Office of the Academic Courses
Indian Institute of Technology Guwahati

NOTICE

Ref. No.: IITG/AcadC/2026/13808,
Date: 02.11.2026

SUB: CHOICE FOR OPTING MINOR DISCIPLINES FOR ELIGIBLE BTECH/BDES/BS FIRST YEAR STUDENTS FROM 2026 BATCH

The students who are completing the first semester of BTech/BDes/BS programme and are interested in pursuing MINOR discipline are hereby requested to submit their choices for minor disciplines by submitting their preferences by login to the Academic ERP portal [https://academic.iitg.ac.in/sso/] **from 2nd November 2026 to 10th November 2026.**

Please note that after successful submission of the preferences, the student should download the PDF of ***Request for Minor Discipline*** and get the recommendation from the Faculty Advisor (FA) and the Head of the Academic Division (HoD). The signed hard copy should reach the Academic Affairs section by **16th November 2026**. Without the recommendation of the FA and HoD on the signed hard copy, the preferences filled online will notbe considered.

The Student are requested to carefully submit their choices because once submitted they cannot alter their preferences. However, based on the advice of the FA/HoD, if any changes are to be made in the preferences, FA/HoD can delete the preferences on the ERP portal so that the student can re-submit the preferences.

The rules concerning Minor discipline are given below:

1. Students completing a minor will have the minor mentioned in the degree certificate and in the final grade card.
   It is also to note that there are restrictions for opting the Minor discipline for students of specific branches as given below:

Sl. No.	Minor Discipline	Undergraduate Discipline for which the Minor Programme is NOT offered.
1.	Design	Design
2.	Computer Science and Engineering	1. Mathematics & Computing 2. Computer Science and Engineering 3. Data Science and Artificial Intelligence
3.	Electronics and Communication Engineering	1. Electronics and Communication Engineering 2. Electronics and Electrical Engineering
4.	Civil Engineering	Civil Engineering
5.	Mathematics	1.Mathematics & Computing 2.Design
6.	Robotics and Automation	None
7.	Data Science and Artificial Intelligence	1.Data Science and Artificial Intelligence 2.Computer Science and Engineering 3.Electronics and Communication Engineering 4.Electronics and Electrical Engineering
8.	Engineering Physics	Engineering Physics
9.	Chemical Science & Technology	Chemical Science & Technology
10.	Material Science and Engineering	None
11.	Biotechnology	Biosciences and Bioengineering
12.	Quantum Technology	Design

2. The minor courses will spread over the second to sixth semesters of a BTech/BDes/BS programme with one course per semester.

3. Numbering of minor courses will be similar as regular courses but will be appended with "M".

4. Only those students who have completed all the credits required in the first semester of their studies with a CPI of 6.5 or above, will be eligible for a minor discipline after the end of first semester.

5. Maximum number of seats in Minor discipline other than Design shall be 60(Sixty) only. The Maximum seats in Minor in Design shall be 30 (Thirty) only. However, a Minor discipline will not be available if the number of applicants in that discipline is less than 10(Ten).

6. Students may enlist their choices of a minor discipline in order of preference, to which they wish to join. It will not be permissible to alter the choices after the application has been submitted.

7. Selection to minor disciplines shall be made strictly in order of merit of the applicants. For this purpose, the CPI obtained at the end of the first semester shall be considered.

8. Joining the minor disciplines carried out in accordance with the above rules will be effective from the second semester of the applicants concerned. No change of minor discipline shall be permitted after this.

9. A student with only minor courses remaining as backlogs and completed all other requirements for the B.Tech/BDes/BS discipline will be deemed to have completed the B. Tech/BDes/BS programme and he/she will be awarded a B.Tech/BDes/BS degree without a minor.

10. After allotment, if a student does not register for Minor course for any of the concerned semesters, his/her name shall be dropped from the Minor programme automatically.

11. For additional rules on MINOR programme, in regard to withdrawal etc., **Annexure-A** enclosed herewith may please be seen.

12. For the details of all the Minor programme structures please see **Annexure-B.**



Monalisa Kakati
HoS (Academic Courses)

Head of Section
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Annexure – A

Additional Rules on MINOR programme (Applicable from 2014-batch of BTech students onwards)

A.1		**Rules relating to withdrawal from MINOR programme**
	A.1.1	If a student submits application for dropping the MINOR discipline within the scheduled time of any semester, all grades awarded to him/her in previous semesters for Minor discipline related courses SHALL BE REMOVED from his/her grade statement.
	A.1.2	Students who drop out from MINOR discipline having earned any `F' grade SHALL NOT BE ELIGIBLE for award of Institute medal.
	A.1.3	Students who drop out from MINOR discipline without having earned any `F' grade will remain ELIGIBLE for award of Institute medal.
A.2		**Presentation of performance in MINOR programme in Pass Certificate**
	A.2.1	Presentation of performance in MINOR programme in Pass Certificate shall be as follows: **Bachelor of Technology in xxxxxxxxxx** with **Minor in yyyyyyyyyy** where, xxxxxxxxxx shall reflect the BTech/BDes discipline, and **yyyyyyyyyy** shall reflect MINOR discipline.
A.3		**Presentation of performance in MINOR programme in Grade Card**
	A.3.1	For students who SUCCESSFULLY complete MINOR discipline**:** There will be a SINGLE Grade Card with the final SPI/CPI representing all courses (*excluding* MINOR discipline courses). For these students, at the bottom of the Grade Card, the Course Codes, Course Titles, Course Credits, and Grades, for respective MINOR discipline courses will only be shown, with a caption, Summary of Additional Learning MINOR in **yyyyyyyyyy** where, **yyyyyyyyyy** shall reflect MINOR discipline. Also, for these students, on the back side of their pre-printed high security Grade Card format of the Institute, an additional insertion shall be made as: **MINOR discipline courses** : These courses are over and above the syllabi and credit structures prescribed for B.Tech./B.Des. programme of the Institute. Students can additionally opt for a Minor in a discipline other than the discipline he/she is registered in. Course codes for minor courses are similar as regular courses but are appended with "M". Students who complete all MINOR discipline courses will have the minor mentioned in the degree Certificate and final Grade Card.

	A.3.2	For students who FAIL in MINOR discipline courses OR opt out from MINOR discipline, there will be TWO Grade Cards as per details below: (i) The main Grade Card will be with the final SPI/CPI representing all courses (*excluding* MINOR discipline courses), without any mentioning about the student's MINOR discipline courses at the bottom of the Grade Card; For this type of a Grade Card, nothing will be inserted or added on the back-side of the pre-printed high security format. (ii) There will be a separate Grade Card prepared for this type of a student, presenting the MINOR courses with whatever grades he/she secured, with a caption, Summary of Additional Learning For this type of a Grade Card also, nothing will be inserted or added on the back-side of the pre-printed high security format.

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Minor Programmes

1. **Name of the Academic Division:** Department of Design
2. **Discipline (Title) of the Minor Programme:** Minor in Design
3. **Preamble of the Minor Programme:**

Brief description of the programme. The coverage, target and outcomes, etc.

The Minor in Design programme is intended for B.Tech. students and draws from the revised B.Des. curriculum. It provides exposure to the foundations and applications of design through a structured sequence of courses. The Minor in Design programme covers design history and theory, ergonomics, systems thinking, interaction design, and design management and entrepreneurship. The target students are those from engineering disciplines who wish to augment their technical education with design knowledge. Expected outcomes include improved ability to approach complex problems with a design perspective, competency in user-centered and systems-oriented design, and readiness to apply design management principles in professional practice. Enrolment is limited to 10 students per batch.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Ergonomics in Design (DD 214)	3-0-0-6	Human factors and ergonomics; anthropometrics, biomechanics, safety and health, cognitive aspects, visual communication principles, environmental factors, and participatory ergonomics.
III	Introduction to Design (DD 101)	1-2-0-6	History and evolution of design; modern concepts; introduction to various domains and trends in design.
IV	Systems Approach to Design (DD 311)	1-0-4-6	Systems thinking applied to design problems; systems and subsystems; system analysis; schematic representation; application of design methods in the design of a product systems and communication systems.
V	Interaction Design (DD 301)	2-0-4-8	Concepts and paradigms in human-computer interaction; interaction models, ergonomics, design process, evaluation methods, and case studies.
VI	Design Management and Entrepreneurship (DD 314)	3-0-0-6	Principles and practices of design management; strategic role of design in organizations; entrepreneurship; case studies in design management.

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

S. No.	UG Programme	Justification
1.	**BDes**	**Overlap of courses**

Minor Programmes

1. **Name of the Academic Division: Physics**
2. **Discipline (Title) of the Minor Programme: Engineering Physics**
3. **Preamble of the Minor Programme:**

There has already been a minor programme in Engineering Physics which offers entry level courses on basic and applied Physics. The courses on applied Physics comprises areas which are industrially relevant. This program is now revised and course structure is updated to be more suitable for students with non Physics background.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Computational Physics	2- 0- 2- 6	Entry level course on numerical methods relevant to Physics and laboratory practice
III	Engineering Optics	3- 0- 0- 6	Entry level course on optical Physics and Photonics
IV	Quantum Physics	2- 1- 0- 6	Entry level course on Quantum Physics with some problem solving practices
V	Laser Physics and Technology	3- 0- 0- 6	Basic course on Laser and its applications
VI	Materials Science & Engineering	3- 0- 0- 6	Basic course on material science and engineering.

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

NA

S. No.	UG Programme	Justification
1.	Engineering Physics	Overlap in Courses

Minor Programmes

1. **Name of the Academic Division:** Computer Science and Engineering
2. **Discipline (Title) of the Minor Programme:** Computer Science and Engineering
3. **Preamble of the Minor Programme:**

The minor program on CSE enables students to learn five fundamental courses spanning the three major areas of theoretical computer science, computer systems and machine learning.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Theoretical Foundations of Computer Science	3-0-0-6	Covers foundational mathematics topics such as set theory, combinatorics, logic and graph theory
III	Data Structures and Algorithms	3-0-0-6	Covers fundamental data structures and basic paradigms of algorithm design
IV	Digital Logic and Computer Architecture	3-0-0-6	Covers the building blocks of a computer system, its organization and architecture
V	Operating Systems Database Systems	3-0-0-3 3-0-0-3	Covers fundamental concepts from Operating systems and Database Management Systems
VI	Machine Intelligence	3-0-0-6	Covers foundations of machine learning, deep learning and generative AI

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

S. No.	UG Programme	Justification
1	Data Science and Artificial Intelligence	B.Tech students already cover 3 courses in their curriculum
2	Mathematics and Computing	B.Tech students already cover 3 courses in their curriculum
3	Computer Science and Engineering	Overlap in courses

Minor Programmes

1. **Name of the Academic Division: Chemistry**
2. **Discipline (Title) of the Minor Programme: CST(Minor)**
3. **Preamble of the Minor Programme:**

The CST Minor programme has already been in place since long back with an aim to offer basic chemistry courses including spectroscopy, applied inorganic and organic chemistry, drug design etc to the non-chemistry students. These course structures are revised to make them more application oriented. This course will give a brief idea to the non-chemistry students about the applications of chemistry in various areas of consumer products.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Inorganic Chemistry	3-0-0-6	This course will help to understand the basic inorganic chemistry.
III	Applied Organic Chemistry	3-0-0-6	This course will help to understand the basic organic chemistry which are required for chemical industry.
IV	Spectroscopic Techniques in Chemistry	3-0-0-6	Spectroscopy is a group of major analytical techniques in the field of chemistry. Very basic level of those techniques will be discussed.
V	Physical Chemistry	3-0-0-6	Entry level physical chemistry will be taught
VI	Chemical Technology	3-0-0-6	This will deal with the industrial applications of chemistry

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

S. No.	UG Programme	Justification
1.	Chemical Science and Technology	Overlap of Courses

Minor Programmes

1. **Name of the Academic Division: Biosciences and Bioengineering**
2. **Discipline (Title) of the Minor Programme: Biotechnology**
3. **Preamble of the Minor Programme:**

This program offers an interdisciplinary foundation in biotechnology and biochemical sciences, integrating molecular biology, bioengineering, and analytical techniques to understand and manipulate biological systems for research, industrial, and therapeutic applications.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Essentials of Biochemistry (BT201M)	3-0-0-6	Comprehensive overview of biochemical principles including cellular foundations, bioenergetics, metabolic pathways, hormonal regulation, and enzyme mechanisms
III	Molecular Biotechnology (BT202M)	3-0-0-6	Overview of cellular structure, genome organization, molecular genetics, microbial growth and reproduction, gene regulation, and genetic engineering techniques.
IV	Cellular Biotechnology (BT301M)	3-0-0-6	Exploration of cell biotechnology encompasses culture techniques, tissue engineering, stem cells, cloning, immunotolerance, and the development of transgenic organisms
V	Bioprocess Technology (BT 302M)	3-0-0-6	Comprehensive study of bioprocess engineering covering kinetics, transport phenomena, bioreactor design, metabolite production, process control, scale-up, and economics
VI	BioanalyticalTechniques and Bioinformatics (BT401M)	3-0-0-6	Advanced bioanalytical techniques for precise biomolecular characterization and screening integrating spectroscopy, microscopy, molecular assays, computational biology, and drug design

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

S. No.	UG Programme	Justification
1.	**Biosciences and Bioengineering**	**Overlap of courses**

Minor Programmes

1. Name of the Academic Division: Department of Mathematics
2. Discipline (Title) of the Minor Programme: Minor in Mathematics
3. Preamble of the Minor Programme:

The minor programme in mathematics is meant for the B.Tech. students of all disciplines (except B.Tech. in mathematics and computing) who have interest in mathematics and want to learn more than what are already covered in their basic compulsory mathematics courses. The first two courses will be also directly helpful for those who want to use this programme only for industry internships or industry placements. The other courses will help the students to learn mathematics apart from helping them to learn critical thinking and improve reasoning ability.

4. Curriculum of the Minor Programme

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Modern Algebra	3-0-0-6	This course teaches algebraic structures like, group, ring, field and also some basic properties of integers.
III	Mathematical Statistics	3-0-0-6	This course teaches both probability and statistics.
IV	Scientific Computing	3-0-0-6	This course teaches various numerical methods and techniques for solving nonlinear equations, differential equations, finding integrals, etc.
V	Real Analysis	3-0-0-6	This course teaches metric space, some parts of several variable real analysis, and measure theory and integration.
VI	Differential Geometry	3-0-0-6	This course teaches geometry of curves and surfaces.

5. List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.

S. No.	UG Programme	Justification
1	B.Des (Bachelor of Design)	These students do not take any mathematics course in first semester and so they will not have basic knowledge required for the courses in the minor programme.
2	Mathematics & Computing	Overlap in Courses

It is placed to the senate through IUPC for approval.

Minor Programmes

1. **Name of the Academic Division: Mehta Family School of Data Science &AI**
2. **Discipline (Title) of the Minor Programme: Data Science &AI**
3. **Preamble of the Minor Programme:**

The course will make the students familiar to important subjects that are relevant to appreciate the area of data science, machine learning

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Mathematical Foundations of Data Science	3-0-0-6	Exposing students to the background foundation to pursue minor in DSAI
III	Artificial Intelligence	3-0-0-6	Exposing students to basics of AI
IV	Machine Learning	3-0-0-6	Exposing students to basics of machine learning
V	Deep Learning	3-0-0-6	Exposing students to basics of deep learning
VI	Multi-modal Data Processing and Learning	3-0-0-6	Exposing students to application of machine learning

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

Sl.No.	UG Programme	Justification
1	Computer Science and Engineering	Overlap of courses from the major stream
2	Data Science &AI	Overlap in Courses
3	EEE	Overlap of courses from the major stream
4	ECE	Overlap of courses from the major stream

Minor Programmes

1. **Name of the Academic Division:** Chemical Engineering
2. **Discipline (Title) of the Minor Programme:** Material Science and Engineering
3. **Preamble of the Minor Programme:**

Brief description of the programme. The coverage, target and outcomes, etc.
The minor programme in "Material Engineering" deals with knowledge on fundamentals and applications of different types of materials, including both conventional and advanced materials. Some of the advanced and functional materials include energy materials, sustainable polymers, nanocomposites, and smart materials. On completion of this minor, the students may find career in energy, polymers, composites and other material processing industries.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Fundamentals of Material Science	3 – 0 – 0 – 6	Classification of materials and processing techniques.
III	Thermodynamics and Kinetics of Phase Transformations	3 – 0 – 0 – 6	Basics of thermodynamics, phase diagrams, kinetics of material transformations.
IV	Computational and Experimental Techniques	3 – 0 – 0 – 6	Fundamental teaching on computational tools (such as Material Studio) and experimental tools (such as XRD, FESEM, TEM, TGA, etc.) used for material characterization
V	AI and ML in Material Engineering	3 – 0 – 0 – 6	Basics of AI/ML and their applications in material processing.
VI	Introduction to Functional Materials	3 – 0 – 0 – 6	Basics of advanced materials such as biomaterials, nanomaterials, composites, biopolymers, etc.

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

S. No.	UG Programme	Justification
	NONE	

Minor Programmes

1. **Name of the Academic Division:** Mechanical Engineering
2. **Discipline (Title) of the Minor Programme:** Robotics and Automation
3. **Preamble of the Minor Programme:**

Brief description of the programme. The coverage, target and outcomes, etc.
The *Minor Program in Robotics and Automation*, offered by the *Department of Mechanical Engineering*, *IIT Guwahati*, combines mechanical design, computational modelling, robotics, and digital manufacturing. The program introduces students to the digital product realisation cycle, from conceptual design and geometric modelling to process automation, robotic programming, and intelligent manufacturing. It consisted of five courses: *Introduction to Robotics, Computer-Aided Design and Automation, Digital Manufacturing, Computational and Numerical Methods,* and *Design of Mechatronic Products.* Together, these courses build a foundation in CAD, open data formats, process planning, robotic manufacturing, and mechatronic system design. Upon completion, learners will be able to model, analyse, and automate mechanical and robotic systems, implement computational design and manufacturing workflows, and develop intelligent mechatronic products aligned with the principles of Industry 4.0 and smart manufacturing.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Introduction to Robotics	3-0-0-6	The course is intended as a first level introduction to robotics. The course would cover the fundamental concepts and mathematics required to understand, analyze, and control robotic manipulators. The course would prepare students to undertake more advanced courses/topics in focused areas like, motion planning, rehabilitation robotics, and unmanned vehicles, etc.
III	CAD and Automation	3-0-0-6	In this course, students will learn the underlying data structures and representations of CAD models, enabling them to apply programming skills for model handling and automation. The course emphasises developing CAD automation workflows that can be extended to practical engineering applications. In addition, students will be introduced to offline programming methodologies for robots and manufacturing systems, allowing learners from diverse specialisations to engage in design-to-manufacturing integration using computer-aided tools.
IV	Digital Manufacturing	3-0-0-6	In this course, students will learn how computers are utilised in manufacturing processes to design products specific to their area of specialisation while considering their manufacturability. The course also introduces reverse engineering methodologies, enabling students to analyse existing components and apply the acquired knowledge to redesign or develop new products optimised for digital manufacturing environments.
V	Computational Methods	3-0-0-6	With the enormous growth of computational power in recent decades, use of numerical methods have become common place in industry and research. The proposed course is intended to be a first course in computational methods for

			undergraduate students and aims to equip the student with the necessary background and basic tools of computational methods.
VI	Design of Mechatronics Products	1-0-3-6	In this course, a few cases will be considered for developing the mechatronics products, and the students will develop the products in a laboratory component.

5. List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.

S. No.	UG Programme	Justification
NONE		

Minor Programmes

1. **Name of the Academic Division: Civil Engineering**

2. **Discipline (Title) of the Minor Programme: Minor in Civil Engineering**

3. **Preamble of the Minor Programme:**

Civil Engineering has seven different specializations, namely (a) Structural Engineering, (b) Geotechnical Engineering, (c) Infrastructure Engineering and Management, (d) Transportation Systems Engineering, (e) Water Resources Engineering and Management, (f) Environmental Engineering and (g) Earth System Science and Engineering. The Minor Programme in Civil Engineering is aimed to provide the flavour of the different specializations through highlighting the practical applications of the basic principles. On completion of the Minor Programme, a student should be able to appreciate the engineering aspects and background of civilian infrastructure in any country.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Fundamentals of Structural Analysis and Design	3 - 0 - 0 - 6	The course aims to provide an overview of structural analysis and design for students from disciplines other than Civil Engineering. It starts from the basics of structural mechanics through illustration of bending, shear and axial stresses. Then it is extended to the member level behaviour through beams, trusses, frames, cables and arches. Finally, the structural design philosophy is explained along with the application in reinforced concrete and steel structures.
III	Introduction to Geotechnical Engineering	3 - 0 - 0 - 6	This course intends to acquaint the students with the basics of geotechnical engineering. It starts with the introduction of soil mechanics, and then moves to the application part with examples of retaining walls and different types of foundations.
IV	Infrastructure and Transportation Systems Planning	3 - 0 - 0 - 6	This course aims to introduce the key concepts of planning and management of infrastructure projects. Secondly, the engineering and management of one of the key infrastructure sectors, transportation projects, will be explained. The overview of application part relating to highway infrastructure projects starting from fixing of alignment to highway design, pavement evaluation and traffic engineering, is intended to be provided to the students.
V	Water Resources Engineering and Management	3 - 0 - 0 - 6	The course is aimed to provide the students an overview of water resources engineering and management. The different aspects of surface water hydrology, groundwater hydrology and open channel hydraulics as well as watershed management and

			sediment transport, will be illustrated with practical examples.
VI	Ecology and Environment	3 - 0 - 0 - 6	This course intends to provide overview of different aspects of environmental science, natural resources, ecosystem, environmental pollution and environmental management. It describes the uses and effects of overexploitation of natural resources i.e., forest, water, mineral, food, energy and land. Different ecosystems, their functions and characteristics are highlighted with practical examples. It describes the importance and value of biodiversity and its conservation. It deals with the various types of pollution and hazards and their management, taking into account the technical and social aspects. The sources, effects and control of global environmental threats, e.g., acid rain, greenhouse effects and global warming, are highlighted. Finally, the importance of environmental laws and legislations, is introduced to the students.

5. List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.

S. No.	UG Programme	Justification
	Civil Engineering	Overlap in Courses

Minor Programmes

1. **Name of the Academic Division: Electronics and Electrical Engineering**
2. **Discipline (Title) of the Minor Programme: Electronics and Communication**
3. **Preamble of the Minor Programme:**

The program aims to introduce students to the basic ideas of electronics and communications engineering. The courses are aimed at giving the students a rigorous introduction to the subjects and research areas of the program.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
II	Analog Circuits	3-0-0-6	Introduces the students to analog circuit design.
III	Digital Circuits	3-0-0-6	Introduces the students to digital circuit design.
IV	Electromagnetic Field Theory	3-0-0-6	Introduces the students to electromagnetic fields and wave propagation.
V	Signal Processing	3-0-0-6	Introduces basic signal processing ideas
VI	Communication Systems	3-0-0-6	Introduces information and communication theory

5. **List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.**

S. No.	UG Programme	Justification
1	BTech (ECE)	Significant overlap in courses
2	BTech (EEE)	Significant overlap in courses

Minor Programmes

1. **Name of the Academic Division:** Physics Department
2. **Discipline (Title) of the Minor Programme:** Quantum Technology
3. **Preamble of the Minor Programme:**

Brief description of the programme. The coverage, target and outcomes, etc.

This minor program would be offered to second semester B. Tech students (all disciplines) as the target audience. This would give the students a much-needed exposure to quantum engineering and thereby stimulate them to take quantum technology as a career. This activity will provide an extra dimension in quantum optics study and research in the country of Raman, especially in the north-eastern region.

4. **Curriculum of the Minor Programme**

Semester	Course Title	Credit Structure	Brief Description of the Course
2nd	**Mathematical Foundations of Quantum Computing**	3-0-0-6	**Probability and Statistics**: Introduction to Statistics, Data Representation, Random Variables and Probability Distributions [8]; **Mathematical Tools for Quantum Computing**: Function Spaces and Basic Operators, Fourier Transform [6]; vectors and vector spaces, inner products, norms and orthogonality, matrices and linear transformations [8]; **Introduction to Computational Models**: Classical Bits vs Information Representation, Introduction to Algorithms and Computational thinking, Basics of Boolean Algebra, Logic Gates and Circuits, Limitations of Classical Computation [18].
3rd	**Foundation of Quantum Technologies**	3-0-0-6	**Quantum Computation:** Basics of qubits, Basics of qubit gates and quantum circuits, Physical implementation of qubits, Overview of applications and recent achievements [12]; **Quantum Sensing**: Basics of quantum sensing, Basics of Photon, State of the art in Quantum Sensing [6]; **Quantum Communications**: Basics of digital communication [3], Quantifying classical information – Shannon entropy, Basic ideas of quantum communication [10], security, eavesdropping, Overview of quantum communication achievements [9].
4th	**Quantum Technologies and Applications**	3-0-0-6	Quantum Mechanics: Postulates of Quantum Mechanics [4],Density operator formalism of quantum mechanics – pure and mixed states [3],Superposition and Entanglement in quantum mechanics [3],No cloning theorem,Applications of postulates [2], Number states, ladder operators [4] and Coherent states of a harmonic oscillator [2],Spin and Angular momentum – spin half particles [3],Rabi problem of a spin-half particle in a rotating magnetic field [3]; Statistical Physics:Quick review of first and second laws of thermodynamics [1], Thermal Equilibrium and Gibbs principle,Applying Gibbs principle [2] to Classical and Quantum harmonic oscillators [3],Bosons and Fermions and Quantum statistics [2];Information Science:Digital communication and information [1],Basic ideas of quantum information [3],Decoherence and noise [3],Introductory ideas of Kraus operator [2];Brief overview of Computational Complexity [1]

5th	Quantum Computation	3-0-0-6	Computer Architecture Basics: Principles of Computer Design [2], Basic Computer organization and Microprocessor [3], Memory Hierarchy [1] Review of Turing Machines and Classical Computational Complexity [2]; Qubits versus classical bits [3]; Quantum correlations [3];Introduction to Quantum computational models [2];Universal quantum logic gates [3] and circuits [3], Gate Universality and examples[2]; Quantum algorithms [2]; Quantum Fourier Transform and prime factorization [6]; Database search [3];Quantum complexity classes [2];Additional Topics in Quantum Algorithms [2];Introduction to Error correction[3]
6th	Basic Laboratory Course for Quantum Technologies **OR**	0-0-6-6	Experiments based on advanced RF and microwave electronics, quantum optics, quantum noise and quantum computing. Hands on skill development towards laboratory equipment interfacing and automation.
	Quantum Technology Numerical Laboratory	0-0-6-6	The detailed syllabus will be made available at a later point

5. List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.NA

S. No.	UG Programme	Justification
1	**B.Des (Bachelor of Design)**	These students do not take any Mathematics and Physics course in first semester and so they will not have basic knowledge required for the course in the minor programme.