventions, treaties, and governance structures.

Module 6: Climate Mitigation and Adaptation

Mitigation Strategies: Renewable energy, carbon sequestration, afforestation, reforestation, and emission reduction technologies. Adaptation Strategies: Ecosystem-based adaptation, community-based adaptation, adaptive management, and resilience building. International Climate Agreements: Paris Agreement, Kyoto Protocol, United Nations Framework Convention on Climate Change (UNFCCC).

Module 7: Interface and Influence of Climate and Conservation

Emerging Issues in Climate Science and Conservation Biology: Intersections of climate change impacts and biodiversity conservation.. Future Directions and Technological Role: Integration of climate and conservation science through modeling, GIS, remote sensing, and citizen science.

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours (One Lecture: one hour)
1	Introduction to Climate Science: • Fundamentals of Global Climate: Sun, Earth, and the Atmosphere • Sun-Earth relationship, • Solstices and equinoxes • Motion of Earth	5
2	Atmosphere: • Vertical thermal structure of the atmosphere, • Composition of the atmosphere: dry air, water vapor (Vertical profiles of temperature, wind, pressure, water vapor, and microphysical processes in the atmosphere). • Electromagnetic radiation, • Atmospheric thermodynamics,	5
3	Earth's Energy Balance: • Earth's energy balance and Natural Climate Variability (El Niño and the Southern Oscillation), • Climate System and Interaction among Components: (Atmosphere, oceans, sea ice, and land surface; feedback) mechanisms,	5
4	Biodiversity and Conservation Biology: • Principles of Biodiversity: Definitions, components, and levels of biodiversity; genetic, species, and ecosystem diversity. • Threats to Biodiversity: Habitat loss, climate change, invasive species, pollution, overexploitation. • Conservation Genetics: Genetic diversity, population genetics, inbreeding depression, genetic drift, gene flow, and conservation implications	5
5	Conservation Strategies and Policies Protected Areas and Reserve Design: • Types of protected areas, principles of reserve design, zoning, landscape ecology, and corridors. • Habitat Restoration and Management: Restoration ecology principles, rewilding, species reintroduction, and ecosystem management approaches. • Conservation Policy and Legislation: National and international conservation laws, conventions, treaties, and governance structures.	3
6	Climate Mitigation and Adaptation: • Mitigation Strategies: Renewable energy, carbon sequestration, afforestation, reforestation, and emission reduction technologies. • Adaptation Strategies: Ecosystem-based adaptation, community-based adaptation, adaptive management, and resilience building. International Climate Agreements: Paris Agreement, Kyoto Protocol, United Nations Framework Convention on Climate Change (UNFCCC).	3

7	Interface and Influence of Climate and Conservation: Emerging Issues in Climate Science and Conservation Biology: Intersections of climate change impacts and biodiversity conservation. Future Directions and Technological Role: Integration of climate and conservation science through modeling, GIS, remote sensing, and citizen science.	2
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Brief Description of Tutorial/Discussion Activities:

Module No	Topic	No. of Hours
1-3	Introduction to Climate Science, Atmosphere, Earth's Energy Balance	5
4	Biodiversity and Conservation Biology	5
5-7	Biodiversity and Conservation Biology	4

Brief Description of Laboratory Activities: Laboratory: None

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable):

Suggested Readings:

1. Principles of Conservation Biology" by Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll
2. Climate Change and Biodiversity" edited by Thomas E. Lovejoy and Lee Hannah
3. Climate Change: A Very Short Introduction" by Mark Maslin
4. Protected Area Governance and Management" edited by Graeme L. Worboys, Michael Lockwood, Ashish Kothari, Sue Feary, and Ian Pulsford
5. Climate Change and Conservation: A Primer for Nature Stewards" by David B. Lindenmayer and Mark A. Burgman
6. Global Warming of 1.5°C" - IPCC Special Report

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):
Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

Additional Guidelines

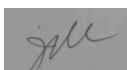
Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

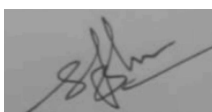
S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:



(Prof. Joydip Mukhopadhyay)



(Dr. Azhar M. Shaikh)



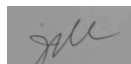
(Dr. Tushar M. Chakraborti)

Pragnaditya Malakar

(Dr. Pragnaditya Malakar)

Recommendation of External experts/Senate members/Subject expert(s)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

 Convener, DUGC	 Convener, DPGC	 FIC/HoD
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For Use of Academic Section

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Indian Institute of Science Education and Research Berhampur
Proposal of a New Course
Department of Earth and Environmental Sciences

Course Title	Geological Maps and Structural Problems				
Course Level (tick (✓) in relevant option)	100 200 ☒ 300 400 ☐ 500 ☐ 600 ☐ 700 ☐	Semester: Odd Even ☒ Either semester ☐			
Course Type (tick (✓) in relevant option)	Core ☒ Professional/Department Elective/Open Elective/Minor/PhD				
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practical (P)	Total Credits	
	0	0	3	1	
Course Code:	ES212				
Name of faculties who can teach the course:	Prof. Joydip Mukhopadhyay, Dr. Azhar M. Shaikh				
Will the course require participation of visiting faculties: Yes					
Prerequisites, if any	No				
Course code(s)					

Course Objective

To introduce the basic methods of interpretation of geometry and interrelation of different rock bodies, as shown in standard geological maps.

Learning Outcomes

Upon successful completion of this course, students will be able to learn:

- The methods of solving problems involving orientation of rock layers.
- The application of such methods in actual situation as seen in the field, and also on maps formed by using the field data.
- How to establish the geometrical order of superposition of different rock bodies.
- To prepare interpretative planar sections of three-dimensional (3-D) structures based on two-dimensional (2-D) geological maps.

	Modules	Details	Class-hours
1	Idea of topographic maps. Notion of scale. Interpretation of topography.	Interpretation of elevation contours Reduction of 3-D topography onto a 2- D map. Contour patterns for peaks, basins, ridges, valleys, salient slopes. Relevance of contour spacing. Types of scales: linear, proportional.	6
2	Graphical solution to orientation problems	Geometric construction on lab- notebook to find out dips, apparent dips of planar surfaces, and plunges, and rakes of lines	12
3	Use of stereographic projections	3-D orientations of planes and lines on 2-D paper using projection nets and tracing papers– projection of lines, planes; measurement of angles between lines, between planes, between lines and planes.	12
4	Interpretation of structures from geological maps.	V-rules. Drawing of strike lines on the map. Measuring vertical thickness, Application of methods in #2 & #3. Construction of topographic profiles, structural cross-sections. Establishing structural successions.	12
total			42 hours

Reference Books

4. Marshak, S and Mitra G. (1988) Basic Methods in Structural Geology, Prentice Hall
5. Lisle, R. J. (2004) Geological Structures and Maps, 3rd ed, Pergamon

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Mid-term written examination: 30% weightage; end-term written examination: 50% weightage; Assignments-Class test-Attendance: 20% weightage.

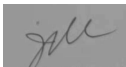
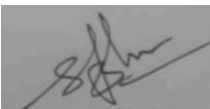
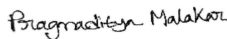
Additional Guidelines

Similarity with the existing courses, if any: Nil

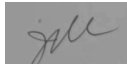
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Name and Signature of course proposers:			
			
(Prof. Joydip Mukhopadhyay)	(Dr. Azhar M. Shaikh)	(Dr. Tushar M. Chakraborti)	(Dr. Pragnaditya Malakar)

The above proposal followed by the recommendations of the External experts/~~Senate members~~/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on 15-4-25. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

		
Convener, DUGC	Convener, DPGC	FIC/HoD

For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	A Potpourri of Mathematics				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☐ Either semester ☐	
Course applicable for	BSMS ☐ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	MS101				
Names of faculties who can teach the course	All faculties of the Department of Mathematical Sciences				
Will the course require participation of visiting faculties: No					
Prerequisites, if any	No				
Learning Objective(s): The aim of this course is to cultivate a strong foundation in basic concepts of mathematics and introduce students to some flavours of mathematics.					
Expected Learning Outcome(s): By the end of this course, the students will have a better understanding of the basics of mathematics and will be able to apply these concepts whenever needed. Also, students will have a good idea about different possibilities offered by mathematics.					
Contents of the course: • Function: injections, surjections, bijections, composition of functions, inverse function, graph of a function. • Countable and uncountable sets: definitions and examples, countability of Q, uncountability of R. • Matrices: definition and examples, determinant, inverse of a matrix and system of linear equations. • Elements of Number Theory: divisibility, prime numbers and their properties, modular arithmetic, Euler totient functions, RSA cryptosystem. • Graph Theory: definition, isomorphisms, connectivity, trees, Eulerian graphs, Applications of graph theory, statement of four color theorem. • Geometry: Parametrization of a curve, planar symmetry.					
Lecture Outline: (Not more than 6 lectures per module)					

Module No	Topic	No. of Hours
1	Function: injections, surjections, bijections, composition of functions, inverse function, graph of a function.	4
2	Countable and uncountable sets: definitions and examples,	3
3	Countability of $\mathbb{Q}$, uncountability of $\mathbb{R}$	3
4	Matrices: definition and examples, determinant,	5
5	Inverse of a matrix and system of linear equations	5
6	Elements of Number Theory: divisibility, Prime numbers and their properties, Modular arithmetic,	4
7	Euler totient functions, sigma functions, Mobius function and their properties	3
8	Euler's Theorem, Fermat's little theorem as a corollary of Euler's theorem. RSA cryptosystem	5
9	Graph Theory: definition, isomorphisms, connectivity, trees, Eulerian graphs,	4
10	Applications of graph theory, statement of four color theorem.	2
11	Geometry: Parametrization of a curve, planer symmetry	4
	Total Lecture Hours	42 (Including 6 h discussion sessions)

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- Kenneth H. Rosen, Discrete Math and its Applications, McGraw Hill, 8th Edition, 2021.
- R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 4th Edition, 2011.

- David Burton, Elementary Number Theory and Applications, McGraw Hill, 2023.
- Rafael Pass, Wei-Lung Dustin Tseng, A Course in Discrete Structures (Lecture Notes).
- Tom M. Apostol, Calculus (Volume I), Willey, 2nd Edition, 2022.
- Ali Grami, Discrete Mathematics Essential and Applications, Academic Press, 1st Edition, 2022.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): Evaluation will be as per the BS-MS manual, the instructor should declare all the details in the first lecture.

Additional Guidelines:

Name and Signature of course proposer(s):

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and

Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	Calculus Of One Variable				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	MS102				
Names of faculties who can teach the course	All faculties of the Department of Mathematical Sciences				
Will the course require participation of visiting faculties: No					
Prerequisites, if any Course code(s)	MS101				
Learning Objective(s): This is a core mathematics course for second semester BS-MS students. The aim of this course is to introduce students to the concepts of limit, continuity, differentiation and integration, and their applications in various fields.					
Expected Learning Outcome(s): The students will be able to understand the concepts of continuity, differentiation and integration. They will be able to apply the learned concepts in the other branches of sciences when it is required.					
Contents of the course: ● Sequence and series of real and complex numbers. ● Real number system, limit superior, limit inferior, supremum principle, limits and continuity, definitions, continuity and discontinuity of a function at a point, left and right continuity, examples of continuous and discontinuous functions, intermediate value theorem. (If time permits: boundedness of a continuous function on a closed interval.) ● Differentiation: definition and basic properties, Rolle's theorem, mean value theorem, Leibnitz's theorem on successive differentiation, Taylor's theorem. ● Integration: Riemann integral viewed as an area, partitions, upper and lower integrals, existence of the Riemann integral, basic properties, fundamental theorem of integral calculus, integration by parts.					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Sequence of real and complex numbers	3
2	Series of real and complex numbers	3
3	Real number system, limit superior, limit inferior, supremum principle	5
4	Limits and continuity, definitions, continuity and discontinuity of a function at a point, left and right continuity,	5
5	Examples of continuous and discontinuous functions, intermediate value theorem. (If time permits: boundedness of a continuous function on a closed interval.)	4
6	Differentiation: definition and basic properties,	4
7	Rolle's theorem, mean value theorem, applications	5
8	Leibnitz's theorem on successive differentiation, Taylor's theorem	4
9	Integration: Riemann integral viewed as an area, partitions, upper and lower integrals,	3
10	Existence of the Riemann integral, basic properties	3
11	Fundamental theorem of integral calculus, integration by parts.	3
	Total Lecture Hours	42 (Including 6 h discussion sessions)

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.)

- G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, 9th Edition, Indian student edition, Addison-Wesley, 1998.
- T. M. Apostol, Calculus (Volumes I and II), 2nd Edition, Wiley Eastern, 1980.
- R. Courant, F. John, Introduction to Calculus and Analysis (Volume I), Classics in Mathematics, Springer, 1989.
- Terrence Tao, Analysis I, 4th Edition, Hindustan Book Agency, 2022.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): Evaluation will be as per the BS-MS manual, the instructor should declare all the details in the first lecture.

Additional Guidelines:

Among the 42 lecture hours, the instructor may have a discussion session after every 5-6 lecture hours.

Name and Signature of course proposer(s):

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	Writing Mathematics				
Course Level (tick (√) in the relevant option)	100 ☐ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (√) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	1	0	0	1	
Course Code:	MS103				
Names of faculties who can teach the course	All faculties of the Department of Mathematical Sciences				
Will the course require participation of visiting faculties: No					
Prerequisites, if any					
Course code(s)					
Learning Objective(s): The aim of this course is to make students able to communicate mathematical ideas in writing and to revise the basics of Mathematics. This will also serve as a bridge course for people with non-mathematical backgrounds.					
Expected Learning Outcome(s): By the end of this course, the students will be able to analyze and construct valid mathematical arguments using set theory, relations, functions, and various methods of proof.					
Contents of the course: • Mathematical statements and their validity. • Set: union and intersection of sets, distributive laws, De Morgan's Law, finite and infinite sets. • Relation: equivalence relation and equivalence classes. • Function: injections, surjections, bijections, composition of functions. • Logical Notations and method of Mathematical Proofs: Negation, Mathematical induction, construction, contradiction, contrapositive. • Pigeonhole principle for finite sets, squaring a circle, • Understanding infinity (Hilbert Hotel), some paradoxes.					
Lecture Outline: (Not more than 6 lectures per module) NA					
Module No	Topic			No. of Hours	
1	Set: union and intersection of sets, distributive laws, De Morgan's Law, finite and infinite sets			2	
2	Relation: equivalence relation and equivalence classes			2	

3	Function: injections, surjections, bijections, composition of functions	2
4	Logical Notations and method of Mathematical Proofs: Negation, Mathematical induction	2
5	Proof by construction, contradiction, contrapositive.	2
6	Pigeonhole principle for finite sets, squaring a circle,	2
7	Understanding infinity (Hilbert Hotel), some paradoxes	2
	Total Lecture Hours	14

Brief Description of Tutorial Activities:

[illegible]

Brief Description of Laboratory Activities:

Brief Description of Laboratory Activities:		
Experiment No:	Topic	No. of Hours
	Total Lab Hours	

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- Kenneth H. Rosen, Discrete Math and its Applications, 8th Edition, McGraw Hill, 2021.
- J.P. D'Angelo and D.B. West, Mathematical Thinking: Problem-Solving and Proofs, 2nd Edition, Pearson Publisher, 2019.
- M. Aigner and G. M. Ziegler, Proofs from THE BOOK, 6th Edition, Springer, 2018.
- Gary Chartrand, Albert D. Polimeni and Ping Zhang, Mathematical Proofs, 4th Edition, Pearson Publications, 2023.
- K. B. Sinha et al, Understanding Mathematics, University Press, 2003.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): There will be tests during mid semester and end semester examinations.

Additional Guidelines: This is mostly an interactive course in nature. The instructors are suggested to teach this course with this spirit.

Name and Signature of course proposer(s):

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	Linear Algebra				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	1	0	4	
Course Code:	MS201				
Names of faculties who can teach the course	All faculties of the Department of Mathematical Sciences				
Will the course require participation of visiting faculties: No					
Prerequisites, if any Course code(s)	MS101				
Learning Objective(s): The goal of this core course is to introduce the notion of abstract vector space in the end beginning with the addition of vectors in higher dimensional Euclidean Spaces. The course also illustrates the connection between the study of matrices and vector spaces throughout and explores the solutions of systems of linear equations.					
Expected Learning Outcome(s): At the end of this course, the students will be able to solve system of linear equations through matrices. they will be able to use the eigenvalues and eigenvectors in diverse areas of mathematics.					
Contents of the course: • Review of complex numbers • Matrices, matrix operations, special matrices (diagonal, triangular, symmetric, skew-symmetric, orthogonal, hermitian, skew hermitian, unitary, normal), • Vectors in R^n and C^n, matrix equation $Ax = b$, row-reduced echelon form, row space, column space, and rank of a matrix. • Determinants, systems of linear equations • Vector space R^n, linear independence and dependence, linear span, linear subspaces, bases and dimensions • Linear transformations, matrix of a linear transformation, rank-nullity theorem, Inner product spaces, orthonormal bases, Gram-Schmidt orthogonalization, projections • Eigenvalues and eigenvectors of a linear operator, characteristic polynomial, diagonalizability of a linear operator, eigenvalues of the special matrices stated above,					

- Spectral theorem for real symmetric matrices and its application to quadratic forms, positive definite matrices.

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Review of complex numbers, Matrices, matrix operations,	3
2	Special matrices (diagonal, triangular, symmetric, skew-symmetric, orthogonal, hermitian, skew hermitian, unitary, normal),	3
3	Vectors in R^n and C^n , matrix equation $Ax = b$, row-reduced echelon form, row space, column space, and rank of a matrix.	5
4	Determinants, systems of linear equations	3
5	Vector space R^n , linear independence and dependence, linear span, linear subspaces, bases and dimensions	5
6	Linear transformations, matrix of a linear transformation, rank-nullity theorem,	5
7	Inner product spaces, orthonormal bases, Gram-Schmidt orthogonalization, projections	5
8	Eigenvalues and eigenvectors of a linear operator, characteristic polynomial,	5
9	Diagonalizability of a linear operator, eigenvalues of the special matrices stated above,	4
10	Spectral theorem for real symmetric matrices and its application to quadratic forms, positive definite matrices.	4
	Total Lecture Hours	42

Brief Description of Tutorial Activities:

Module No	Topic	No. of Hours
1	Matrices, matrix equation, echelon forms, Determinants, system of linear equations	5
2	Vector space R^n , Linear transformations, Rank-nullity theorem	5
3	Eigenvalues and eigenvectors, Spectral theorem	4
	Total Tutorial Hours	14

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- T. M. Apostol, Calculus, Volume 2, 2nd edition, Wiley Eastern, 1980.
- H. Anton, Elementary linear algebra and applications, 8th edition, John Wiley, 1995.
- G. Strang, Linear algebra and its applications, 4th edition, Thomson, 2006.
- S. Kumaresan, Linear algebra - A Geometric Approach, Prentice Hall of India, 2000.
- R. Rao and P. Bhimasankaram, Linear Algebra, 2nd edition, Hindustan Book Agency, 2020.
- M. Artin, Algebra, Prentice-Hall of India, 1994.
- R. Bapat, Linear Algebra and Linear Models, HBA, 1999.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): Evaluation will be as per the BS-MS manual, the instructor should declare all the details in the first lecture.

Additional Guidelines:

Name and Signature of course proposer(s):

Similarity with the existing courses, if any:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	Mathematical Methods	Not Available	Vector space with examples, Matrices, Eigenvalues and Eigenvectors, Transformation of matrices, Diagonalization of matrices	<10
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	Groups And Symmetry				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	MS202				
Names of faculties who can teach the course	All faculties of the Department of Mathematical Sciences				
Will the course require participation of visiting faculties: No					
Prerequisites, if any Course code(s)	MS101				
Learning Objective(s): The aim of this course is to introduce the symmetries around and how these symmetries form a fundamental object in abstract algebra named groups.					
Expected Learning Outcome(s): After successful completion of the course, the students will develop understanding in mathematics through group theory. They will be able to use properties of groups in other areas of mathematics.					
Contents of the course: • Basic operations, row reduction, determinant and trace, Cramer's rule. • Basic notions of groups, permutation groups. • Group actions, prime-power groups. • Finite Abelian groups. • Matrix groups, SO(3) and rotations. • Groups of symmetries of real plane and Platonic solids. • Vector spaces and linear transformations, eigenvalues and eigenvectors, diagonalization. • Application of Group Theory (Fermat's Little Theorem, Euler's Theorem).					
Lecture Outline: (Not more than 6 lectures per module)					
Module No		Topic			No. of Hours

1	Basic operations, row reduction, determinant and trace, Cramer's rule.	5
2	Basic notions of groups, permutation groups.	5
3	Group actions, prime-power groups.	5
4	Finite Abelian groups.	5
5	Matrix groups, $SO(3)$ and rotations.	5
6	Groups of symmetries of real plane and Platonic solids.	5
7	Vector spaces and linear transformations,	4
8	Eigenvalues and eigenvectors, diagonalization.	3
9	Application of Group Theory (Fermat's Little Theorem, Euler's Theorem)	5
Total Lecture Hours		42 (Including 6 h of discussion sessions)

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- M. A. Armstrong, Groups and Symmetry, Springer, 1988.
- M. Artin, Algebra, Prentice-Hall of India, New Delhi, 1994.
- I. S. Luthar and I. B. S. Passi, Algebra Vol. I, Narosa Publishing House, 1996.
- J. A. Gallian, Contemporary Abstract Algebra, D. C. Heath Canada, 1986.
- Kristopher Tapp, Symmetry: A Mathematical Exploration, Springer, 2011.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): Evaluation will be as per the BS-MS manual, the instructor should declare all the details in the first lecture.

Additional Guidelines:

Among the 42 lecture hours, the instructor may have a discussion session after every 5-6 lecture hours.

Name and Signature of course proposer(s):

Similarity with the existing courses, if any: 10%

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	Mathematical Methods I	PS203	Introduction to Groups, Finite Groups, Permutation Groups,	10%
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	Introduction to Probability and Statistics				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	MS203				
Names of faculties who can teach the course	Senthil Raani K S, R Sengupta				
Will the course require participation of visiting faculties: Yes					
Prerequisites, if any	MS101 and MS102				
Learning Objective(s): This is an introductory course of Probability and Statistics. Various tools and techniques pertaining to this area will be introduced, mostly from a frequency-based point of view though with a little bit of continuous variable probability distribution.					
Expected Learning Outcome(s): On successful completion of this course, a student will be able to undertake the following works: a) Understand the concept of the subject. b) Use the tools in practical applications, in particular for non-mathematical subjects. c) Because of the combination of statistics with the program R he/she will understand the assumptions and limitations of the standard Excel program used universally and mostly without any knowledge of the underlying assumptions.					
Contents of the course: • Definitions of statistics. Collection and presentation of data. Frequency distribution. Measures of central tendency. Measures of dispersions. • Elementary probability theory. Theorems of probability of events. Limitations of frequency based approach (not rigorous). Axiomatic definition of probability. Conditional probability. Random variables and expectations and variance. Joint distributions of two random variables. Probability inequalities (Markov, Chebyshev, and its applications. Law of large numbers. • Univariate theoretical distributions. Probability mass and probability density functions. Uniform, Bernoulli, binomial, Poisson distribution for discrete distributions and uniform, exponential, and Gaussian distribution for continuous cases. Moments of the same. • Bivariate frequency distributions. More on stochastic independence. Correlation and regression line.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No	Topic			No. of Hours	

1	What is statistics, historical note, Data – Primary and secondary, collection and scrutiny of data. Diagrammatic presentation of data.	1
2	Summarisation of data, attributes and variables. Frequency distribution of attributes. Graphical representation of frequency distributions, frequency curve.	1
3	Meaning of dispersion, range, mean deviation standard deviation. Quartile deviation, measures of relative dispersions, curve of concentration, moments	3
4	Meaning of probability, Theorems of probability of events. Combinatorial method, along with examples.	3
5	Limitations of frequency based approach (not rigorous). Axiomatic definition of probability. Conditional probability, Bayes theorem	5
6	Random variables and expectations and variance. Uniform, Bernoulli, binomial, Poisson distribution and moments.	4
7	Probability inequalities (Markov, Chebyshev, and its applications. Weak law of large numbers. Extensive exercises.	5
8	Univariate theoretical distributions. Probability mass and probability density functions.	4
9	Uniform, exponential, and Gaussian distribution for continuous cases. Moments of the same.	4
10	Joint distributions of two random variables. Covariance and correlation. Bivariate frequency distributions. More on stochastic independence. Extensive exercises.	5
11	Correlation and regression line.	2
12	Programming in R	5
	Total Lecture Hours	42 (Including 6 h of discussion sessions)

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Siva Athreya, Deepayan Sarkar, and Steve Tanner-Probability and Statistics with Examples using R, 2024 (available in <https://psweur.github.io/>)

2. Alan Agresti, Christine A. Franklin, Bernhard Klingenberg- Statistics: The Art and Science of Learning from Data, 5th Edition, 2022.
3. Allen Craig, Robert V Hogg, Joseph W McKean- Introduction To Mathematical Statistics, Pearson, 8th Edition, 2021.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): Same as in the BS-MS manual. A short portion on R will be initially taught by a guest faculty, until the department members take the full responsibility of the course.

Additional Guidelines:

Among the 42 lecture hours, the instructor may have a discussion session after every 5-6 lecture hours.

Name and Signature of course proposer(s):

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and

Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Mathematical Sciences

Course Title	Multivariable Calculus				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ Professional (Department) Core ☒ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	1		4	
Course Code:	MS204				
Names of faculties who can teach the course	All faculties of the Department of Mathematical Sciences				
Will the course require participation of visiting faculties: No					
Prerequisites, if any Course code(s)	MS102				
Learning Objective(s): The aim of this course is to generalize the basic concepts of Calculus of one variable to R^2 and R^3 .					
Expected Learning Outcome(s): After successful completion of the course, the students will know about the notion of continuity, differentiation and integration in R^2 and R^3 . They will learn Green's Theorem, Divergence Theorem and Stoke's Theorem and will be able to apply them in different contexts.					
Contents of the course: • Vectors in R^2 and R^3, dot product of vectors, length of a vector, orthogonality of vectors, cross product of vectors • Lines, planes, and quadric surfaces • Continuity and differentiability of vector-valued functions, tangent vectors • Functions of two or more variables, limits and continuity, partial derivatives, gradient, directional derivatives, maxima, minima and saddle points, Lagrange multipliers • Double and triple integrals, change of coordinates, vector fields, line integrals, surface integrals, Green's theorem, Divergence theorem, Stokes' theorem • First order ordinary differential equations: variables separable, homogeneous, linear and exact equations, Method of variation of parameter.					
Lecture Outline: (Not more than 6 lectures per module)					
Module No	Topic			No. of Hours	
1	Vectors in R^2 and R^3 , dot product of vectors, length of a vector, orthogonality of vectors, cross product of vectors			3	
2	Lines, planes, and quadric surfaces			2	

3	Continuity and differentiability of vector-valued functions, tangent vectors	4
4	Functions of two or more variables, limits and continuity, partial derivatives	6
5	Gradient, directional derivatives, maxima, minima and saddle points, Lagrange multipliers	6
6	Double and triple integrals, change of coordinates, vector fields, line integrals	6
7	Surface integrals, Green's theorem, Divergence theorem, Stokes' theorem	5
8	First order ordinary differential equations: Formation of ODE, Separation of variables, Homogeneous differential equations,	5
9	Linear and exact equations, Method of variation of parameter.	5
	Total Lecture Hours	42

Brief Description of Tutorial Activities:

Module No	Topic	No. of Hours
1	Dot product and cross product, lines, planes and quadric surfaces, Continuity	3
2	Differentiability, Partial derivatives, maxima and minima, Double and Triple integrals	4
3	Green's theorem, Divergence Theorem, Stoke's Theorem	3
4	Ordinary Differential Equations	4
		14
	Total Tutorial Hours	

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- G. B. Thomas and R. L. Finney, *Calculus and Analytic Geometry*, Addison-Wesley, 9th edition, 1998.
- T. M. Apostol, *Calculus*, Volumes 1 and 2, Wiley Eastern, 2nd edition, 1980.
- J. E. Marsden and A. Tromba, *Vector Calculus*, W.H. Freeman & Company, 2004.
- R. Courant, F. John, *Introduction to Calculus and Analysis*, Vol. 2, Classics in Mathematics, Springer, 1989.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual): Evaluation will be as per the BS-MS manual, the instructor should declare all the details in the first lecture.
Additional Guidelines: Among the 42 lecture hours, the instructor may have a discussion session after every 5-6 lecture hours.

Name and Signature of course proposer(s):
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Similarity with the existing courses, if any: <10%

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	Mathematical Methods	Not Available	Ordinary differential equations (with constant coefficients)	<10
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____.

committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Fundamentals of Physics I				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	PS101				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): To introduce students to some of the fundamental concepts of physics, including the basics of classical mechanics, general properties of matter, special theory of relativity and heat and thermodynamics.					
Expected Learning Outcome(s): On successful completion of this course, students 1) will gain knowledge about the basics of classical mechanics, small oscillations, general properties of matter, special theory of relativity and heat and thermodynamics 2) will be able to solve basic problems on the above topics					
Contents of the course: Mechanics: i) Introduction to mechanics: Newton's laws of motion, momentum, momentum of system of particles, frames of reference, conservation laws, collisions, center of mass - approximately 5 lecture hours ii) Rigid body motion: Rigid body, moment of inertia, rigid body Kinematics, rigid body kinetics, motion of gyroscope - approximately 6 lecture hours iii) Non Inertial Frame: Physics in the rotating coordinate system, fictitious force, central force and motion of planets and satellites - approximately 6 lecture hours Small oscillations: approximately 3 lecture hours Properties of matter: Elasticity, stress, strain, Young's modulus - approximately 4 lecture hours Heat and Thermodynamics:, Concepts of heat flow, entropy, enthalpy, specific heat, Carnot engine, laws of thermodynamics, kinetic theory of gas - approximately 6 lecture hours Special theory of relativity: Axioms of relativity, Lorentz transformation, length contraction, time dilation, relativistic mass energy, Doppler effect - approximately 6 lecture hours Problem solving and discussions: approximately 6 lecture hours					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Mechanics: Introduction to mechanics - Newton's laws of motion, momentum, momentum of system of particles	1
2	Mechanics: Introduction to mechanics - frames of reference, conservation laws	2
3	Mechanics: Introduction to mechanics - collisions, center of mass	2
4	Mechanics: Rigid body motion - Rigid body, moment of inertia	2
5	Problem solving and discussions	1
6	Mechanics: Rigid body motion - Rigid body Kinematics, rigid body kinetics, motion of gyroscope	4
7	Non Inertial Frame: Physics in the rotating coordinate system, fictitious force, central force and motion of planets and satellites	3
8	Non Inertial Frame: Central force and motion of planets and satellites	3
9	Problem solving and discussions	1
8	Small oscillations	3
10	Properties of matter	4
11	Problem solving and discussions	1
12	Heat and Thermodynamics: Concepts of heat flow, entropy, enthalpy, specific heat	2
13	Heat and Thermodynamics: Carnot engine, laws of thermodynamics	2
14	Heat and Thermodynamics: Kinetic theory of gas	2
15	Problem solving and discussions	1
16	Special theory of relativity: Axioms of relativity, Lorentz transformation	2
17	Special theory of relativity: Length contraction, time dilation	2
18	Special theory of relativity: Relativistic mass energy, Doppler effect	2
19	Problem solving and discussions	2

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Klepner D. and Kolenkow R., An Introduction to Mechanics (McGraw Hill Education, 2017)
2. Zemansky M. and Dittman R. H., Heat and Thermodynamics (McGraw Hill Education, 2017)
3. Verma H.C., Concept of Physics 1 (Bharati Bhawan, 2025)

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Additional Guidelines:

The number of hours per module given above is approximate.

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	Physical Chemistry I	CH206	Heat and Thermodynamics	14%
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Fundamentals of Physics II				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	PS102				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): The course aims to give the students an overview of the basics of some of the modern advancements in physics.					
Expected Learning Outcome(s): On successful completion of this course, students 1) will gain knowledge about the basics of quantum mechanics, statistical mechanics and nuclear physics 2) will be able to solve basic problems on the above topics					
Contents of the course: Notable experiments on quantum physics: Double-slit experiment, Frank Hertz Experiment, Stern Gerlach experiment - approximately 2 lecture hours Discrete spectra and Bohr model: Review of Bohr atom model, its successes and failures - approximately 4 lecture hours Particle properties of waves: light and waves, black body radiation, photoelectric effect, Compton effect, X-ray diffraction, pair production - approximately 6 lecture hours Wave properties of particles: de Broglie wavelength, wave particle duality, phase and group velocities, particle/electron diffraction – approximately 6 lecture hours Quantum states and dynamics of particles: Superposition, uncertainty principle, Schrödinger equation, introduction to operators - approximately 4 lecture hours Physical properties of particles in potentials (without derivation): particle in a box, finite well potential, tunnelling, hydrogen atom - approximately 5 lecture hours Statistics of particles: distinguishable and indistinguishable particles, Boltzmann statistics, Fermi Dirac statistics, Bosonic statistics - approximately 4 lecture hours Nuclear physics: radioactivity, fusion, fission, introduction to nuclear shell model - approximately 5 lecture hours					

Problem solving and discussions: approximately 6 lecture hours

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Notable experiments on quantum physics: Double-slit experiment, Frank Hertz Experiment, Stern Gerlach experiment	2
2	Discrete spectra and Bohr model: Review of Bohr atom model, its successes and failures	4
3	Problem solving and discussions	1
4	Particle properties of waves: light and waves, black body radiation	2
5	Particle properties of waves: photoelectric effect, Compton effect, X-ray diffraction, pair production	4
6	Wave properties of particles: de Broglie wavelength, wave particle duality	2
7	Wave properties of particles: Phase and group velocities, particle/electron diffraction	3
8	Problem solving and discussions	1
9	Quantum states and dynamics of particles	4
10	Physical properties of particles in potentials: particle in a box, finite well potential, tunnelling	3
11	Physical properties of particles in potentials: Hydrogen atom	2
12	Problem solving and discussions	1
13	Statistics of particles: Distinguishable and indistinguishable particles, Boltzmann statistics	2
14	Statistics of particles: Fermi Dirac statistics, Bosonic statistics	3
15	Problem solving and discussions	1
16	Nuclear physics: radioactivity, fusion, fission	3
17	Nuclear physics: Introduction to nuclear shell model	2
18	Problem solving and discussions	2
total		42 hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Beiser A., Concept of Modern Physics (McGraw Hill Education, 2009)
2. Verma H. C., Quantum Physics (Surya Publications, 2022)
3. Feynman R. P., Leighton R. B. and Sands M., The Feynman Lecture on Physics, Vol 3 (Pearson Education, 2012)
4. Mani H. S. and Mehta G. K., Introduction to Modern Physics (Affiliated East-West Press, 1990)

5. Halliday D., Resnick R. and Walker J., Principles of Physics (Wiley, 2020)

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

30 - 40 % for the mid semester examination, 50 - 60 % for the end semester examination and 0 - 20% for other components, viz. quizzes, assignments and attendance

Additional Guidelines:

1. The number of hours per module given above is approximate.
2. The instructor may need give rigorous derivations of the results introduced in this course

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Coordinator/Dean, Academic Affairs

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Physics Laboratory I				
Course Level (tick (✓) in the relevant option)	100 ☒ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course Code:	PS104				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): 1. To introduce students to fundamental experiments in classical and modern physics. 2. To develop practical skills in experimental physics, including measurement techniques, data acquisition, data analysis, and error estimation. 3. To cultivate scientific reasoning and enhance the ability to relate physical models to experimental observations. 4. To familiarize students with laboratory equipment and protocols for safe and accurate experimentation.					
Expected Learning Outcome(s): On successful completion of this course, students will be able to: 1. Demonstrate understanding of key physics concepts in classical and modern physics 2. Gain knowledge about collecting data in experiments 3. Analyze physical phenomena through graphical representation and quantitative evaluation, including fitting curves to extract physical constants. 4. Interpret experimental data and compare with theoretical predictions, identifying possible sources of systematic and random errors. 5. Communicate experimental findings effectively through clear, structured, and concise lab reports.					
Contents of the course: 1) Introduction to the theoretical aspects of the experiments 2) Introduction to basic experimental apparatus, error analysis, plotting and linear regression 3) Measurement of the moment of inertia of a flywheel using a gyroscope 4) Determination of acceleration due to gravity using a bar pendulum 5) Determination of acceleration due to gravity by free fall 6) Measurement of Young's Modulus of the material of a bar using uniform and non uniform bending using pin and microscope method. 7) Investigation of free, forced and chaotic oscillations with various degrees of damping by using Pohl's Pendulum 8) To study the dependence of moment of force as a function of position vector, force and angle between the position vector and force 9) Measurement of the specific heat of a solid 10) Measurement of Planck's constant and workfunction by photoelectric effect. 11) Measurement of the grating constant of a grating by using a spectrometer 12) To study thermoelectric effect and to measure Seebeck and Peltier coefficient.					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours
1	Introduction to the theoretical aspects of the experiments	3
2	Introduction to basic experimental apparatus, error analysis, plotting and linear regression	3
3	Measurement of the moment of inertia of a flywheel using a gyroscope	3
4	Determination of acceleration due to gravity by using a bar pendulum	3
5	Determination of acceleration due to gravity by free fall	3
6	Measurement of Young's Modulus of the material (Steel/Plastic/Aluminium) of a bar using uniform and non uniform bending using pin and microscope method.	3
7	Investigation of free, forced and chaotic oscillations with various degrees of damping by using Pohl's Pendulum	3
8	To study the dependence of moment of force as a function of position vector, force and angle between the position vector and force	3
9	Measurement of the specific heat of a solid	3
10	Measurement of Planck's constant and workfunction by photoelectric effect.	3
11	Measurement of the grating constant of a grating by using a spectrometer	3
12	To Study thermoelectric effect and to measure Seebeck and Peltier Coefficient.	3
13	Open Lab	3
14	End semester examination	3

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

Laboratory Manual

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Suggested structure - Laboratory record book + continuous evaluation: 60%, Quiz / viva / lab exam: 40%

Additional Guidelines:

NA

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil**(Similarity content is declared as per the number of lecture hours on similar topics)**

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:**Recommendation of External experts/Senate members/Subject expert(s)**

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
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Recommended / Not Recommended for the approval/ratification by the Senate

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Classical Mechanics				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	PS201				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): The course aims to teach advanced concepts of mechanics. It gives an in-depth understanding of Lagrangian and Hamiltonian mechanics, conservation principles, oscillations and waves, gravitation, central force, scattering, rigid body etc.					
Expected Learning Outcome(s): On successful completion of the course a student will gain skills in using Lagrangian and Hamiltonian formalism for solving problems in classical mechanics. The tools learnt in this course will be extremely useful to understand wide branches of physics including quantum mechanics, condensed matter, high energy physics and cosmology.					
Contents of the course: Review of Newtonian mechanics - approximately 2 lecture hours Lagrangian mechanics Part I: Principle of least action, generalized coordinates, calculus of variations, constraints - approximately 4 lecture hours Lagrangian mechanics Part II: Principle of virtual work, Lagrange's equation - approximately 3 lecture hours Symmetry: symmetry principles, Noether theorem - approximately 3 lecture hours Central force motion: central forces, planetary motions, Kepler's laws - approximately 4 lecture hours Collisions: collisions, scattering - approximately 3 lecture hours Oscillations: small oscillations, normal modes, forced oscillators, anharmonic oscillators - approximately 4 lecture hours Perturbation theory - approximately 3 lecture hours Rigid body dynamics: motion of a top - approximately 3 lecture hours Hamiltonian mechanics Part I: Hamilton's equations, phase space & phase trajectories, canonical transformations - approximately 4 lecture hours Hamiltonian mechanics Part II: Poisson brackets, Hamilton- Jacobi theory - approximately 3 lecture hours Problem solving and discussion - approximately 6 lecture hours					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Review of Newtonian mechanics	2
2	Lagrangian mechanics Part I: Principle of least action, generalized coordinates, calculus of variations, constraints	4
3	Lagrangian mechanics Part II: Principle of virtual work, Lagrange's equation	3
4	Problem solving and discussions	1
5	Symmetry: symmetry principles, Noether theorem	3
6	Central force motion: central forces, planetary motions, Kepler's laws	4
7	Problem solving and discussions	1
8	Collisions: collisions, scattering	3
9	Oscillations: small oscillations, normal modes, forced oscillators, anharmonic oscillators	4
10	Problem solving and discussions	1
11	Perturbation theory	3
12	Rigid body dynamics: motion of a top	3
13	Problem solving and discussions	1
14	Hamiltonian mechanics Part I: Hamilton's equations, phase space & phase trajectories, canonical transformations	4
15	Hamiltonian mechanics Part II: Poisson brackets, Hamilton- Jacobi theory	3
16	Problem solving and discussions	2
Total		42 hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Goldstein H., Classical Mechanics (Pearson Education, 2011)
2. Landau L. D. and Lifshitz E. M., Mechanics (Course of Theoretical Physics) (Butterworth-Heinemann, 1982)
3. Rana N. C and Joag Joag P. S., Classical Mechanics (McGraw Hill Education, 2017)
4. Morin D., Introduction to Classical Mechanics (Cambridge University Press, 2007).

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Additional Guidelines:

The number of hours per module given above is approximate.

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	

Director/Chairperson Senate

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Quantum Mechanics I				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	PS202				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): The course will lay down foundations of quantum mechanics via wave-particle duality, uncertainty principle and Schrodinger's equation. Operator formalism will be developed and applied to various problems in one-dimensional potential and central potential. Particularly, hydrogen atom problem and angular momentum algebra will be discussed in detail.					
Expected Learning Outcome(s): It is expected that at the end of the course a student will 1) have an in-depth understanding of the basics of quantum mechanics, 2) will be able to use operator formalism to analyze different problems in quantum mechanics 3) will be able to solve problems involving quantum particles in simple forms of potentials 4) will gain knowledge about dynamics of charged particles in magnetic fields, in the quantum regime					
Contents of the course: Basics of quantum mechanics: Postulates of Quantum Mechanics, Schrodinger equation. Uncertainty Principle; Probability interpretation, probability current, continuity equation - 6 lecture hours Operator Formalism Part I: Hilbert spaces, Expectation values of dynamical variables. Introduction to Dirac's notation, Hermitian and Unitary operators - 4 lecture hours Operator Formalism Part II: Eigenvalues; Simultaneous eigenstates of commuting operators, Classical limit, Ehrenfest's theorem - 3 lecture hours One Dimensional Problems Part I: Harmonic Oscillator, creation and annihilation operators; brief descriptions of potential step, barrier and well, ideas of tunneling - 5 lecture hours One Dimensional Problems Part II: Bound states, scattering states and resonances; Dirac-delta potential - 3 lecture hours Theory of Angular Momentum: Orbital angular momentum and eigenvalue problem; spherical harmonics, Spin angular momentum, addition of angular momentum - 5 lecture hours Three dimensional problems: 3D problems in Cartesian coordinates, free particle, box potential; 3D problems in spherical coordinates; central potential; free particle in spherical coordinates; bound states in three dimensions; hydrogen atom - 6 lecture hours Charged particle in magnetic field: Gauge invariance of Schrodinger equation; Larmor frequency; Brief discussions on normal and anomalous Zeeman effect, Landau levels - 4 lecture hours Problem solving and discussions - 6 lecture hours					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1.	Basics of quantum mechanics: Postulates of Quantum Mechanics, Schroedinger equation. uncertainty Principle	4
2.	Basics of quantum mechanics: Probability interpretation, probability current, continuity equation	2
3.	Problem solving and discussions	1
4.	Operator Formalism Part I: Hilbert spaces, Expectation values of dynamical variables	2
5..	Introduction to Dirac's notation, Hermitian and Unitary operators	2
6.	Problem solving and discussions	1
7.	Operator Formalism Part II: Eigenvalues; Simultaneous eigenstates of commuting operators, classical limit, Ehrenfest's theorem	3
8.	One Dimensional Problems Part I: Harmonic Oscillator, creation and annihilation operators;	3
9.	One Dimensional Problems Part I: Brief descriptions of potential step, barrier and well, ideas of tunneling	2
10.	Problem solving and discussions	1
11.	One Dimensional Problems Part II: Bound states, scattering states and resonances, Dirac-delta potential	3
12.	Theory of Angular Momentum: Orbital angular momentum and eigenvalue problem; spherical harmonics	3
13.	Theory of Angular Momentum: Spin angular momentum, addition of angular momentum	2
14.	Problem solving and discussions	1
15.	Three dimensional problems: 3D problems in Cartesian coordinates, free particle, box potential; 3D problems in spherical coordinates; central potential	3
16.	Three dimensional problems: Free particle in spherical coordinates; bound states in three dimensions; hydrogen atom	3
17.	Problem solving and discussions	1
18.	Charged particle in magnetic field: Gauge invariance of Schroedinger equation; Larmor frequency, brief discussions on normal and anomalous Zeeman effect, Landau levels	4
19.	Problem solving and discussions	1
total		42 hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Verma H. C., Quantum Physics (TBS, 2012)
2. Sakurai J. J. and Napolitano J., Modern Quantum Mechanics (Cambridge University Press, 2020)

3. Bransden B. H. and Joachain C. J., Quantum Mechanics (Pearson, 2020)
4. Cohen-Tannoudji C., Quantum Mechanics, (Vol I and II) (John Wiley and Sons, 1977)
5. Shankar R., Principles of Quantum Mechanics (Springer, 2014)
6. Merzbacher E. Quantum Mechanics (Wiley, 1998)
7. Griffiths D. J., Introduction to Quantum Mechanics (Cambridge University Press, 2024)
8. Zettili N., Quantum Mechanics (Wiley, 2009)

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Additional Guidelines:

The number of hours per module given above is approximate.

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Mathematical Methods I				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	PS203				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): This course is the first part of a two parts course that aims to introduce the mathematical techniques commonly used in other physics courses of the BSMS curriculum, including in Quantum Mechanics I, Quantum Mechanics II, Electricity and Magnetism and Electrodynamics.					
Expected Learning Outcome(s): This course prepares a student for more advanced topics to be taught in Mathematical Methods II, and helps a student in solving problems in different courses in physics, including Quantum Mechanics I, Quantum Mechanics II, Electricity and Magnetism and Electrodynamics, that will be taught in the BSMS curriculum.					
Contents of the course: Vector space: Linear Vector space with examples, Hilbert space, Inner product, Orthonormal Basis and Dimensionality, Bra-Ket notation, Tensor product of vector spaces - approximately 6 lecture hours Vector analysis in curvilinear coordinates: Review of Vector algebra, dot, cross and scalar triple product. Directional derivative, Grad, Div, Curl and their representation in cartesian, spherical and cylindrical coordinates. Line and surface integral, Gauss Divergence theorem, Stokes theorem. - approximately 6 lecture hours Matrix Algebra: Determinant and Trace of matrix, Inverse of a Matrix, Characteristic equation, Eigenvalues and Eigenvectors,, Hermitian and Unitary Matrices, Similarity Transformation, Diagonalization of matrices - approximately 6 lecture hours Fourier and Laplace: Fourier series expansion and Fourier integrals, their use in some simple problems, Fourier and Laplace transforms - approximately 4 lecture hours Ordinary differential equations (ODE): Solution methods of ODE with constant coefficients, Inhomogeneous ODE, particular and complementary solution - approximately 4 lecture hours Sturm-Liouville theory: Sturm-Liouville theory, orthogonal expansions - approximately 2 lecture hours Singular point and series solution method of ODE - approximately 2 lecture hours Special functions Part I: Legendre and Bessel equations and their solutions - approximately 3 lecture hours Special functions Part II: Hermite and Laguerre equations and their solutions - approximately 3 lecture hours Problem Solving & Discussions: approximately 6 lecture hours					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Vector space: Linear Vector space with examples, Hilbert space, Inner product	3
2	Vector space: Orthonormal Basis and Dimensionality, Bra-Ket notation, Tensor product of vector spaces	3
2	Problem solving and discussion	1.5
3	Vector analysis in curvilinear coordinates: Review of Vector algebra, dot, cross and scalar triple product. Directional derivative, Grad, Div, Curl and their representation in cartesian, spherical and cylindrical coordinates	4
	Vector analysis in curvilinear coordinates: Line and surface integral, Gauss Divergence theorem, Stokes theorem	2
4	Problem solving and discussion	1.5
5	Matrix Algebra: Determinant and Trace of matrix, Inverse of a Matrix, Characteristic equation, Eigenvalues and Eigenvectors, Hermitian and Unitary Matrices, Similarity Transformation, Diagonalization of matrices	6
6	Fourier and Laplace: Fourier series expansion and Fourier integrals, their use in some simple problems, Fourier and Laplace transforms	4
7	Problem solving and discussion	1.5
8	Ordinary differential equations (ODE): Solution methods of ODE with constant coefficients, Inhomogeneous ODE, particular and complementary solution	4
9	Sturm-Liouville theory: Sturm-Liouville theory, orthogonal expansions	2
10	Singular point and series solution method of ODE	2
11	Special functions Part I: Legendre and Bessel equations and their solutions	3
12	Special functions Part II: Hermite and Laguerre equations and their solutions	3
15	Problem Solving & Discussions	1.5
Total		42 hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Arfken B. and Weber H. J., Mathematical Methods for Physicists, (Elsevier, 2012)
2. Boas M. L., Mathematical Methods in the Physical Sciences (Wiley, 2005)
3. Joglekar S. D. , Mathematical Physics: The Basics (CRC Press, 2007)
4. A. K. Ghatak A. K., Goyal I. C. and Chua S. J.,, Mathematical Physics (Laxmi Publications, 2016)
5. Joshi A. W., Elements of Group Theory for Physicists (New Age International Publishers, 2018)
6. Dennery P. and Krzywicki A., Mathematics for Physicists (Dover Publications, 1996)
7. Mathews J. and Walker R. L., Mathematical Methods of Physics (Pearson Addison-Wesley, 1971)

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Additional Guidelines:

The number of hours per module given above is approximate.

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: 10%

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	Groups And Symmetry	MS202	Vector space	10%

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Electricity and Magnetism				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	3	0	0	3	
Course Code:	PS204				
Names of faculties who can teach the course	All Departmental faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): The course aims to teach the students about the physics of generation of electric and magnetic fields, and interaction of charged particles with such fields.					
Expected Learning Outcome(s): On successful completion of the course a student will i) gain knowledge about generation of electric fields through charges at rest ii) gain knowledge about generation of magnetic fields through steady currents iii) gain knowledge about interaction of electric charges and electric currents with electric and magnetic fields iv) gain skills in solving problems on the above topics					
Contents of the course: Electrostatics I: Coulomb's Law, Gauss's law and its applications, electric potential, Laplace's and Poisson's equations - approximately 6 lecture hours Electrostatics II: Energy of a charge distribution, boundary conditions, formal solution with Green functions, conductors, capacitance, uniqueness theorem, method of images- approximately 6 lecture hours Electric fields in matter I: Field and Potential due to dipole, multipole expansion, polarization in a dielectric - approximately 5 lecture hours Electric fields in matter II: Vectors D, P and E, linear dielectrics, force on dielectrics - approximately 3 lecture hours Electric currents: Line, surface and volume currents and current densities, electrical conductivity and Ohm's law, equation of continuity, energy dissipation, motion of charged particles in electric fields - approximately 5 lecture hours Magnetostatics: Biot-Savart and Ampere's law, motion of charged particles in magnetic fields, divergence and curl of B, integral and differential forms of Ampere's law, vector potential, Boundary conditions - approximately 6 lecture hours Magnetic fields in matter: Magnetic dipoles, multipole expansion, magnetization in materials, H, B and M, Dia-, para- and ferro-magnetism, B and H in bar-magnet - approximately 5 lecture hours Problem solving and discussion - approximately 6 lecture hours					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Electrostatics I: Coulomb's Law, Gauss's law and its applications, electric potential	3
2	Electrostatics I: Laplace's and Poisson's equations	3
3	Problem solving and discussions	1
4	Electrostatics II: Energy of a charge distribution, boundary conditions, conductors	3
5	Electrostatics II: uniqueness theorem, method of images	3
6	Problem solving and discussions	1
7	Electric fields in matter I: Field and Potential due to dipole, multipole expansion, polarization in a dielectric	5
8	Electric fields in matter II: Vectors D, P and E, linear dielectrics, force on dielectrics	3
9	Problem solving and discussions	1
10	Electric Currents: Line, surface and volume currents and current densities, electrical conductivity and Ohm's law	2
11	Electric currents: Equation of continuity, energy dissipation, motion of charged particles in electric fields	3
12	Problem solving and discussions	1
13	Magnetostatics: Biot-Savart and Ampere's law, motion of charged particles in magnetic fields, divergence and curl of B, integral and differential forms of Ampere's law	4
14	Magnetostatics: Vector potential, Boundary conditions	2
15	Problem solving and discussions	1
16	Magnetic fields in matter: Magnetic dipoles, multipole expansion, magnetization in materials, H, B and M, Dia-, para- and ferro-magnetism, B and H in bar-magnet	5
17	Problem solving and discussions	1
Total		42 hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Griffiths D. G., Introduction to Electrodynamics (Pearson, 2015)
2. Purcell E. M. and Morin D. J., Electricity and Magnetism (Cambridge University Press, 2013)

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

30 - 40 % for the mid semester examination, 50 - 60 % for the end semester examination and 0 - 20% for other components, viz. quizzes, assignments and attendance

Additional Guidelines:

The number of hours per module given above is approximate.

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil**(Similarity content is declared as per the number of lecture hours on similar topics)**

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:**Recommendation of External experts/Senate members/Subject expert(s)**

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Physics Laboratory II				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course Code:	PS205				
Names of faculties who can teach the course	All Departmental Faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): 1. To introduce students to fundamental experiments in general properties of matter, electromagnetism, optics, and modern physics that reinforce theoretical concepts taught in lectures. 2. To develop practical skills in experimental physics, including measurement techniques, data acquisition, data analysis, and error estimation. 3. To cultivate scientific reasoning and enhance the ability to relate physical models to experimental observations. 4. To familiarize students with laboratory equipment and protocols for safe and accurate experimentation.					
Expected Learning Outcome(s): On successful completion of this course, students will be able to: 1. To introduce students to fundamental experiments in general properties of matter, electromagnetism, optics, and modern physics, that reinforce theoretical concepts taught in lectures. 2. Analyze physical phenomena through graphical representation and quantitative evaluation, including fitting curves to extract physical constants. 3. Interpret experimental data and compare with theoretical predictions, identifying possible sources of systematic and random errors. 4. Understand and verify quantum phenomena, such as the quantization of atomic energy levels using the Frank-Hertz experiment. 5. Determine material properties such as surface tension, and understand their dependence on experimental conditions. 6. Communicate experimental findings effectively through clear, structured, and concise lab reports.					
Contents of the course: 1) Introduction to the theoretical aspects of the experiments 2) Determination of the moment of inertia of a flywheel by measurement of gyroscope frequency and precision frequency 3) Determination of surface tension using the ring detachment method 4) To investigate resonance in Force oscillation and to find the spring constant 5) Verification of atomic energy quantization via the Franck-Hertz experiment 6) To study the charging and discharging behaviour of a capacitor in RC circuit 7) Determination of the numerical aperture angle of an optical fiber 8) Determination of the wavelength of a monochromatic light by Young's double slit 9) Determination of the refractive index of a prism using a spectrometer 10) Determination of particle size using LASER diffraction 11) Study of temperature dependent resistance in metal and semiconductor 12) Verification of the Heisenberg's uncertainty principle of quantum mechanics					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours
1	Introduction to the theoretical aspects of the experiments	3
2	Determination of the moment of inertia of a flywheel by measurement of gyroscope frequency and precision frequency	3
3	Determination of surface tension using the ring detachment method	3
4	To investigate resonance in Force oscillation and to find the spring constant	3
5	Verification of atomic energy quantization via the Franck-Hertz experiment	3
6	To study the charging and discharging behaviour of a capacitor in RC circuit	3
7	Determination of the numerical aperture angle of an optical fiber	3
8	Determination of the wavelength of a monochromatic light by Young's double slit	3
9	Determination of the refractive index of a prism using a spectrometer	3
10	Determination of particle size using LASER diffraction	3
11	Study of temperature dependent resistance in metal and semiconductor	3
12	Verification of the Heisenberg's uncertainty principle of quantum mechanics	3
13	Open Lab	3
14	End semester examination	3

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

A separate manual and recommended references will be provided for each experiment.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

The assessment of students in Physics Laboratory II will be carried out continuously, emphasizing regular participation, hands-on skills, analytical thinking, and communication of experimental results. The breakdown of assessment components and their respective weightage is as follows:

Suggested structure - Laboratory record book + continuous evaluation: 60%, Quiz / viva / lab exam: 40%

Additional Guidelines:

NA

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Physical Sciences

Course Title	Physics Laboratory III				
Course Level (tick (✓) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even ☒ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ Lab ☒ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0	0	3	1	
Course Code:	PS206				
Names of faculties who can teach the course	All Departmental faculty				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	Nil				
Learning Objective(s): 1. To deepen understanding of wave optics, electromagnetism and the quantum nature of matter. 2. To provide hands-on experience with a range of optical and electron-based experiments. 3. To train students in using standard laboratory equipment such as Helmholtz coils, diffraction gratings, and electron diffraction tubes. 4. To train students in scientific measurement techniques, data analysis, error estimation, and effective documentation of experimental work.					
Expected Learning Outcome(s): On successful completion of this course, students will be able to: 1. To introduce students to fundamental experiments in quantum mechanics and electricity and magnetism that reinforce theoretical concepts taught in lectures. 2. Demonstrate understanding of key physics concepts such as magnetic fields, electric circuits, electromagnetic induction, atomic energy quantization, and light refraction through structured experiments. 3. Carry out accurate measurements and calibrations using laboratory instruments such as Helmholtz coils, gauss meters, spectrometers and oscilloscopes. 4. Apply concepts of symmetry, superposition, and conservation laws to explain observed behaviors in electric and magnetic systems. 5. Demonstrate the wave nature of matter and light by observing electron diffraction patterns and verifying the de Broglie hypothesis, analyzing interference and diffraction phenomena. 6. Apply experimental techniques to determine charge-to-mass ratio (e/m) of the electron using magnetic and electric field interactions, and estimating the resolving power of diffraction gratings. Also, apply experimental techniques to Determination of the Rydberg's constant and the wavelengths involved in the emission spectrum of the Hydrogen atom 7. Using capacitance meter and a dielectric cell, students will be able to measure the capacitance of a material and correctly apply the formula to determine its dielectric constant. 8. By using LCR series and parallel circuits, the students will be able to measure the resonance frequency experimentally.					
Contents of the course: 1) Introduction to the theoretical aspects of the experiments 2) Determination of magnetic field by a pair of Helmholtz coils 3) Measurement of magnetic moment of a coil in a uniform magnetic field using Helmholtz coils 4) Verification of the de Broglie hypothesis through electron diffraction 5) Determination of the charge-to-mass ratio (e/m) of the electron using electron beam deflection tube					

- 6) Determination of wavelength of light and radius of curvature using Newton's rings
- 7) Verification of Lenz law
- 8) Measurement of the resolving power of a diffraction grating using spectrometer
- 9) Resonance behavior in LCR series and parallel circuits
- 10) Study of diffraction patterns arising from single slit, thin wire, cross wire, and grating
- 11) Measurement of dielectric constant of a solid using dielectric cell
- 12) Determination of the Rydberg's constant and the wavelengths involved in the emission spectrum of the Hydrogen atom in the visible range (Balmer series)

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours

Brief Description of Tutorial Activities: NA

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: NA

Experiment No:	Topic	No. of Hours
1	Introduction to the theoretical aspects of the experiments	3
2	Determination of magnetic field by a pair of Helmholtz coils	3
3	Measurement of magnetic moment of a coil in a uniform magnetic field using Helmholtz coils	3
4	Verification of the de Broglie hypothesis through electron diffraction	3
5	Determination of the charge-to-mass ratio (e/m) of the electron using electron beam deflection tube	3
6	Determination of wavelength of light and radius of curvature using Newton's rings	3
7	Verification of Lenz law	3
8	Measurement of the resolving power of a diffraction grating using spectrometer	3
9	Resonance behavior in LCR series and parallel circuits	3
10	Study of diffraction patterns arising from single slit, thin wire, cross wire, and grating	3
11	Measurement of dielectric constant of a solid using dielectric cell	3
12	Determination of the Rydberg's constant and the wavelengths involved in the emission spectrum of the Hydrogen atom in the visible range (Balmer series)	3
13	Open day	3
14	End semester examination	3

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

A separate manual and recommended references will be provided for each experiment.

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

The assessment of students in Physics Laboratory II will be carried out continuously, emphasizing regular participation, hands-on skills, analytical thinking, and communication of experimental results. The breakdown of assessment components and their respective weightage is as follows:

Suggested structure - Laboratory record book + continuous evaluation: 60%, Quiz / viva / lab exam: 40%

Additional Guidelines:

NA

Name and Signature of course proposer(s):

DUGC Convener (Victor Mukherjee)

HOD (Shashi Bhuashan Singh)

Similarity with the existing courses, if any: Nil**(Similarity content is declared as per the number of lecture hours on similar topics)**

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%: NA**Recommendation of External experts/Senate members/Subject expert(s)**

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
---	---

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Computer Science

Course Title	Introduction to Programming with Python				
Course Level (tick (√) in the relevant option)	100 √ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ Even √ Either semester ☐	
Course applicable for	BSMS √ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (√) in the relevant option(s))	Institute Core √ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory √ Lab √ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	2	0	1	3	
Course Code:	CS102				
Names of faculties who can teach the course	All faculty members in Computer Science Department				
Will the course require participation of visiting faculties: Yes / No/					
Prerequisites, if any	None				
Learning Objective(s): The objective of this course is to introduce students to the fundamental concepts of programming using the Python language. The course aims to develop a strong foundation in computational thinking, algorithmic logic, and code organization through practical, hands-on experience. It emphasizes problem-solving, code readability, and real-world applications, enabling students to write modular, efficient, and error-free Python programs.					
Expected Learning Outcome(s): By the end of this course, students will be able to: - Understand programming fundamentals and core concepts, including data types, control structures, functions, and object-oriented programming paradigms. - Write and execute Python programs - Apply control flow constructs - Use and manipulate Python data structures - Design reusable functions and understand variable scope - Perform file operations with proper exception handling mechanisms in-place - Follow best practices of Python and solve real-world problems programmatically					
Contents of the course: Introduction to Programming: Types of Programming Languages (low-level and high-level), (compiled vs inter and high-level), compiled vs interpreted languages and their examples, programming paradigms: procedural, Object-Oriented Programming (OOP), functional programming (brief overview), Event-driven Programming Introduction to Python Programming: Python interpreters (CPython, IDLE, Jupyter Notebook), Python environment setup (installation and configuration), .py files, single and multi-line comments, use of input() and print() functions, syntax, variables, "Hello World" Program. Intro to virtual environments (venv). Operators: Different types of Operators: Arithmetic, bitwise, logical, assignment, comparison, identity & membership operators (is, is not, in, not in), etc. Precedence of operator.					

Operations: Operation on String (concatenation, repetition, slicing) , list (indexing, appending, slicing, nested lists), dictionary (key access, insertion, deletion), and set (union, intersection, difference)

Data Types: Built-in data types: numeric, boolean, string, list, set, dictionary, tuple, None, etc.

Data type conversion (implicit and explicit conversion), type checking using `type()` and `isinstance()`.

Control Structure: if-else, nested-if, while, for loop, break, continue statements.

Function: Modular Programming, Reusability, `def` keyword, naming conventions, function calls and execution flow, Arguments (positional, keyword, defaults, variable-length (`*args`, `**kwargs`), command line), variable scope and lifetime, global keyword, recursion with examples (e.g., factorial, Fibonacci), docstrings using triple quotes, lambda (anonymous) functions.

Class and Objects: Procedural and object-oriented programming, class naming conventions, `class` keyword classes docstring, Class Instantiation-Object, use of `self`-parameter, defining attributes in `__init__()` method, accessing and modifying attributes, child class, method overriding, use of `super()`, checking object type and class relationships using `isinstance()`, use of regular expression.

File handling: Why file?, file types and extensions (text and binary files), file operations (create, read, write, append, delete), file opening modes, `open()` and `close()` functions, content reading from file, content writing methods, use of `with` keyword, navigation within content.

Error and Exception Handling: Error types: syntax and runtime, common runtime errors (e.g. `ZeroDivisionError`, `TypeError`, `NameError`, `ValueError`, `FileNotFoundError`, `PermissionError` etc.), error vs exception handling, try and except blocks, catching specific exceptions, multiple except blocks, use of `raise` to throw an exception, `else` and `finally` clauses, and custom exceptions.

Python best practices: Naming conventions (variables, functions, classes), indentation and spacing, Line length and breaking long lines, keeping code modular (functions, classes, files), using of `__init__.py` for modular organization, use of built-in functions (`enumerate`, `zip`, `any`, `all`, etc., inline vs block comments (documentation).

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
1	Introduction to Programming and Python Basics: Programming types and paradigms, OOPs, Python introduction, and "Hello World !!!" program. Setting up virtual environments (venv)	4
2	Data Types, Operations, and Operators: Data types, type checking and conversion, operator types, String operation, lists and sets operations, dictionary.	6
3	Control Structures and Functions: Control structures (loops and loop control), Function, <code>def</code> keyword, arguments, variable scope and lifetime, return statement, recursion, lambda functions.	6
4	Object-Oriented Programming (OOP) in Python: Procedural vs Object-Oriented Programming, class keyword, instance and class attributes, use of <code>super()</code> and <code>isinstance()</code> .	6
5	File Handling and Exception Management: File types and extensions, file operations and modes, file navigation, exception handling, data handling using Pandas, Python best practices.	6
TOTAL:		28

Brief Description of Tutorial Activities:

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours
1	Python Basics and Environment Setup (syntax, variables, I/O): Setup: Install Python, IDE (VS Code or PyCharm), working with virtual environment, pip, Write and run "Hello, World!" program; Programming Basic:	5

	Variables & types, Expressions, String ops; I/O: Read input, type conversion, basic validation, Read/write a text file	
2	Operators, Data Types, and Operations: Sequences, List, Tuples, Set, dictionary	7
3	Control Structures (Conditionals, loops) and Functions: Branching and Ternary expression with example, For/while loop examples, Iterate over dictionary (items, keys, values), enumerate, functions, command line argument, variable arguments (*args, **kwargs), use of pytest (optional)	9
4	OOP: Classes, objects, inheritance, file handling: Class design, objects, Inheritance & polymorphism, Subclasses, File handling, handling CSV, json, yaml, txt files, Context managers & pathlib, Use of open(...)	12
5	Error Handling (Exceptions, modular code), pandas and Best Practices: Exceptions & logging, Creating custom exception, use of try/except/else/finally, logging to file and console; logging levels demo, Modularization and refactoring code into src/ with __init__.py, utils.py, pyproject.toml/requirements.txt, pandas intro (read_csv, inspect head/info/describe, select/filter, GroupBy	9
	TOTAL:	42

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- Sundararajan M., Mani Deepak Choudhry, Jeevanandham S, Akshya Jothi, *Python Programming: Beginners Guide*, Notion Press, 2024
- Deepali Srivastava, *Ultimate Python Programming*, BPB Publications, 2024
- Paul Barry, *Head First Python*, 3rd edition, O'Reilly Media, 2023
- Mark Lutz, *Learning Python*, 6th Edition, O'Reilly Media, 2025
- Online resource: <https://docs.python.org/3/>

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

The students' progress will be assessed through the following:

- **Lab work: 50%**
- **Mid-semester exam: 20%**
- **End-semester exam: 30%**

Additional Guidelines:

- Encourage the use of online learning
- Encourage the use of latest stable Python version

Name and Signature of course proposer(s):

Dr. Chinmaya Kumar Dehury

Similarity with the existing courses, if any: Nil

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.	None	None	None	NA

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required) <i>Please find attached sheet</i>	Description (Add separate sheet, if required) <i>Please find attached sheet</i>
--	--

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of Computer Science

Course Title	Introduction to Data Analytics: Concepts and Applications				
Course Level (tick (√) in the relevant option)	100 ☐ 200 ☒ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☒ Even ☐ Either semester ☐	
Course applicable for	BSMS ☒ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (√) in the relevant option(s))	Institute Core ☒ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☒ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	1	0	1	2	
Course Code:	CS201				
Names of faculties who can teach the course	Dr. Anabik Pal, Dr. Chinmaya Kumar Dehury				
Will the course require participation of visiting faculties: Yes / No					
Prerequisites, if any	CS102 - Introduction to Programming with Python				
Learning Objective(s): This is an introductory course on beginner-level understanding of data analytics theory and practical application. The course will contain the mathematical foundation of data analytics and its implementation with Python programming. This course will provide students with some exposure to data analytics and build the necessary foundation required for data-driven scientific discovery.					
Expected Learning Outcome(s): On successful completion of this course, a student will be able to: a) Understand different types, formats, and data structures for effective organization and representation. b) Apply descriptive statistics and probability concepts to summarize and interpret data characteristics. c) Clean and visualize data using standard techniques to handle missing values, outliers, and patterns. d) Build basic machine learning models for supervised and unsupervised learning tasks. e) Implement data analytics algorithms with Python programming.					
Contents of the course: <u>Theory:</u> 1. Understanding and Organizing Data: a) Types of data: Categorical, Nominal, Ordinal, Discrete, Continuous b) Format of data: Structured, Semi-structured, vs unstructured data c) Data Structures and Representation: Array, list, Dictionary, data frame, XML/JSON 2. Statistical Thinking and Probability Foundations: a. Descriptive Statistics: Central Tendency (Mean, Median, Mode), Dispersion (Range, Variance, Standard Deviation, Confidence Intervals) b. Probability Concepts: Random variables and basic probability, Discrete distributions (Bernoulli, Binomial), Continuous distribution (Normal distribution)					

- c. Statistical Inference: intuitive understanding of Hypothesis testing (t-test, p-value, and ANOVA)

- Missing Value Handling: Imputation, Deletion (dealing with incomplete data)
- Outlier Detection and Removal: Identifying and addressing extreme values
- Data Visualizations: Histograms, Boxplots, Scatterplots, Bar charts, Line charts, Pie charts

- Supervised Learning: Understanding and application of Regression, Classification
- Unsupervised Learning: Understanding and application of Clustering, Dimensionality Reduction

Practical:

- Read, write data stored in .xlsx, .csv, .xml, .json file
- Conversion of data and transform into different form
- Manipulation of data for finding descriptive statistics, hypothesis testing and missing value imputation

- Plotting data to visualize data distribution
- Creating and customizing histograms, bar charts, line plots, box plots, and scatter plots

- Performing Supervised learning (KNN, Decision Trees, Random Forests, SVM) and performance evaluation
- Performing Clustering (K-Means, Gaussian mixture model)

Lecture Outline: (Not more than 6 lectures per module)

Brief Description of Tutorial Activities:

Brief Description of Laboratory Activities:		
Experiment No:	Topic	No. of Hours
1.	Python revisited for list, dictionary, and array manipulation	3
2.	Usage of Python libraries: Logical & conditional functions, Lookup functions, Sorting, Filtering, Formatting, Summarization and Aggregation	3
3.	Python package (e.g. Pandas) for reading, writing data stored in .xlsx, .csv, .xml, .json files	3
4.	Python package (e.g. Pandas) for data manipulation	3
5.	Data visualization and plotting using Python packages (e.g. Matplotlib, Seaborn)	3
6.	Python-Numpy, Scipy or other packages for advanced data manipulation for finding descriptive statistics, hypothesis testing and missing value imputation, etc.	3
7.	Python Scikit-learn package for classification, clustering	12
Total Lecture Hours		42

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

1. Doing Data Science by Cathy O'Neil, Rachel Schutt Released October 2013 Publisher(s): O'Reilly Media, Inc. ISBN: 9781449358655
2. Data Science from Scratch, 2nd Edition by Joel Grus Released May 2019 Publisher(s): O'Reilly Media, Inc. ISBN: 9781492041139
3. From Concepts to Code Introduction to Data Science by Adam P. Tashman *CRC Press* © 2024 ISBN: 978-1-032-51795-7
4. An Introduction to Statistical Learning with Applications in Python by Gareth James, Daniela Witten, Trevor Hastie, Rob Tibshirani, Jonathan Taylor
5. Official Documentation of Python packages (pandas, numpy, Matplotlib, Seaborn, Scipy, scikit-learn)

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Theory (Midsem 30, EndSem 30): 60,
Practical: 40

Additional Guidelines:

Name and Signature of course proposer(s):

Similarity with the existing courses, if any: N/A

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur
Proposal of a New Course
Department of _____

Course Title	Fundamental of Physical Education and Well-Being				
Course Level (tick (✓) in the relevant option)	100 ☐ ✓ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ ✓ Even ☐ Either semester ☐	
Course applicable for	BSMS ☐ ✓ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ ✓ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ ✓ Lab ☐ ✓ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	0.5	0	1.5	1	
Course Code:	HS103				
Names of faculties who can teach the course					
Will the course require participation of visiting faculties: Yes					
Prerequisites, if any Course code(s)	None				
Learning Objective(s): The objective of this course is to provide students with the knowledge and skills to adopt and maintain a healthy, active lifestyle, fostering physical competence. Equips students to take responsibility for their own well-being, promoting long-term health and wellness. Impart a fair understanding of various sports activities and yoga for overall well-being.					
Expected Learning Outcome(s): 1. Understand the fundamental components of physical fitness including endurance, strength, flexibility, speed, and coordination 2. Learn the physiological basis of muscle function and differentiate between health-related and skill-related fitness 3. Learn the basics of strength training, major muscle groups, and their functions 4. Able to identify different types of posture and postural deformities, and their impact on health and fitness 5. Recognize the significance of posture in preventing and managing lifestyle-related ailments 6. Learn the concepts and philosophy of Yoga, including <i>Asana</i> and <i>Pranayama</i>, and <i>Ashtanga Yoga</i> 7. Understand breathing techniques 8. Impart basic proficiency in athletic events (track and field) and selected team sports 9. Develop a positive attitude toward lifelong physical activity, health, and wellness 11. Impart the importance of teamwork, discipline and sportsmanship 12. Learn regularity, commitment, and responsibility					
Contents of the course:					

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
I. Theory Classes		
1	Components, conditioning & concept of physical fitness	3
1.1.	Endurance, Strength endurance, Muscular strength, Flexibility, Speed and Coordination	
1.2.	Major muscle groups & functions. Muscle physiology and different approaches during exercises and body types	
1.3	Basics of strength training	
2	Posture and postural deformities. Discussion on Health-Related Fitness and Skill-Related Fitness.	2
3	Theory and practice of Yoga	2

II. Practical Sessions

Training Schedule: A total of 20 hours training in the semester (2 hours of training per week)
Students will be divided into groups of appropriate size for effective training sessions.

(Monday to Friday, Morning and Evening sessions)

1	Gym (strength & endurance training)	21
2	Introduction to Yogic Asanas	
3	Skill training in following activities	
	○ Athletics (Field & Track) ○ Basketball ○ Volleyball ○ Football ○ Kho-Kho	

Brief Description of Tutorial Activities: None

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities:

Experiment No:	Topic	No. of Hours

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.

- 1) Inclusive Physical Activity: A Lifetime of Opportunities by Susan L. Kasser, Rebecca K. Lytle, Human Kinetics Publishers, 2005
- 2) The Physical Education Curriculum, 6th Edition by Stillwell. J L CBS Publication, Jim L Sill Well & Carl E Wellingoose, 2015
- 3) Game Sense – Pedagogy for Performance, Participation, and Enjoyment by Richard Right, 2012
- 4) Essentials of Physical Education - Ajmer Singh, Kalyani Publishers 6th Revised Edition, 2022
- 5) Sports Education International perspective by Peter Hastie, 1st edition 2011

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Part A: Written test (based on Theory classes), Max marks: 30

Part B: Skill test* (gym, yoga & sports), Max marks: 60

Part C: Regular attendance & active participation, Max marks: 10

*Evaluation will be conducted based on UGC guidelines for physical education

Final grade = A + B + C (out of 100 marks)

Additional Guidelines:

Name and Signature of course proposer(s):

Jose Sebastian (CSA_Sports)



Similarity with the existing courses, if any:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

Indian Institute of Science Education and Research Berhampur

Proposal of a New Course

Department of _____

Course Title	Basic Communication Skills				
Course Level (tick (✓) in the relevant option)	100 ☐ ✓ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☐ 700 ☐			Semester: Odd ☐ ✓ Even ☐ Either semester ☐	
Course applicable for	BSMS ☐ ✓ Int. PhD. ☐ Ph.D. ☐				
Tag of the course (tick (✓) in the relevant option(s))	Institute Core ☐ ✓ Professional (Department) Core ☐ Department Elective ☐ Open Elective ☐ Minor ☐				
Type of the course	Theory ☐ ✓ Lab ☐ Project ☐ Non-Credit ☐				
Credit Structure	Lectures (L)	Tutorials (T)	Practicals (P)	Total Credits	
	1	0	0	1	
Course Code:	HS101				
Names of faculties who can teach the course					
Will the course require participation of visiting faculties: Yes					
Prerequisites, if any	None				
Course code(s)					
Learning Objective(s): The objective of this course is to underscore the significance of developing clear, concise, and confident communication skills in written, oral, listening, and reading forms. The course aims to equip students with the ability to articulate ideas effectively, comprehend information critically, and engage in active listening and reflective reading. Attention will also be given to tone, style, and non-verbal elements such as body language, to foster impactful and memorable communication. The course highlights the adaptation of these skills to academic, professional, and cross-cultural contexts, preparing students for effective participation in both local and global arenas. By fostering these complementary skills, the course seeks to enable students to distinguish themselves in academic and professional contexts at both national and global levels.					
Expected Learning Outcome(s): ■ Explain the principles, processes, and theories of communication (Speech Act Theory, Grice's Maxims) and differentiate between verbal, non-verbal, oral, and written communication. ■ Identify and analyze barriers to effective communication and apply suitable strategies to overcome them. ■ Demonstrate proficiency in oral and written expression with correct grammar, diction, clarity, coherence, and style. ■ Apply reading comprehension strategies to interpret, evaluate, and synthesize information from academic and professional texts. ■ Employ listening strategies to distinguish types of listening, overcome barriers, and enhance critical understanding. ■ Present ideas effectively using descriptive, narrative, argumentative, and expository techniques in speech. ■ Adapt tone, style, and non-verbal elements such as body language to academic, professional, and cross-cultural contexts.					

 Reflect on the importance of communication skills in personal growth, academic success, and professional advancement in local and global settings.

Contents of the course:

1. Communication Skills
2. Reading Skills
3. Language Skills
4. Spoken Language Skills
5. Listening Skills

Lecture Outline: (Not more than 6 lectures per module)

Module No	Topic	No. of Hours
I	Communication Skills: Introducing the meaning of successful communication, and processes involved, Principles of Communication, Speech Act Theory, Grice's Maxims for effective Communication, Barriers to Communication, Ways to avoid barriers, Oral and Written Communication, Verbal and Nonverbal Communication	3
II	Reading Skills: Process of Reading, way to improve reading skills Reading Comprehension skills, searching for information; drawing information and making generalizations.	3
III	Language Skills: Common Grammatical Mistakes, Diction, Strategies: Economy, emphasis, Clarity, concreteness, unity and coherence, etc.	3
IV	Spoken Language Skills: Descriptive, narrative, argumentative and expository techniques in spoken language use	3
V	Listening Skills: Importance and Process of Listening, Types of Listening, Barriers to Listening	2
Total		14

Brief Description of Tutorial Activities:

[illegible]

Brief Description of Laboratory Activities:

[illegible]

Suggested Reading: (Please use the format: Author(s) (Surname first), Title, Publisher, Year of publication.		
1. Alan Barker (2011) Improve your communication skills. Kogan Page Ltd. 2. Andrea J. Rutherford, Basic Communication Skills for Technology, Pearson Education. Inc., Eleventh edition, 2010 3. Austin, J. L. (1975). <i>How to do things with words</i>. Harvard University Press. 4. Ian Tushovsky (2018). 21 days of effective communication: everyday habits and exercises to improve your communication skills and social intelligence. 5. Matthukutty M Monippally, Business Communication Strategies, Oxford University Press, Sixth Edition 2011 6. Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford University Press, Sixth Edition 2011		
Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):		
Additional Guidelines:		

Name and Signature of course proposer(s):
--

Similarity with the existing courses, if any: No

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Name of the Course	Course Code	Similarity Content	Approx. % of Content
1.				
2				

Justification of new course proposal if cumulative similarity content is >30%:

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
---	---

The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on_____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of the Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	

11A. Guidelines for Voluntary Exit (With MS (Research) Degree):

1. A board should be formed after the comprehensive examination for students who opt for the MS (Research) exit option after completing the six registered semesters (four semesters of MS and two semesters of Research), and it will be called the **MS Academic Progress Committee (MAPC)**. The MAPC shall consist of:
 - (i) Supervisor (Chair) and Co-supervisor (if any)
 - (ii) A departmental faculty member nominated by DPGC/HOD (research field expert)
 - (iii) An external member* (from another department) nominated by the project supervisor and selected by the HOD

** The project supervisor has to nominate three faculty members from another department within the institute, and the HOD will select one of them to be part of the MAPC.*
2. **Activity of the MAPC:** The committee will monitor the research activity and progress of the project work during the two semesters (one year). The committee will have a meeting at the end of the 5th semester and follow with the 6th semester, and grade the student according to the research progress (following the grading criteria).
3. At the end of the 5th semester, a research progress report needs to be submitted by the student, and a progress seminar needs to be conducted by the project supervisor
4. At the end of the 6th Semester, the student needs to submit the **Final MS project report**, which needs to be submitted in the following manner:
 - (i) **Synopsis:** On satisfactory completion of the prescribed courses and research, students under the MS (Research) Program shall submit to the HOD through their project guide(s) the requisite copies of the synopsis of the research work for consideration by the MS Academic Progress Committee. Prior to the submission of the synopsis, students are required to give at least one seminar talk on the topic of their research work in front of the MAPC. The iPh.D. students shall present the synopsis before the MS Academic Progress Committee. The Committee will approve the work reported in the synopsis and permit the student to submit the final project report for review.
 - (ii) **Submission of Project Report:** The iPh.D. student shall, within one month of the acceptance of the synopsis, submit a soft copy and the requisite number of hard copies of the project report, along with an abstract as stipulated. The Dean (Academics) may grant additional time beyond one month on request from the iPh.D. student for valid reasons.
5. **Panel of Examiners:** The submitted project report shall be referred to the project supervisor/s and one external examiner chosen by the Dean, Academic Affairs, from among the panel of examiners recommended by the MAPC at its synopsis meeting.
6. **Project Report:**
 - (i) The examiner is expected to send the report on the project within three weeks from the date of receipt of the MS project report.
 - (ii) If reports from all examiners declare the project as "recommended", the MS Academic Progress Committee will consider the reports and recommend conducting a viva voce.
 - (iii) If one of the project report examiners declares the report is not recommended, the project evaluation report and modified project with corrections shall be put up to the MS Academic Progress Committee. The MAPC will further clarify the revisions for evaluation.
 - (iv) If an examiner suggests resubmission of the report, after revision, the iPh.D. student will be allowed to resubmit the project within the time stipulated by the MS Academic Progress Committee, failing which the revised project will not be accepted and their registration will be cancelled.
7. **Viva Voce Examination:** The student should appear in the Viva Voce examination within two weeks of receiving a satisfactory reviewer's report. The viva-voce board shall comprise the members of the MAPC.
 - (i) The viva-voce board will examine the iPh.D. student on his/her project work and evaluate his/her performance as satisfactory or otherwise.
 - (ii) If the report of the viva-voce board declares the performance of the iPh.D. as not satisfactory, they may be asked to reappear for viva-voce at a later date (not earlier than a month and not later than six months from the date of the first viva-voce).
 - (iii) If the viva-voce board on the second occasion also evaluates the performance of the iPh.D. student as

not satisfactory, the matter will be referred to the Senate for a decision on cancellation of registration or continuation for further work.

- (iv) The viva-voce board may also recommend revisions to be made in the final version of the project report after taking into consideration, suggestions of the examiners who evaluated the project and the discussion at the viva-voce examination. The Chairman of the viva voce board shall forward the project report to the Academic section certifying that the revisions recommended by the viva-voce board, if any, have been incorporated in the copy of the project report along with the report of the viva-voce board.
 - (v) All students shall submit a digitally authenticated soft copy of the final form of the MS project report to the Academic Progress Committee after the viva voce board recommends the award of the degree.
8. **Award of MS (Research):** On the recommendation of the Academic Progress Committee, the Senate, and with the approval of the Board of Governors of the Institute, the iPh.D. student will be awarded the MS (Research) degree.

Academic Calendar 2025

BS-MS 2025 Batch (1st Year BS-MS)

*Odd Semester (September - December 2025)	
Event	Schedule
Commencement of Classes	Sep 10 (Wed)
Invenio (SAC event)	Sep 13-14
Class Committee Meeting	In the week of Oct 13 -16
Mid-semester examination	Oct 27-31 (Mon- Fri)
SRS	Nov 25 - 30 (Tue - Sat)
Last day of instruction	Dec 08 (Mon)
End-semester examination	Dec 09-13 (Tue-Sat)
Winter vacation (1 st Year BS-MS Students)	Dec 15, 2025 - Jan 04, 2026
Make-up examination	Dec 17-18 (Wed - Thu)
Last date for showing evaluated answer scripts	Dec 19 (Fri)
Grade moderation day	Dec 19 (Fri)
Last date for grade submission and conversion of 'I' grade	Dec 20 (Sat)
Winter vacation for faculty (Offering Courses for 1 st Year BS-MS)	Dec 20, 2025 (Sat) - Jan 04, 2026 (Sun)

Lectures on the following days will be held with the schedule of the days mentioned against them:

Time Table Adjustment Sem I	
Wednesday Time Table will be followed	Sep 27 (Sat)
Thursday Time Table will be followed	Oct 11 (Sat)
Friday Time Table will be followed	Oct 25 (Sat)
Tuesday Time Table will be followed	Nov 1 (Sat)
Wednesday Time Table will be followed	Nov 22 (Sat)

Proposal of a New Course

Course Title	Research Methodology	
Course Level (tick (✓) in relevant option)	100 ☐ 200 ☐ 300 ☐ 400 ☐ 500 ☐ 600 ☒ 700 ☐	Semester: Odd ☐ Even ☐ Either semester ☒
Course Type (tick (✓) in relevant option)	Open Elective/PhD	
Department:	Academic Affairs (PG)	
Credits with LTP structure:	0 (Lecture: 1 + Tutorial: 0 + Fieldwork: 0 + Self-study)	
Course number:	RM 601	
For:	BS-MS (Dual Degree) ☐ Integrated Ph.D. ☒ Ph.D. ☒	
Name of faculties who can teach the course:	Faculty from each department will offer this course to deliver the basic understanding of the Research methodology, in addition some common instructor will also cover some general topics.	
Will the course require participation of visiting faculty: Yes No		
Pre-requisites, if any	Nil	
Course code(s)		
Objective(s) and Expected Learning Outcomes: Objectives: This course is designed to introduce fundamental principles and important aspects of scientific research. Mainly this course provides a broad knowledge on methods of research, data analysis, report writing, presentation, protecting intellectual property and ethical practices. Expected Learning Outcome: After completion of this course, the students will be able to understand research methods, develop the skills of writing of research reports, develop ethical practices in research, and discuss research information within the scientific community and society.		
Course Content: 1. What is research: The concept and objectives of research, types of research, research hypothesis, research and theory, conceptual and theoretical Models. Types and Methods of Research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. 2. Research planning or experimental design: Necessity to define research problem, research gap, working hypothesis, planning process, research design. Planning of Research: The planning Process, Selection of a Problem for Research, Formulation of the Selected Problems, Measurement, Research Design/Plan. Lab and biosafety for the relevant department (Mainly experimental research work): Safe laboratory practices, biosafety levels, biological hazard information, labels, signs and storage of chemical and biological reagents, Classes and types of biosafety cabinets, inactivation and disposal of biological products, waste management, and incident response, report and risk management. 3. Data collection and analysis and Research ethics: Meaning and Importance of Data, Basics of statistics, data processing and analysis strategies and tools, hypothesis testing, interpretation of data. Ethical issues, citation and acknowledgement, plagiarism, reproducibility and accountability. 4. Literature search, collection, storage and citation: Importance of literature review in defining a problem, literature review, online tools, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis 5. Writing research reports, Science journals and the peer-review process: Types of reports (articles, reviews, progress reports and thesis), formats, planning of report writing. Figure preparation and manipulation. Effective use of English language in scientific papers. Types of journals, publication process, peer-review process, meaning of impact factor, H-index, etc. 6. Presentation skills and Science popularization and outreach: Preparation of slides for talks, preparation of posters, design of research paper Presentation types and skills. Media coverage, lectures in public forums, circulation of scientific ideas and provoking thoughts, and the pros abs cons of these activities. 7. IPR: Intellectual property rights and patent law, commercialization, copyright, trademarks, royalty, trade-related aspects of intellectual property rights, and a few case studies.		
Lecture Outline:		
Module No	Topic	No. of Hours (1 Lecture = 1 hour)
1	What is research	1
2	Research planning or experimental design	3

3	Data collection and analysis and Research ethics	3
4	Literature search, collection, storage and citation	3
5	Writing research reports, Science journals and the peer-review process	2
6	Presentation skills and Science popularization and outreach	1
7	IPR	1
Total number of contact hours		14 hours

Brief Description of Tutorial Activities: Not Applicable

Module No	Topic	No. of Hours

Brief Description of Laboratory Activities: Not Applicable

Experiment No:	Topic	No. of Hours

Justification for a need of modification (If applicable): **Not Applicable**

Suggested Reading:

1. The Craft of Research. 4th edition by Wyne C. Booth, Colomb, William, University of Chicago Press.
2. Doing Your Research Project. A Guide for First-time Researchers. By Judith Bell, Stephen Waters, publishers: McGraw-Hill Education (2014).
3. Research Methodology: A Step-By-Step Guide For Beginners, by Ranjit Kumar, Publisher: Sage South Asia (2011).
4. Research Methodology: Methods and Techniques, by C. R Kothari, Publisher: New Age International (2004).
5. The Dissertation Journey, by Laura Hyatt, Carol Roberts, Publisher: Corwin (2023).
6. How to Write a Scientific Paper: An Academic Self-Help Guide for PhD Students, by Jari Saramaki (2018).
7. WIPO Intellectual Property Handbook (Web resources).
8. The WHO Laboratory Biosafety Manual (LBM), 4th edition (online).

Modalities for Students Performance Assessment (with details of weightage for different components of performance assessment within the broad guidelines given in BS-MS/PhD manual):

Continuous assessment (class test, assignments, quiz etc), mid-Semester and end-Semester examinations (the weightage of these components will be as per the Institute PhD manual).

Name and Signature of course proposers: **Coordinator PG, Academic Affairs**

Recommendation of External experts/Senate members/Subject expert(s)

Description (Add separate sheet, if required)	Description (Add separate sheet, if required)
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The above proposal followed by the recommendations of the External experts/Senate members/Subject expert(s) appointed by Director is found to be acceptable by the DUGC/DPGC in its meeting held on _____. The committee recommended the introduction of new course for consideration of CoAA/DoAA and Director/Chairperson Senate.

Convener, DUGC	Convener, DPGC	FIC/HoD
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For Use of Academic Section

Recommended/Not Recommended to Senate Chairperson	Coordinator/Dean, Academic Affairs
Recommended / Not Recommended for the approval/ratification by the Senate	
Director/Chairperson Senate	



भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान बरहमपुर
Indian Institute of Science Education and Research Berhampur
Established by the Ministry of Education, Govt. of India

No. 18-26011/2/2025-AA
Computer No. 138

13 October 2025

**Corrigendum to the Minutes of the 25th Meeting of the Senate
held on 02 September 2025**

1. With the approval of the Competent Authority, the following amendment is hereby incorporated to the minutes of the 25th meeting of the Senate held on 02 September 2025 at Resolution No. 25.2.1:

For	Read as
The Credit definition as part of the BSMS Pre-major proposal was approved by the Senate in its 23rd meeting (Resolution No. 23.2.2) held on 30 Apr 2025 to be implemented from AY 2025-26 Semester-I onwards. As per the suggestions of the Senate regarding the credit structure, including the course contents, number of pre-major options, and other modalities, the Academic Development Committee (ADC) in its meetings held on 25 July 2025 and 21 Aug 2025 extensively discussed and recommended its inputs to be presented to the Senate. The Dean of Academic Affairs presented the proposal of the ADC, which was prepared inline with the Senate recommendation.	The Credit definition as part of the BSMS Pre-major proposal was approved by the Senate in its 23rd meeting (Resolution No. 23.2.2) held on 30 Apr 2025 to be implemented from AY 2025-26 Semester-I onwards. As per the suggestions of the Senate regarding the credit structure, including the course contents, number of pre-major options, and other modalities, the Academic Development Committee (ADC) in its meetings held on 25 July 2025 and 21 Aug 2025 extensively discussed and recommended its inputs to be presented to the Senate. The Dean of Academic Affairs presented the proposal of the ADC, which was prepared inline with the Senate recommendation.
The Senate discussed at length and resolved to approve the Concept Note, Credit Structure and Curriculum (a combined document is enclosed as Annexure-1) for the 5-Year BS-MS Dual Degree Programme to be implemented from AY 2025-26 Semester-I onwards.	The Senate discussed at length and resolved to approve the Concept Note, Credit Structure and Curriculum (a combined document is enclosed as Annexure-1) for the 5-Year BS-MS Dual Degree Programme to be implemented from BS-MS 2025 Batch onwards .


(Pradeep Kumar Ray)
Registrar