

**INDIAN INSTITUTE OF TECHNOLOGY MANDI**  
**KAMAND, DISTT. MANDI – 175075 (HIMACHAL PRADESH)**



**MINUTES OF 49<sup>TH</sup> BOARD OF ACADEMICS MEETING**

VENUE	:	GUEST HOUSE (NC) CONFERENCE ROOM + ONLINE
DATE	:	28 <sup>TH</sup> MARCH, 2023 (TUESDAY)
TIME	:	10:00 A.M.

**Following members attended the meeting**

Sl. No	Responsibilities	Name
1	Dean Academics	Prof. Rahul Vaish
2	Associate Dean (Research)	Dr. Amit Jaiswal
3	Associate Dean (Courses)	Dr. P. Anil Kishan
4	Chairman Senate Library Committee	Prof. Rahul Vaish
5	Chairman Course Proposal Committee	Dr. Venkata Uday Kala
6	Nominee-1: School of Computing and Electrical Engineering	Dr. Padmanabhan Rajan
7	Nominee-2: School of Computing and Electrical Engineering	Dr. Gopi Shrikanth Reddy
8	Nominee-1: School of Chemical Sciences	Dr. Bhaskar Mondal
9	Nominee-2: School of Chemical Sciences	Dr. Garima Agrawal
10	Nominee-1: School of Biosciences and Bioengineering	Dr. Sumit Murab
11	Nominee-2: School of Biosciences and Bioengineering	Dr. Kasturi Prasad
12	Nominee-1: School of Mathematical and Statistical Sciences	Dr. Rajendra K Ray
13	Nominee-2: School of Mathematical and Statistical Sciences	Dr. Syed Abbas
14	Nominee-1: School of Civil and Environmental Engineering	Dr. Maheshreddy Gade
15	Nominee-2: School of Civil and Environmental Engineering	Dr. Prasanna Rousseau
16	Nominee-1: School of Mechanical and Materials Engineering	Dr. Gaurav Bhutani
17	Nominee-1: School of Humanities & Social Sciences	Dr. Rajeshwari Dutt
18	Nominee-2: School of Humanities & Social Sciences	Dr. Ramna Thakur
19	Nominee-1: IKSHMA	Dr. Aniruddha Chakraborty
20	Nominee-2: IKSHMA	Dr. Sumit Murab
21	Academic Affairs Secretary	Mr. Naveen S. Thota
22	Deputy Registrar (Academics): Secretary	Mr. Suresh Rohilla

**Following members could not attend the meeting**

Sl. No.		Name	
1	Nominee-1: School of Physical Sciences	Dr. Arko Roy	Member
2	Nominee-2: School of Physical Sciences	Dr. Girish Sharma	Member
3	Nominee-2: School of Mechanical and Materials Engineering	Dr. Sudhir Pandey	Member
4	Nominee-1: Centre of AI and Robotics	Dr. Narendra Kumar Dhar	Member
5	Nominee-2: Centre of AI and Robotics	Dr. Jagadeesh	Member
6	Industry Member – 1	Dr. Nadeem Akhtar	Member
7	Research Affairs Secretary	Mr. Shubham Ranjan	Member

**Special Invitee**

<b>Sl. No.</b>	<b>Name</b>	
1	Dr. Sandip Kumar Saha	Asst. Prof. SCENE
2	Dr. Satvasheel Powar	Asso. Prof. SMME
3	Dr. Mrityunjay Doddamani	Asso. Prof. SMME
4	Dr. Anirban Sarkar	Asst. Prof. SCEE
5	Dr. Muslim Malik	Asso. Prof. SMSS
6	Prof. Manoj Thakur	Prof., SMSS
7	Dr. Shyam K Masakapalli	Asso. Prof. SBB
8	Dr. Varun Dutt	Asso. Prof. SCEE
9	Dr. Arnav Bhavsar	Asso. Prof. SCEE
10	Dr. Dericks P. Shukla	Asso. Prof. SCENE
11	Dr. Shyamasree Dasgupta	Asso. Prof. SHSS
12	Dr. Kaushik Halder	Asst. Prof. SCEE

## PART-A

### (Issues discussed by the Board of Academics when the Student Members were present)

#### 49.1 Confirmation of the minutes of 48<sup>th</sup> meeting of the Board of Academics:

The minutes of the 48<sup>th</sup> meeting of the Board of Academics held on 10<sup>th</sup> January, 2023 were confirmed.

#### 49.2 To consider the proposal of BS credit structure:

Prof. Pradeep Parameswaran, Chair of School of Chemical Sciences presented a proposal to the Board of Academics regarding BS Credit Structure in Chemical Sciences. After due deliberations, the BoA recommended the given below proposal for consideration of the Senate and its approval.

Division	Sub-Division	BS Credit	BS-MS Credit
Institute Core Courses (IC)	IC Compulsory	As per the institute's 1 <sup>st</sup> year B.Tech. Curriculum with courses from IC/HSS/Management baskets as per the requirements of a specific BS program	
	IC Basket		
	Humanities and Management		
	IKSHMA		
Discipline Courses*	Discipline Core	Min. 50	Min. 50
	Discipline Electives (DE)	Min. 12	Min. 18
Free Electives and Research Projects	Free Electives (FE)	Min. 12	Min. 12
	Research Communications and Projects/DE	Min. 12	Min. 38
	<b>Total Credit</b>	<b>160-163</b>	<b>192-201</b>

\*Total credits for Discipline Core and Electives should not exceed 85.

#### 49.3 To consider the proposal by School of Chemical Sciences to update BS Chemical Science, as per BS credit structure:

Prof. Pradeep Parameswaran, Chair of School of Chemical Sciences presented the proposal to update BS Chemical Sciences as per BS credit structure. After due deliberations, the BoA approved the proposal with minor modification and the same shall be reported to the Senate.

The modified proposal is placed as **Annexure – A**.

#### 49.4 To consider the proposal of B.Tech. in General Engineering branch:

Dr. Satvasheel Powar, presented a revised proposal to start a new branch in B.Tech. in General Engineering. After due deliberations, the BoA recommended the proposal with minor modifications for consideration of the Senate and its approval.

The modified proposal is placed as **Annexure – B**.

#### 49.5 To consider the proposal of B.Tech. in Maths and Computing branch:

Dr. Muslim Malik, Chair SMSS, presented a revised proposal to start a new branch in B.Tech. in Maths and Computing. After due deliberations, the BoA suggested to sort the execution issues and USP of the programme needs to be considered. Along with the support of SCEE, the proposal may be considered in future. The modified proposal is placed as **Annexure-C** for consideration of Chairman, Board of Academics.

**49.6 To consider the proposal of five years Integrated MBA programme:**

Dr. Manoj Thakur, Chair SoM, presented the proposal of five years Integrated MBA programme. After due deliberations, the BoA recommended the proposal with minor modification for consideration of the Senate and its approval.

The modified proposal is placed as **Annexure – D.**

**49.7 To consider the proposal of revision of Comprehensive Examination in Ph.D. programme:**

Dr. Shyamasree Dasgupta, Chair SHSS presented the proposal of revision of Comprehensive Examination in Ph.D. programme. After due deliberations, the BoA recommended the proposal with minor modification for consideration of the Senate and its approval.

The modified proposal is placed as **Annexure – E.**

**49.8 To consider the proposal of execution of Minor/specialization in B.Tech. programme:**

Dr. Padmanabhan Rajan, presented the proposal of execution of Minor/specialization in B.Tech. programme. After due deliberations, the BoA approved the guidelines given below and the same shall be reported to the Senate.

1. Students intending to do a minor at the beginning of the 3<sup>rd</sup> semester, keeping in mind the prerequisite of courses. This should be done preferably via a facility in the OAS.
2. This information is to be shared with the schools involved so that they can plan for the corresponding courses involved in the minor.
3. The schools will then indicate how many students they can accommodate in the courses.
4. If possible, the schools can try to offer minor related courses every semester, so that students get multiple opportunities to complete the minor.

**49.9 To consider the proposal of committee on guidelines of B.Tech. (Honours) in UG Programme:**

Dr. Shyam K Masakapalli, Committee Chair presented the proposal on modified guidelines of B.Tech. (Honours) in UG programme. After due deliberations, the BoA recommended the proposal with minor modification for consideration of the Senate and its approval.

The modified proposal is placed as **Annexure – F.**

**49.10 To consider the proposal of Thesis credit structure for M.Tech.(R)/Ph.D. programmes:**

Dr. Sandip Saha, Committee Chair presented the proposal of thesis credit structure for M.Tech. (R)/Ph.D. programmes. After due deliberations, the BoA recommended the proposal for M.Tech. (Research) not for Ph.D. The same is recommended with minor modification for consideration of the Senate and its approval.

The modified proposal is placed as **Annexure – G.**

**49.11 To consider the proposal of selection of Discipline Elective courses and its execution:**

Dr. P Anil Kishan, Associate Dean (Courses), presented the proposal of selection of Discipline Elective courses and its execution in B.Tech. programmes. After due deliberations, the BoA approved the proposal with minor modification and the same shall be reported to the Senate.

The modified proposal is placed as **Annexure –H.**

**49.12 To consider the proposal to establish a new centre Human-Computer Interaction (HCI) at IIT Mandi:**

Dr. Varun Dutt, presented the proposal to establish a new centre Human-Computer Interaction (HCI) at IIT Mandi. After due deliberations, the BoA recommended the proposal with minor modification for consideration of the Senate and its approval.

The modified proposal is placed as **Annexure – I.**

**49.13 To consider the proposal of update in B.Tech. Ordinances & Regulations:**

The proposal cannot be presented to BoA.

**49.14 To consider the proposal of five years B.Tech-M.Tech Integrated Dual Degree in Bio-Engineering to B.Tech. four years:**

Dr. Shyam K Masakapalli, Chair SBB, presented the proposal of five years B.Tech.-M.Tech. Integrated Dual Degree in Bio Engineering to B.Tech. four-year degree programme. After due deliberations, the BoA approved the proposal with minor modification and the same shall be reported to the Senate.

The proposal is placed as **Annexure – J.**

**49.15 To consider the proposal of curriculum revision of B.Tech-M.Tech integrated Dual Degree in Bio-Engineering:**

Dr. Sumit Murab, presented the proposal of revised curriculum of B.Tech-M.Tech. Integrated Dual Degree in Bio Engineering programme. After due deliberations, the BoA approved the proposal with minor modification and the same shall be reported to the Senate.

The modified proposal is placed as **Annexure – K.**

**49.16 To consider the proposal of modification in ISTP, MTP, Outside Electives, Free Electives etc. in UG and PG programmes:**

Dr. P Anil Kishan, Associate Dean (Courses) presented the proposal of modification in ISTP, MTP, Outside Electives, Free electives etc. in UG and PG programmes. After due deliberations, the BoA approved the proposal with minor modification and the same shall be reported to the Senate.

The modified proposal is placed as **Annexure – L.**

**49.17 Any other item with the permission of the Chair.**

With the permission of the Chairman, the BoA deliberated on the following points:

- (i) **To consider the proposal of modification in the B.Tech. 2019 (Electrical Engineering) branch students to consider the listed courses as DE:**

Dr. Gopi Shrikanth Reddy, Nominee from SCEE, presented the proposal of modification in the B.Tech. 2019 Electrical Engineering branch students to consider the following courses as Discipline Elective:

BE-502	Design and Analysis of Bioalgorithms
DS-201	Data Handling and Visualisation
DS-303	Statistical Foundation of Data Science
DS-401	Optimisation for Data Science
DS-403	Introduction to Statistical Learning
DS-404	Information Security and Privacy
EN-504	Energy: Environment Policy and Law
ET-501	Power Electronic Applications in Electric Transportation
ET-502	Embedded System and IoT for E-Transportation
ET-503	Electric Machine and Drives in Electric Transportation

After due deliberations, the BoA approved the proposal with minor modification and the same shall be reported to the Senate.

- (ii) **To consider the proposal of revised Course Proposal Process:**

Dr. P Anil Kishan, Associate Dean (Courses) presented the proposal of revised Course Proposal Process. After due deliberations, the BoA approved that the current CPC Chair will complete the CPC process of the pending courses, before the new course proposal process starts.

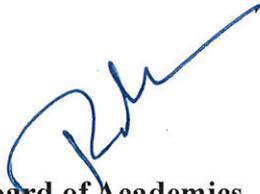
The modified proposal is placed as **Annexure – M.**

**PART-B**

**(Issues discussed by the BoA without the Student Members being present)**

**-NIL-**

The meeting ended with a vote of thanks to and by the Chair.



**Chairman, Board of Academics**



**Secretary, Board of Academics**

Annexure-A

**Academic Plan**

for

**4-Year Bachelor (BS) with Optional 1-Year Masters**

**(MS)**

in

**Chemical Sciences**

with

*Specialization in*

Organic, Inorganic, Physical, and Materials Chemistry and

*Minor in*

(Computer Science & Engineering, Communication  
Engineering, Management, German Language, etc.)



School of Chemical Sciences (SCS)

Indian Institute of Technology Mandi

Mandi, HP-175075

## Table of Contents

Sl. No.	Section Title	Page No.
<b>1</b>	<b>Introduction</b>	
	1.1. Preamble of the program	3
	1.2. Objective of the program	3
	1.3. Uniqueness of the Program	3
	1.4. Placement Prospect	4
<b>2</b>	<b>Details of the Program</b>	
	2.1. Admission procedure	4
	2.2. Intake strength	4
	2.3. Duration	4
	2.4. Credits to be earned	4
	2.5. Branch change policy	4
	2.6. Exit option	4
	2.7. Graduation requirements	5
<b>3</b>	<b>Overview of the Program and Credit Distribution</b>	
	3.1. Overall credit distribution	5
	3.2. Semester-wise course distribution	6
	3.3. Suggested courses for specialization	7
	3.4. Suggested courses for minors	7

## **1. Introduction**

### **1.1. Preamble of the Program**

The discipline of Chemical Sciences as an integral part of Basic Sciences serves as the basis of critical developments for value-added chemicals, pharmaceuticals, novel materials, understanding biological processes, and establishing the theoretical basis of natural phenomena. The 4-year BS with an optional 1-year MS program (BS-MS) in Chemical Sciences is designed to prepare graduates with a strong foundation in fundamental Chemistry along with Engineering for today's research and technology-driven world. The program creates a perfect harmony between Chemistry and Engineering branches by bridging the gap between chemical, physical, mathematical, computational, data, and engineering sciences. Particularly, owing to the "true" cross-disciplinary nature of the program, it can help advance the knowledge ranging from atomic-level understating of the chemical and biochemical phenomena to designing and developing new molecules, materials, and devices. As the barrier between Basic Sciences and Engineering is fast disappearing with modern innovations and their applications, the BS-MS program in Chemical Sciences can perfectly inculcate the young minds in academia to develop and deploy chemistry-based technologies for the modern world.

### **1.2. Objective of the Program**

The major objective of this program is to train the graduates with fundamental concepts of both Chemistry and Engineering, thereby, equipping them for taking up diverse roles in industry and academia. The program particularly aims at training young minds to creatively think about research and innovation at a very early stage through a diverse range of hands-on projects. The perfect fusion of chemistry and engineering along with specializations and minors in different branches is the goal that will prepare the students for industry and academia and motivate them toward research and innovation.

### **1.3. Uniqueness of the Program**

The BS-MS program offers specialization in chemistry branches, minors in engineering and humanities branches, and is highly research-oriented, which makes the program one of its kind. Particularly, it offers,

- Option for specialization in major chemistry branches, organic, inorganic, physical, and material chemistry through discipline elective courses in the 3<sup>rd</sup> and 4<sup>th</sup> year of BS.
- Option for minors in different branches including Computer Science Engineering, Communication Engineering, Electronics Engineering, Measurement and Instrumentation, Management, German Language, etc.

Due to the research-oriented nature of the program, the graduates get good exposure to research in the desired area as early as in their 4<sup>th</sup> year of the BS program. In addition, the 5<sup>th</sup> year of MS is primarily research-focused with specialized theory courses. Thus, the program presents a unique opportunity for graduates to pursue a research career just after completing the BS.

### **1.5. Placement Prospects**

The BS-MS Chemical Sciences program graduates will have placement opportunities in various chemical, pharmaceutical, and technology industries. In addition, after completing the MS, they will have the opportunity to pursue a research career in a specialized field.

## **2. Details of the Program**

### **2.1. Admission procedure**

The admission has been primarily planned through Joint Entrance Examination (Advanced).

### **2.2. Intake strength**

As decided by the Institute.

### **2.3. Duration**

BS: 4 years, minimum 8 semesters

BS-MS: 5 years, minimum 10 semesters

### **2.4. Credits to be earned**

A minimum of 163 credits needs to be earned for the BS degree and a minimum of 201 credits needs to be earned for the BS-MS dual degree in Chemical Sciences.

### **2.5. Branch change policy**

The existing B.Tech. branch change policy at IIT Mandi will be applicable to students enrolled in the BS Chemical Science program.

### **2.6. Exit option**

There will be an exit option available after the 4<sup>th</sup> year completing eight semesters for a BS degree in Chemical Sciences.

## 2.7. Graduation requirements

A student can complete the BS degree in Chemical Science by earning a total of 163 credits comprising,

- a. 52 Credits of Institute Core (IC)
- b. 62 Credits of Discipline Core
- c. 20 Credits of Discipline Elective
- d. 15 Credits of Free Elective
- e. 14 Credits of Research Communication and Project\*/Discipline Elective

\*Project is optional and can be fulfilled with discipline electives.

In addition, a student can complete the BS-MS degree in Chemical Sciences by earning an additional 38 credits comprising of,

- a. 6 Credits of Discipline Elective
- b. 32 Credits of MS Project

To avail of one of the following specializations in organic, inorganic, physical, and material chemistry, a minimum of 12 credits of elective courses in the required area must be completed with a minimum CGPA of 7.0.

To successfully complete a minor, a student needs to take at least 9 credits out of the courses defined in the corresponding minor basket with a with a minimum CGPA of 7.0.

## 3. Overview of the Program and Credit Distribution

### 3.1. Overall credit distribution

The overall credit distribution is tabulated below following the proposed general credit structure of the IIT Mandi BS-MS Regulation (R.3.7).

Division	Sub-Division	BS Credit	BS-MS Credit
Institute Core Courses (IC)	IC Compulsory	As per the institute's 1 <sup>st</sup> -year B.Tech. curriculum with IC-I (Chemistry and Biotech. courses Compulsion) and IC-II (Physics Compulsion)	
	IC Basket		
	Humanities and Management		
	IKSHMA		
Discipline Courses	Discipline Core	62	62
	Discipline Electives (DE)	20	26
Free Electives and Research Projects	Free Electives (FE)	15	15
	Research Communication and Projects/DE	14	46
<b>Total Credit</b>		<b>163</b>	<b>201</b>

### 3.2. Semester-wise course distribution\*\*

The semester-wise credit distribution is tabulated below

1 <sup>st</sup> and 2 <sup>nd</sup> Year (Total Credit: 84)			
Semester-I		Semester-II	
• Math-I Calculus (IC)	2	• Math-III Linear Algebra (IC)	2
• Math-II Complex and Vector Calculus (IC)	2	• Math-IV ODE & Integral Transform (IC)	2
• Graphics for Design (IC)	4	• Applied Electronics (IC)	3
• Computing and Data Science (IC)	4	• Applied Electronics Lab (IC)	2
• IC-I Basket (Chemistry Compulsion)	3	• Data Science II (IC)	4
• HSS Course (HSS Basket)	3	• IC-II Basket (Physics Compulsion)	3
• IKShma (IKS)	3	• Foundations of Design Practicum (IC)	4
		• Physics Practicum (IC)	2
	21		22
Semester-III		Semester-IV	
• Understanding Biotech. and Its Application (IC-I)	3	• Discipline Elective II (DE)	2
• Physical Chemistry-I (CY)	3	• Physical Chemistry-II (Quantum & Spec.) (CY)	3
• Basic Organic Chemistry (CY)	3	• Analytical Chemistry (CY)	3
• Principles of Inorganic Chemistry (CY)	3	• Discipline Elective III (DE)	3
• Discipline Elective I (DE)	3	• Organic Chemistry Lab (CY, Lab-II)	2
• Physical Chemistry Lab (CY, Lab-I)	2	• Inorganic Chemistry Lab (CY, Lab-III)	2
• HSS Course (HSS Basket)	3	• HSS Course (HSS Basket)	3
		• Free Elective I (FE)	3
	20		21

3 <sup>rd</sup> and 4 <sup>th</sup> Year (Total Credit: 79)			
Semester-V		Semester-VI	
• Organic Reactions & Mechanisms (CY)	3	• Photochemistry & Pericyclic Reactions (CY)	3
• Chemistry of Main Group Elements (CY)	3	• Chemistry of Transition Elements (CY)	3
• Advanced Quantum Chemistry (CY)	3	• Symmetry and Group Theory (CY)	3
• Discipline Elective IV (DE)	3	• Stereochemistry and Asymmetric Synthesis (CY)	3
• Physical Chemistry Laboratory (CY)	3	• Discipline Elective V (DE)	3
• Inorganic Chemistry Laboratory (CY)	3	• Organic Chemistry Laboratory (CY)	3
• Research Literature Presentation I (P)	P/F(1)	• Research Literature Presentation II (P)	P/F(1)
	19		19
Semester-VII		Semester-VIII	
• Discipline Elective VI (DE)	3	• Reaction Dynamics, Kinetics & Catalysis (C)	3
• Chemical & Statistical Thermodynamics (C)	3	• Heterocyclic Chemistry (C)	2
• Introduction Organometallic Chemistry (C)	3	• Discipline Elective VII (DE)	3
• Free Elective II (FE)	3	• Free Elective IV (FE)	3
• Free Elective III (FE)	3	• Free Elective V (FE)	3
• Undergraduate Research Project I* (P)	6	• Undergraduate Research Project II* (P)	6
	21		20

\*Research Lab I and II in the 7<sup>th</sup> and 8<sup>th</sup> semesters is optional, students can opt for discipline electives in place of the research lab if they wish to.

5 <sup>th</sup> Year (Total Credit: 38)			
Semester-IX		Semester-X	
• Discipline Elective VI (DE)	3	• Discipline Elective VII (DE)	3
• Postgraduate Project - I (PGP-I)	16	• Postgraduate Project - II (PGP-II)	16
	19		19

\*The two discipline elective courses at the MS level 9<sup>th</sup> and 10<sup>th</sup> semesters (6 credits) can be completed before without violating the maximum allowed credit in a semester to have more time for MS projects in the 5<sup>th</sup> year.

\*\*Specific course names, content, and credit structure (L-T-P-C) for the 1<sup>st</sup> and 2<sup>nd</sup> year CY courses are being worked out.

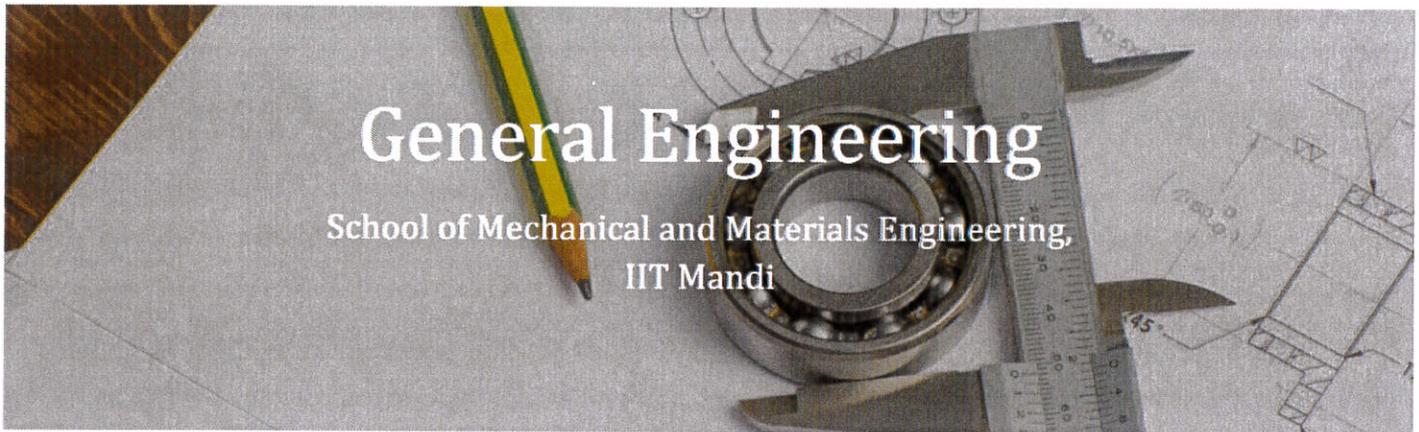
### 3.3. Required courses for chemistry specializations

For specialization in a specific chemistry branch, students need to complete at least *12 credits* from discipline electives with the following mandatory courses (to be updated) specific to a branch.

Organic	Organic Spectroscopy Natural Product Synthesis Asymmetric Organic Synthesis Reagents in Organic Synthesis
Inorganic	Advanced Inorganic Spectroscopy Bioinorganic Chemistry - -
Physical	Computational Chemistry Basic and Applied Electrochemistry Numerical Methods, Computer Programming, Data Analysis -
Material	Science and Technology of Nanomaterials Introduction to Polymer Science & Technology Hydrogen Generation and Storage Applied Polymer and Material Chemistry

### 3.4. Suggested courses for minors

As per the institute's B.Tech. curriculum requirements. Students can select the free electives as per the minor requirements to obtain minor in a specific branch.



## Comments from last senate meeting

1. There should not be conventional UG specialization associated with this degree programme.
2. There should be inputs from the Industries and placement cell about the job prospectus
3. There should be a USP of the programme w.r.t existing similar program in other IITs.
4. The committee may explore specialization in the discipline of Liberal Art, photography, fashion design, filmmaking, product design, etc. In this regard collaboration with NIFT, CEPT etc. desirable where students can spend one year.
5. Committee may explore the execution of these specializations with sister institutions.

## General Engineering

A general engineering programme is a interdisciplinary programme that gives students a foundation of theoretical and practical knowledge for a career in engineering. through active learning, an interdisciplinary approach, and collaboration with industry/academia for specialization.

## Programme Structure

Course Type	Current credits	Proposed credits
IC course	39	39
Basket of IC course	6	6
HSS courses	12	12
IKS	3	3
Discipline Core	33	36
Discipline electives	33	
Free Electives	22	22
ISTP	4	4
MTP in specialization	8	8
Specialization courses + Internship		30
<b>Total</b>	<b>160</b>	<b>160</b>

## General Engineering Programme Structure

- Students will complete the Institute core (compulsory for all branches) and General Engineering Discipline courses for the first two years, before selecting a specialization.
- During their third and final year of study, they will take courses related to their chosen specialization and free electives.
- The students will spend a year with a collaborating institute in their chosen field of specialization.

## Institute Core Courses

Course Name
Calculus
Complex Variables and Vector Calculus
Linear Algebra
ODE & Integral Transforms
Internship
Engineering Graphics
Introduction to Python and Data Science
Probability and Statistics
Machine Learning
Design Practicum
Applied Electronics
Applied Electronics Lab
Physics Practicum
Environmental Science
Data Structures and Algorithms

## General Engineering Discipline core courses

Course Name		Credits
Reverse Engineering (Mech)	0-0-2-1	1
Reverse Engineering	0-0-2-1	1
Electrical Systems Around Us	3-0-2-4	4
Materials Science for Engineers	3-0-0-3	3
Measurement and Instrumentation	2-0-2-3	3
Mathematical Foundations of Data Science	3-1-0-4	4
Artificial Intelligence	3-0-0-3	3
Engineering economics	3-0-0-3	3
Mechanics of Rigid Bodies	3-0-0-3	3
Thermodynamics	3-0-2-4	4
Essentials of Entrepreneurship	3-0-0-3	3
Communication Systems	3-0-2-4	4

## B Tech in General Engineering (with Specialization in ABC) - Specialization options (Phase I)

<p><b>Fashion:</b></p> <ul style="list-style-type: none"> <li>• Fashion Management</li> <li>• Fashion Technology</li> <li>• Sustainable fashion/textile Design</li> <li>• Fashion accessory Design</li> <li>• Functional Fashion Design</li> <li>• ERP for the Fashion industry</li> </ul> <p><b>Design:</b></p> <ul style="list-style-type: none"> <li>• Photography</li> <li>• Graphic Design (UI/UX)</li> </ul>	<p><b>Nascent Engineering:</b></p> <ul style="list-style-type: none"> <li>• Robotics and AI</li> <li>• Advanced Manufacturing</li> <li>• E-Mobility</li> <li>• Energy Engineering</li> </ul> <p><b>Innovation and Entrepreneurship</b></p> <ul style="list-style-type: none"> <li>• Entrepreneurship</li> <li>• Product Design</li> <li>• Business management</li> </ul>
<p><b>For a specialization, student(s) must complete 36 credits in the specified field</b></p>	

## B Tech in General Engineering (with Specialization in ABC) - Specialization options (Phase II)

<p><b>Film:</b></p> <ul style="list-style-type: none"> <li>• Film making</li> <li>• Film and video communication</li> <li>• Animation Film</li> </ul> <p><b>Design</b></p> <ul style="list-style-type: none"> <li>• Industrial Design</li> </ul> <p><b>Administration:</b></p> <ul style="list-style-type: none"> <li>• Political Science Engineering</li> <li>• Economics</li> </ul>	<p><b>Nascent Engineering:</b></p> <ul style="list-style-type: none"> <li>• Sustainability Engineering</li> <li>• Quantum Engineering</li> </ul> <p><b>Indian Knowledge System</b></p> <ul style="list-style-type: none"> <li>• Liberal Arts</li> <li>• Vedic studies</li> </ul>
<p><b>For a specialization, student(s) must complete 36 credits in the specified field</b></p>	

## Collaborations for specializations

 	<p><b>National Institute of Fashion Technology</b></p> <ul style="list-style-type: none"> <li>• Fashion Management</li> <li>• Fashion Technology</li> <li>• Sustainable fashion/textile Design</li> <li>• Photography</li> <li>• Graphic Design (UI/UX)</li> <li>• Fashion accessory Design</li> <li>• Functional Fashion Design</li> <li>• ERP for the Fashion industry</li> </ul> <p><b>Dalarna University, Sweden</b></p> <ul style="list-style-type: none"> <li>• Energy Engineering</li> <li>• Economics</li> <li>• Information Systems</li> </ul>	
--	---	---

## Potential Collaborations for specializations



### National Institute of Design (Ahmedabad, Gandhinagar, Bengaluru)

- Film and video communication
- Graphic Design
- Animation Film
- Photography
- Product Design
- Industrial design



### Film and television Institute, Pune

- Sound recording and Television Engineering
- Electronic Cinematography
- Art Direction
- Screen Writing
- Screen acting



## Specialization Courses for Energy Engineering

Course Name
Renewable Power Generation
Active Power Grids
Industrial Heating Technology
Energy Efficiency
Energy Systems
Scientific Methods
The Environmental Impact of Energy Systems
MTP

## Specialization Courses for Advanced Manufacturing Engineering

Course Name
ME308 - Manufacturing Engineering
ME351 - Management of Manufacturing and Logistics Systems
ME515 - Carbon Materials and Technology
ME510 - Advanced Manufacturing Processes
ME2XX - PMT
ME524 - Additive Manufacturing
ME635 - Manufacturing for Energy Systems
ME509 - Nanomanufacturing
CAD for Additive Manufacturing
Process modelling in Additive Manufacturing
Design for Manufacturing and Assembly

## Specialization courses for e- Mobility

Course Name
Power Electronics
Power Electronics Lab
Fundamentals of Electric Drives
Practicum on Electric Drives
Advanced Electric Drives
Practicum on Advanced Electrical Drives
Systems Design for Electric Vehicle
Embedded Systems and IoT for E-Transportation
Power Electronic Applications in Electric Transportation
Electrical Machine and Drives in Electric Transportation
Laboratory course on Power Electronics and Electrical Drives
Vehicle Design and Dynamics
Laboratory course on Vehicle Design and Control
Electrochemical Systems for Energy Engineering
Energy Storage Technologies
Laboratory course on Energy Storage Technologies
Modeling, Simulation and Control of HEV

## Specialization courses for Product Design

Course Name
IC141 - PMT
ME308 - Manufacturing Engineering
ME523 – Product design
ME524 - Additive Manufacturing
Design thinking
User Experience & Interaction Design
Graphics Design, Animation & VFX
Introduction to Human Factors (Ergonomics & Anthropometry)
Marketing Research & Marketing
Intellectual property rights
Visualisation & Drawing Techniques
Introduction to Indian Craft Techniques

## Specialization courses for Robotics and AI

Course Name
Robotics and control
Robot Kinematics, Dynamics and Control
Mobile Virtual Reality and Artificial Intelligence
Deep Learning and Applications
Advanced Topics in Deep Learning
Advanced Design Practicum
Data Mining for Decision Making
Introduction to Computer Vision
Digital Image Processing
Mechatronics
Robot Programming, Modeling and Simulation
Principles of Robot Autonomy
Deep Learning for Robotics

**Courses for the other specializations are under discussion with collaborating Institutes**

## USP of the Programme

- Flexibility: Choice of a variety of specialization
- interdisciplinary
- Variety of career options
- Easier to keep up with evolving job market and new trends through specializations
- Compulsory year-long exchange program/internship
- It might fulfil the growing demand for interdisciplinary experts and/or specialists in nascent engineering fields

# Proposal for B. Tech. in Mathematics and Computing



**School of Mathematical and Statistical Sciences  
(SMSS)**

**Indian Institute of Technology Mandi**

## Programme Proposal Form

**Name of the New Proposed Program:** B.Tech. in Mathematics and Computing (Four Years Undergraduate Program)

**I. General Information:**

Name (s) of prosper school: School of Mathematical and Statistical Sciences (SMSS)

**II. Program Description:**

**A. Provide a justification/rationale for the program. How does the program relate to the mission of the IIT Mandi?**

The Bachelor of Technology (B.Tech.) program in Mathematics and Computing is a comprehensive course that integrates the principles of mathematics and computing. This program is designed to equip students with a strong foundation in mathematics, computing, and computational thinking, enabling them to develop and apply analytical and problem-solving skills in a variety of fields in science and engineering. The aim of this program is two-fold, one to provide strong mathematical background for strong logical thinking, and other to prepare students for strong computing skills. The mathematics part will also give them strong foundation which enable them to be leader in the field. The program is design in such way that after important foundational courses, students can choose courses as per their interest in a particular domain.

The program aims to produce graduates who are well-versed in a broad range of mathematical and computational concepts, techniques, and tools. With the help of these skills, students can handle complex real-world problems. It will also enhance the ability of the students looking for solving new challenges in the society. With a focus on both theoretical and practical aspects of mathematics and computing, this program prepares students for a wide range of careers in industries, academia and research & development.

**B. SWOT analysis of the program**

The purpose of SWOT analysis is to see how B.Tech. in Mathematics and Computing can be implemented in the IIT Mandi's education system.

<b>ADVANTAGES (Strengths-Opportunities)</b>	<b>DISADVANTAGES (Weakness - Threats)</b>
This program is designed to equip students with a strong foundation in mathematics, computing, and computational thinking, enabling them to develop and apply analytical and problem-solving skills in a variety of fields in science and engineering.	Needs to recruit more faculty members in the core areas of Computational Mathematics and Scientific Computing.
The program aims to produce graduates who are well-versed in a broad range of mathematical and computational concepts, techniques, and tools, through which they can handle complex real-world problems. So, the	Dedicated teaching labs for providing hands on training to UG students in computational aspects of different engineering branches.

program is design in such way that after important foundational courses, students can choose courses as per their interest in a particular domain.	
With a focus on both theoretical and practical aspects of mathematics and computing, this program prepares students for a wide range of careers in industries, academia and research & development.	
Very good job market in the core areas of Scientific Computing and Numerical Computing and soft computing.	

### C. Justification with respect to New National Education Policy (NEP) mandates

One of the major key points of the new national education policy (NEP) is transformational reforms in school and higher education systems in the country and also to foster interdisciplinary education, and learning by doing. In the proposed B.Tech. program, greater emphasis is given to connection between the fundamentals and analytical abilities, critical thinking, and real-life problem solving. The program is designed in such a way that students should get a strong foundation in mathematics, scientific computing, and computational thinking, which will enable them to develop and apply analytical and problem-solving skills in a variety of fields in science and engineering.

The proposed program aims to produce graduates who are well-versed in a broad range of mathematical and computational concepts, techniques, and tools. With the help of these skills, students can handle complex real-world problems. It will also enhance the ability of the students looking for solving new challenges in the society. With a focus on both theoretical and practical aspects of mathematics and computing, this program prepares students for a wide range of careers in industries, academia and research & development.

### D. Provide a mission statement for the program. Include educational and learning objectives

The Bachelor of Technology in Mathematics and Computing program's mission is to prepare graduates who are well-versed in a broad range of mathematical and computational concepts, techniques, and tools, which can enable the students to solve complex real-world problems. With a focus on both theoretical and practical aspects of mathematics and computing, this program will prepare students for a wide range of careers in industries, academia and research & development.

The educational and learning objectives of the B.Tech. in Mathematics and Computing program are:

- Our graduates will be equipped with a strong foundation in mathematics, computing, and computational thinking, which will enable them to develop and apply analytical and problem-solving skills in a variety of fields in science and engineering.
- Our graduates will be trained to become world leaders in the field of scientific computing with strong fundamentals and analytical abilities, and critical thinking.
- With a focus on both theoretical and practical aspects of mathematics and computing, this program will prepare graduates for a wide range of careers in industries, academia and research & development.

**E. Credit Structure of the program.**

The typical credit structure of the institute will be followed as shown below.

Division	Sub division	Credits
<b>Institute Core</b>	IC Compulsory	39
	IC Baskets	06
	Humanities and Social Sciences (HSS)	12
	Indian Knowledge System (IKS)	03
<b>Discipline</b>	Discipline Core (DC)	52
	Discipline Electives (DE)	15
<b>Electives</b>	Free Electives (FE)	21
	Major Technical Project (MTP)	08
	Interactive Socio Technical Practicum (ISTP)	04
	<b>TOTAL</b>	<b>160</b>

The credit structure will be followed as per the existing norms of the institute. Out of 160 credits, 52 credits will be dedicated to discipline core courses and 15 credits will be assigned for discipline electives. Total of 67 credits will be maintained for discipline (i.e., DC (52 credits) and DE (19 credits)) courses while the rest of the credits will be kept for IC and other institute level courses (93 credits). The semester wise distributions of all the courses along with credits details are given below:

<b>B.Tech. (Mathematics and Computing) –1st Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	ICXXX	Calculus	2	0	0	2
2	ICXXX	Complex variables and Vector Calculus	2	0	0	2
3	IC140	Engineering Graphics	2	0	3	4
4	IC152	Introduction to Python and Data Science	3	0	2	4
5	IC131	Understanding Biotechnology & its Applications (basket - 1)	3	0	0	3
6	IC241	Data Structure & Algorithms (basket-2)	3	0	0	3
7	YYXXX	IKSHMA Course	3	0	0	3
8	ICXXX	Data Structure & Algorithm Lab	0	0	2	1

Total Credits: 22

<b>B.Tech. (Mathematics and Computing) –2nd Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	ICXXX	Linear Algebra	2	0	0	2
2	ICXXX	ODE & Integral Transforms	2	0	0	2
3	IC161	Applied Electronics	3	0	0	3
4	IC 161P	Applied Electronics Lab	0	0	3	2
5	IC252	Probability and Statistics	3	0	2	4
6	ICXXX	Foundations of Design Practicum	1	0	6	4
7	IC221P	Physics Practicum	0	0	3	2
8	HSXXX	HSS Course	3	0	0	3

Total Credits: 22

<b>B.Tech. (Mathematics and Computing) –3rd Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	IC201P	Design Practicum	0	0	6	3
2	IC272	Machine Learning	2	0	2	3
3	MAXXX	Real and Complex Analysis	3	1	0	4
4	CS208	Mathematical Foundation of Computer Sciences	3	1	0	4
5	MA513	Ordinary Differential Equation	3	1	0	4
6	FE	Free Elective				3

Total Credits: 21

<b>B.Tech. (Mathematics and Computing) – 4th Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	MA522	Partial Differential Equation	3	1	0	4
2	CS201	Computer Organization	3	0	0	3
3	CS201P	Computer Organization Laboratory	0	0	2	1
4	MA523	Numerical Analysis	3	1	0	4
5	MA515	Applied Mathematics Programming	3	1	0	4
6	HSXXX	HSS Course				3
7		Discipline Basket -I				3

Total Credits: 22

<b>B.Tech. (Mathematics and Computing) – 5th Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	MAXXX	Matrix Computation & Lab	3	0	2	4
2		Formal Language and Automata Theory	3	0	0	3
3	CSXXX	Design of Algorithms	3	0	2	4
4	DE	Discipline Elective				3
5	MAXXX	Mathematical Modelling	3	0	0	3
6	HSSXXX	HSS or Management course				3
7	MAXXX	Reverse Engineering				1

Total Credits: 21

<b>B.Tech. (Mathematics and Computing) – 6th Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1		Applied Databases Practicum				2
2		Discipline Basket-II	3	0	0	3
3	MA609	Numerics of PDE	3	0	0	3
4	FE	Free Elective	3	0	0	3
5	HSSXX	HSS or Management course				3
6	ISTP	ISTP				4
7	MAXXX	Applied Graph Theory	3			3

Total Credits: 21

<b>B.Tech. (Mathematics and Computing) – 7th Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	DE	Discipline Elective				3
2	FE	Free Elective				3
3	FE	Free Elective				3
4	MTP-1	MTP-1				4
5	IC 010	Internship				2

Total Credits: 15

<b>B.Tech. (Mathematics and Computing) –8th Semester</b>						
S.No	Code	Course Name	Lecture	Tutorial	Practical	Credit
1	DE	Discipline Elective				3
2	FE	Free Elective				3
3	FE	Free Elective				3
4	FE	Free Elective				3
5	MTP-2	MTP-2				4

Total Credits: 16

**Grand Total: 160 credits for B.Tech. Mathematics and Computing**

Two discipline elective baskets are proposed for two discipline electives to give a flexibility to the students to choose their free electives in a particular direction.

Discipline electives Basket-I:

Course Numbers	Course Titles	Credits
MA549 (3)	Abstract Algebra	3
MA521 (4)	Functional analysis	4
MA528 (4)	Measure Theory	4
MA516 (4)	Topology	4
MA552 (3)	Number Theory	3

Discipline electives Basket-II:

Course Number	Course Titles	Credits
MAXXX	Climate Modelling	
MA653 (4)	Computational Financial Modelling & Lab	4
MAXXX	Modelling of infectious disease	
MAXXX	Mathematical Image Processing	
MAXXX	Mathematical Control Theory	
ME620 (3)	Modelling and Simulation	3
MA-705(3)	Modelling Population Dynamics	3

Students can take other discipline electives from the proposed list of the discipline electives. The list will be revised/modified time to time to include new discipline electives.

**Discipline Electives:** Discipline electives will be provided according to the requirement of the students and the availability of the faculties. The list of discipline electives are attached herewith. More elective courses will be added time to time as required.

Course Numbers	Course Titles	Credits
MA-550(3)	Statistical Data Analysis	3
MA-553(3)	Mathematical Foundations of Financial Engineering	3
MA-565(3)	Numerical Methods in Quantitative Finance	3
MA-605(3)	Statistical Data Analysis	3
MA-608(3)	Computational Fluid Dynamics	3
MA-654(3)	Financial Engineering	3
MA-656(3)	Stochastic Calculus for Financial Engineering	3
MA-665(3)	Semigroup of Bounded Linear Operators	3
MA-765 (3)	Topics in Semigroup Theory	3
MA-765(4)	Fractional Differential Equations	4
EE-510 (4)	Mathematical Method for Signal Processing	4
EE-511 (4)	Computer Vision	4
EE-608 (3)	Digital Image Processing	3
CS-580 (4)	Advanced Data Structure and Algorithms	4
CS-609 (3)	Speech Processing	3
CS-669 (3)	Pattern Recognition	3
CS-677 (3)	Soft Computing	3
CS-502 (3)	Compiler Design	3
CS-562 (3)	Artificial Intelligence	3
CS-XXX (4)	Computer Networks	4
CS- XXX (4)	Operating Systems	4
DS-XXX (3)	Time Series Analysis	3

Overall, the credits distribution is as follows:

Total- 160 Credits

Discipline Core- 52 Credits

Discipline Elective- 15 Credits (out of which 6 credits would be chosen from two baskets, i.e., baskets-I and baskets-II)

Free Electives- 21 Credits

Institute Core & other required courses: 72

**Requirements:**

**Lab requirement:** A Computer Lab with 30 computers for first year. Number will be increased with increasing student strength.

**Class rooms requirement:** Two dedicated class rooms with 30 student seating capacities.

**Project Evaluation:** As per institute rule. A continuous evaluation process will be followed to evaluate the project/thesis work progress to award letter grades for the credits assigned to project/thesis component, as mentioned in the institute's Ordinance for B.Tech. program.

**Support Staff requirement:** Minimum two staffs required; one non- technical staff for office work and one technical staff for the Computer Lab.

**Current Faculty strength at SMSS:**

Sl. No.	Name	Designation	Research Area
1	Prof. Syed Abbas	Professor	Differential Equation and Ecological Modelling
2	Prof. Rajendra Kr. Ray	Professor	Computational Fluid Dynamics & Numerical Methods for PDEs, Image Processing
3	Prof. Manoj Thakur	Professor	Optimization, Soft Computing, Machine Learning & its Application to Computational Finance
4	Dr. Muslim Malik	Associate Professor	Differential Equations and Mathematical Control Problems
5	Dr. Nitu Kumari	Associate Professor	Mathematical Modelling, Nonlinear Dynamics, Differential Equations
6	Dr. Sarita Azad	Associate Professor	Statistical Time Series Analysis
7	Dr. Qaiser Jahan	Assistant Professor	Harmonic and Wavelet Analysis
8	Dr. Samir Shukla	Assistant Professor	Applied Topology and Combinatorics
9	Dr. Sampat Kumar Sharma	Assistant Professor	Classical K-theory
10	Dr. Saswata Adhikari	Assistant Professor	Harmonic Analysis
11	Dr. Preeti	Assistant Professor	Operations Research
12	Dr. Amulya Kumar Mahto	Assistant Professor	Statistical Inferences

## Programme Proposal Form

Name of the New Proposed Program: *Integrated MBA Program*

**I. General Information:**

Name (s) of prosper schools/centres: *School of Management*

**II. Program Description:**

**A. Provide a justification/rationale for the program. How does the program relate to the mission of the IIT Mandi?**

**Rationale:**

The last decade saw a tremendous increase in uptake of technology by masses in India, particularly due to affordable access to internet and smart devices. In a game changing event, the pandemic amplified the adoption of digital solutions by businesses of every size. It has implications for the scalability of businesses that were earlier deemed to be unviable due to reasons that are now eliminated by high-tech interventions. The competitiveness of businesses has elevated multifold and minimum bar for business success has been raised very high. The larger businesses face competition from new ventures that leverage the modern advancements and continue to challenge former that have dominated the economic circles for long. On the demand side, consumers not only in urban areas, but also rural areas are resorting to technology enabled platforms. The consumers' comfort level with digital transactions has created many new business opportunities.

Therefore, the future belongs to those who will adopt the futuristic solutions in every sphere of doing business ranging from product design, customer awareness, customer acquisition, product delivery, and customer service. The above developments necessitate that the new age management curriculums educate the students on the application of latest high-tech in the traditional and contemporary functional areas of business.

In this context, the School of Management proposes a new *Integrated MBA Program* that will prepare the youth to be ready for the technology-based revolution that is underway. The proposed five-year *Integrated MBA Program* will blend the traditional business knowledge with the modern technology that business executives of tomorrow will require.



This program will create professionals capable of leading the development of innovative products and processes. The program will prepare the youth for the changing business

dynamics of future and meet the human resource requirements of businesses, in turn shaping the economic and business outcomes for the country.

### Intake Strategy: Mode of Admission

We intend to admit students through JEE Mains, which was taken by more than nine lakh students in 2022. Given the technological orientation of the program, students with a science background would be ideal. In contrast, most of the management institutes admit students into their integrated programs through a written exam (generally open to candidates from all streams), the number of students writing these exams is limited.

### B. SWOT analysis of the program

IIT Mandi has a well-established reputation for providing innovative, practicum-based education at the undergraduate and graduate levels. The students of the proposed Integrated MBA Program would have an opportunity to get quality education from one of the premier technical institutes in the country. The students will get the opportunity to brush shoulders with B.Tech. and Masters students of IIT Mandi by means of engaging academically (in some of the courses) as well as by engaging in various extra-curricular and co-curricular activities. This would help them in building a competitive spirit along with the holistic development. In addition to the above, other points of SWOT are given below:

Strengths:	Weaknesses:
<ul style="list-style-type: none"><li>❖ The proposed innovative curriculum is has several differentiating propositions:</li><li>❖ It offers a blend of management education with the application of data science &amp; AI tools.</li><li>❖ The uniquely designed curriculum and innovative pedagogy enables cross functional thinking and problem-solving in students.</li><li>❖ It offers a balanced education in technology and social sciences that will produce business leaders equipped with technical skills who have a strong understanding of business ethics, human behaviour, and life skills.</li><li>❖ It offers experiential learning through hands on training, semester long industrial internship, and project work.</li><li>❖ The fee structure of the proposed program is likely to be lower than the Integrated Programs offered by IIMs/other premier institutions, making our program more economic</li></ul>	<ul style="list-style-type: none"><li>● Awareness of integrated MBA programs across the target segment is low.</li><li>● Availability of dedicated faculty in relevant techno-management areas to deliver the relevant course content using experiential pedagogy.</li><li>● The program will require periodical review of the latest developments in relevant fields to keep the curriculum updated, program execution relevant, and outcomes effective.</li><li>● The school will need to create international visibility and interest in the proposed program to attract overseas.</li><li>● The school will also need to establish collaborations with some of the international institutes to enable student exchange.</li><li>●</li></ul>

<p>proposition for the prospective applicant. This estimation is based on the fee structure of our ongoing MBA program.</p>	
<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>• IIT Mandi can have the first mover advantage among IITs in offering a Five-Year integrated MBA program.</li> <li>• A pre-existing and robust annual pipeline of nine lakh prospective students through JEE Mains Paper 1 (B.E. /B. Tech).</li> <li>• The program has the potential to receive international interest from industry and academia which will benefit academic research, teaching and collaboration for IIT Mandi.</li> <li>• IIT Mandi has a deep industry connection to keep the course content relevant, enable internship and create placements opportunities for the students.</li> </ul>	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>• We need to establish and communicate a clear differentiated position compared to integrated management programs of IIMs. Therefore, the communication strategy must be well planned.</li> <li>• The first mover advantage may be short lived. The proposed program will face competition if other technical institutes also decide to enter this segment.</li> </ul>

**C. Justification with respect to New National Education Policy (NEP) mandates**

The proposed program well aligns with NEP's mandate of holistic and multi-disciplinary education. Some of the salient features of the proposed program that are in line with the NEP are as follows:

- The program is carefully designed with a blend of technology and management, and other courses that would integrate the holistic development of the management graduates.
- In the first three years of the proposed program, a strong base in Science, Technology, Engineering, and Mathematics (STEM) along with courses on management, communications, soft skills, personality development, humanities and social sciences would provide a good blend with the management education.
- The multidisciplinary curriculum would nurture the social, physical, emotional, moral, and intellectual growth of the students in a well-rounded manner.
- The program also offers credits to the courses related to the co-curricular activities, Arts, Music, Sports etc.
- The program offers multiple exit options to the students – BBA and BBA (Honors) after successful completion of third and fourth years, respectively.

**D. Provide a mission statement for the program. Include educational and learning objectives.**

**Mission Statement:**

Integrated MBA Program strives to foster creativity and leadership through a unique management education program that blends traditional business education with the application of technology across diverse business domains. The program will create future business leaders with a deep technology appreciation and effective cross-functional management acumen.

**Educational and learning objectives:**

1. To impart state of the art management education through coursework that blends the technology application into the traditional management courses. The focus of the program is to produce business leaders with capability to translate the broad surface level understanding of business problems to fine grained comprehension and interpretation by critically evaluating, analyzing to produce robust and adaptable solutions in changing business environment.
2. To make the learning more experiential, engaging, and hands-on with the help of lectures, classroom discussions, computing and business simulations labs, case studies, individual and group projects complemented by group discussions, role-plays, industrial internship to enable multifaceted professional and personal development of the students.
3. To develop management professionals with deep understanding of technology and management acumen that are capable of leading technology-oriented organizations in VUCA business world with the help of the experiential learning that inculcates leadership qualities and hones the managerial skills of future leaders to develop desired intent to create more sustainable businesses and socially responsible organizations.
4. To develop management professionals with resilience to face VUCA world and maintain well-being of self and others around them by applying knowledge gained through courses offered from time tested Indian Knowledge System.

**E. Credit Structure of the programme**

The program has a total of 190 credits across five years. The program will provide exit options to the student as follows:

- After successful completion of 3<sup>rd</sup> year, a student will be given a Bachelor of Business Administration (BBA) degree.
- After successful completion of 4<sup>th</sup> year, a student will be given a Bachelor of Business Administration (BBA) Honors degree.
- The students completing the 5 year program will be given Integrated MBA (DS & AI) degree.

The credit breakdown across the years is as follows:

- a) The program has 128 credits in the first three years which are divided into discipline core and elective courses. The details are as follows:

Division	Sub division	Credits
Discipline Core	Management	115
	Economics	
	Indian Knowledge System	
	Data Science	
	Personality Development	
	Language	
	Social Sciences	
	Science and Engineering	
Discipline Electives	Elective Courses	14

b) The credits structure for the fourth years of the program is as follows:

Division	Credits
Industry Internship*	12
Discipline Core**	20

\*\*See the courses offered in Semester 2 of MBA (DS & AI) program

\*Industry internship After successful completion of the first three years program (minimum CGPA 6.0 on 10 points scale). After this, the students of the integrated MBA program would be going for a sixth month long industrial internship any time during June to January. These students will use Semester VII to complete their extended industry internship which is a unique proposition of the proposed program. The students will get 12 credits for the internship.

This unique proposition was validated by both industry and academic experts that were consulted. According to their comments, the industry prefers a long internship instead of the traditional 2-month internship. We also experienced the same during the current internship drive for our students of our existing MBA (DS & AI) program.

Salient features/benefits of the semester long internship are as follows:

- The courses offered to the two-year MBA students in their Semester I are covered by the Integrated MBA students in their first three years and hence the six months internship avoids the repetition of similar courses and utilizes this semester for essential industrial exposure.
- The internship will give the students an exposure to real business world and help relate better to the management courses in 4th and 5th year of the integrated MBA program.

- In the recent years an increasing requirement of six months long internship for the B.Tech. students at IIT Mandi is observed from the companies visiting the campus and found to provide higher chance of Pre-Placement Offers (PPO). It is highly likely that the longer industrial internships for the management students would also open the options of PPO.

c) The credits structure for the fifth year of the program is as follows:

Division	Credits
Core	18
Electives	12

In near future, SOM is also planning to offer a two-year MBA program in multiple specialization. The students of the integrated MBA program will then have the option of choosing one of the specializations. The criteria for allocation of one of the specializations would be formulated in future.

#### F. List of proposed Courses

The following are the details of courses for the first three years of the program

##### List of Core Courses

Core Courses	Credits
Differential Calculus	2
Introduction to Management	3
Python Programming	4
Introduction to Natural Science 1	2
Introduction to Indian Knowledge System	3
Introduction to Accounting	3
Basic Business Communication	3
Sports/Yoga/Physical Training	1
Integral Calculus	2
History of Indian Business	3
Linear Algebra	3
Micro-Economics	3
Basics of Psychology	3
Introduction to Data Structure for Business Application	3
Advanced Business Communication	3
Indian Art forms 1	1
Management Workshop 1	1
Business Statistics	3
Macro Economics	3

Philosophy and Management	3
Critical Thinking and Writing Skills	3
Mindfulness and Consciousness	3
Introduction to Natural Sciences 2	2
Introduction to Marketing	3
Sports/Yoga/Physical Training	1
Operations Research	3
Introduction to Databases	3
Foreign Language Level 1 (German/French etc)	3
Effective Public Speaking and Debating	3
Sustainable Business Practices	3
Spreadsheet Modelling	2
Management Accounting	3
Indian Art forms 2	1
Social immersion	0
Management Workshop 2	1
Web-Based Development	3
Business Research Methods	3
Management Lessons from Indian Knowledge System	3
Introduction to Engineering	2
Elective	6
Sports/Yoga/Physical Training	1
Game Theory	2
Capstone Project 1	1
Basic Econometrics	3
Decision Analysis	3
Elective	8
Ethics and Values	3
Management Workshop 3	1
Indian Art forms 3	1
Capstone Project 2	3

#### List of Elective Courses

Electives	Credits
Numerical Methods	3
Optimization	3
Multivariate Analysis	3
Time Series Analysis	3
Intellectual Property Rights	2
Indian Economy (Arthashastra)	2
Information System	2
International Trade	2
Money Banking and Finance	2

Cost Accounting	2
Business Regulatory Frameworks	2
Indian Financial System	2
Foreign Language level 2 (German/French etc)	3
Foreign Language level 3 (German/French etc)	3
Visual Analytics	2
R Programming	2
Entrepreneurial Practicum	6
Vedic Mathematics	2
Ancient Arts and Architecture	2
Cognitive Psychology and Indian Thought System	2
Sanskrit	2

*Note: The above is not exhaustive list*

The following are the details of the courses for the last two years of the program:

The students of the integrated program will undertake a semester long industry internship in the seventh semester. For the remaining semesters, the students will take the same courses as offered to MBA (DS & AI) students in their last three semesters.

**G. Provide a list of any current courses that would be cross-listed with the program:**

The program has many courses in its first three years that have commonality with the existing courses of other undergraduate and postgraduate programs at IIT Mandi. However, many of existing courses in their present form may not be suitable for Integrated MBA program and will need to be designed afresh keeping in mind program focus.

Secondly, the proposed program aims to make learning more experiential and engaging with the help of following pedagogies that are not essentially used in the existing undergraduate courses at IIT Mandi:

- Hands-on computing and business simulations labs
- Business case studies
- Group discussions
- Management role-plays
- Course instructors from industry to bridge the gap between the academic training and industrial practices
- Projects

**H. What, if any, new courses will be required for the program? A separate course proposal is required for each new required course.**

The detailed course contents are under development. Review comments from the academic and industry experts have been taken into consideration for this purpose.

**I. Provide a sample academic plan for students completing the academic program being proposed.**

**a) Semester 1**

Courses	Credits
Differential Calculus	2
Introduction to Management	3
Python Programming	4
Introduction to Natural Science 1	2
Introduction to Indian Knowledge System	3
Introduction to Accounting	3
Basic Business Communication	3
Sports/Yoga/Physical Training	1

**b) Semester 2**

Courses	Credits
Integral Calculus	2
History of Indian Business	3
Linear Algebra	3
Micro-Economics	3
Basics of Psychology	3
Introduction to Data Structure for Business Application	3
Advanced Business Communication	3
Indian Art forms 1	1
Management Workshop 1	1

**c) Semester 3**

Courses	Credits
Business Statistics	3
Macro Economics	3
Philosophy and Management	3
Critical Thinking and Writing Skills	3
Mindfulness and Consciousness	3
Introduction to Natural Sciences 2	2
Introduction to Marketing	3
Sports/Yoga/Physical Training	1

**d) Semester 4**

Courses	Credits
Operations Research	3
Introduction to Databases	3
Foreign Language Level 1 (German/French etc.)	3
Effective Public Speaking and Debating	3
Sustainable Business Practices	3
Spreadsheet Modelling	2
Management Accounting	3
Indian Art forms 2	1
Social immersion	0
Management Workshop 2	1

**e) Semester 5**

Courses	Credits
Web-Based Development	3
Business Research Methods	3
Management Lessons from Indian Knowledge System	3
Introduction to Engineering	2
Elective	6
Sports/Yoga/Physical Training	1
Game Theory	2
Capstone Project 1	1

**f) Semester 6**

Courses	Credits
Basic Econometrics	3
Decision Analysis	3
Elective	8
Ethics and Values	3
Management Workshop 3	1
Indian Art forms 3	1
Capstone Project 2	3

**J. If established at other institutions, please submit sample programs from those institutions.**

**1. In what ways is this proposal consistent with those programs?**

At present five IIMs are offering an integrated management program. In addition, some of the renowned central and state government institutions and leading private institutions are also offering similar program. Notably, majority of these institutes have started the program in last 3-4 years (please refer table below for details). A recent focus of educational institutes on five-year integrated MBA program indicates its demand.

**List of institutions offering an Integrated Management Program\***

Institute Name	Starting Year	Intake
Indian Institute of Management Indore	2011	150
Indian Institute of Management Rohtak	2019	180
Indian Institute of Management Ranchi	2021	120
Indian Institute of Management Bodh Gaya	2021	60
Indian Institute of Management Jammu	2021	60
Indian Institute of Foreign Trade Kakinada	2022	50
NALSAR University of Law Hyderabad	2021	66
Kurukshetra University	2010	60
Mumbai University	2016	60
Kumaon University	2018	50
Maharshi Dayanand University	2008	120
OP Jindal University		
Manipal Academy of Higher Education		120
Nirma University		180

\*Data collected from different web resources.

**2. In what ways is this proposal different from those programs? Please explain those differences**

The five-year integrated MBA program offered by majority of the premier institutes focus mainly on the traditional management education such as finance, marketing, strategy, human resource management, and operations management. Most of these programs are not adequately inclined towards the growing role of technology in the changing business landscape. While few of these programs offer courses to educate students in analytics domain, but they seem to lack building advance analytical foundation to enable robust student learning.

On the other hand, the proposed program, in addition to these traditional courses, also includes courses that enable learning and experience on latest technology. Moreover, these courses and their pedagogy are intently designed to help students learn the application of these advance analytical tools in the realm of business domains. Particularly, the long-duration internships and live industry projects embedded in the program would help students

develop strong orientation towards the real problems facing industry and the use-cases of analytical tools.

In addition to the differentiated course curriculum, the program offers the students a unique enriching campus life in the lap of nature within the serene Himalayan ecosystem away from the hustle and bustle from cities. It offers the students opportunity for holistic development by engaging in various extra-curricular and co-curricular activities, along with the student of other streams at IIT Mandi. Further, students would have an opportunity to leverage start-up/incubator ecosystem of IIT Mandi and initiate tech-based ventures that can shape the business landscape and create social/economic impact.

**Provide a list of the faculty available to teach courses for this program.**

The School of Management is recently established, and faculty recruitment is under process. Apart from existing faculty members, a number of faculty in the relevant areas would be recruited in SoM to teach the courses.

**In case of interdisciplinary program, mention governances and execution mechanism of the programme:**

Not applicable.

**Student interest:**

**What measures of student interest in the program are there? How/why are the proposers convinced that students would want to take this program of study? (Attach Career and Placement Cell recommendation or any other)**

In the last five years, at least five IIMs, and several private and government universities have offered an integrated management program. It indicates growing student interest in such integrated programs. The proposed programs would be attractive for students for the following reasons:

- The unique curriculum cuts across different type of training and skills in the area of technology, management, and other courses offers a holistic learning experience for the management graduates in the pristine Himalayan environment.
- Several students spend one to two years in preparation for the competitive exams after their bachelor's degree. The integrated program by its design enables the student to peruse the bachelor's and master's degree and saves the time and cost spend in preparation for competitive exams.
- The proposed program will provide a long industrial internship opportunity for 3<sup>rd</sup> year students. The internship will provide the students an exposure to real business world and help relate better to the management courses in 4<sup>th</sup> and 5<sup>th</sup> year of the integrated program.
- Six months internship has been highly desired and accepted by the companies for the B.Tech. students and provides a much higher chance of getting Pre-Placement Offers (PPO). Many companies now a days look for management interns for a longer duration (up to six months or more) instead of the traditional 2-month internship. It is highly likely that the longer industrial internships for the management students would also open the options of PPO.

- The fee structure of the proposed program is likely to be lower than the Integrated Programs offered by other premier institutions, making our program more economic proposition for the prospective applicant. This estimation is based on the fee structure of our ongoing MBA program.
- The proposed program will also create national and international student exchange opportunities.
- The proposed program, in addition to mentoring from faculty advisor, will facilitate guidance/mentoring through engagement with industry professionals for better career guidance.
- The proposed students would also have an opportunity to leverage start-up/incubator ecosystem of IIT Mandi and initiate tech-based ventures that can shape the business landscape and create social/economic impact.

**Resources:**

**Additional requirements of laboratory space with justification (name of the labs)**

For smooth functioning of the program and for experiential learning, following labs will be set up over the next two years:

1. Business Analytics Laboratory (1500 Sq. feet)
2. Behavioral Laboratory (1500 Sq. feet)
3. Finance Research Laboratory (1500 Sq. feet)
4. Entrepreneurship Research Laboratory (1500 Sq. feet)

**Additional requirements of laboratory fund (recurring and non-recurring) with justification (name of the labs)**

- |  |          |
|--|----------|
| 1. Business Analytics Laboratory           | (1.5 Cr) |
| 2. Behavioral Laboratory                   | (1.2 Cr) |
| 3. Finance Research and Trading Laboratory | (1.5 Cr) |
| 4. Entrepreneurship Research Laboratory    | (1.0 Cr) |

**Additional requirements of faculty and non-teaching staff (Numbers and justification)**

1. We would require about 20-24 faculty members in relevant research and teaching areas in the next 5 years.
2. We would require a staff member dedicated for managing internships, placements, industry liaisoning, and students exchange visits.
3. We will require two laboratory assistants to maintain the laboratories proposed earlier in this proposal.
4. We will require assistance of one office assistant to manage day to day operations related to the proposed program.

Note: The proposed infrastructure would also be helpful for executive education programs including FDP, MDP, Continuing Education, etc., which is a proven source of significant revenue to the institute.

**III. Origin and development of the proposal:**

- **Please mention name for faculty involve in developing this proposal.**
  1. Dr. Ashish Bollimbala
  2. Dr. Saumya Dixit
  3. Dr. Puran Singh
  4. Prof. Manoj Thakur
  
- **Details of external industry experts and their recommendations (please include their evaluation)**
  1. Mr. Saurabh Mittal, Qyon
  2. Mr. Vinay Kumar, Datawise
  3. Mr. Mahesh Venkataraman, Accenture
  
- **Details of external academia experts and their recommendations (please include their evaluation):**
  1. Prof. A K Swain
  2. Prof. G Shridhar
  3. Prof. B K Mohanty
  4. Prof. M. Venkateswarlu

● **Proposers faculty name and their signatures:**

Name of Faculty members	Signatures
Dr. Ashish Bollimbala	
Dr. Saumya Dixit	
Dr. Puran Singh	
Prof. Manoj Thakur	

**Recommendations of Chairperson of School/ Centre**

**Signature with Date:**

**Dean (Students) recommendations on availability of hostels and other requirements**

**Signature with Date:**

**Associate Dean (Courses) recommendation on class rooms availability and other academic infrastructure requirements**

**Signature with Date:**

**Dean Finance recommendation on financial aspects (if any)**

**Signature with Date:**

**Dean Academics recommendations:**

**Recommended/Not Recommended**

**Signature with Date:**

*Please enclose additional information if any.*

## Annexure A

### Curriculum of 2 years MBA DS & AI at program IIT Mandi

The proposed **MBA (DS & AI)** program is a blend of management of contemporary concepts, softer skills towards developing individuals, and relevant applications of data science tools. **MBA (DS & AI)** is a 2-year long full-time Masters programme, distributed in 4 semesters. The credit requirement is 70. The program aims to provide an in-depth exposure on data science tools and techniques like analytics, artificial intelligence machine learning, deep learning, natural language processing, and neural networks with a strong emphasis on problem solving approach.

The course structure has three major components as detailed below:

#### **Discipline Cores (46 credits):**

Discipline Cores are designed to give the students appropriate exposure to different thoughts and theories of 'management' and 'Data science'. These include course in managerial competence such as communication skills, Legal aspects of business, HR management, creative thinking problem solving and decision making, organizational behaviour; as well as data science course such as Neural networks fundamentals for business, Mathematical foundations, disruptive technologies for data science, Introduction to AI and automation etc.

#### **Electives (8+4 credits):**

A pool of discipline and free elective courses help students to go deeper into selected areas of application of data science and artificial intelligence in business. While discipline cores are more theme oriented and interdisciplinary in nature, the discipline electives have greater disciplinary grounding. The pool of discipline electives courses is dynamic in nature and more courses may be added in the future depending upon suitability. Students also have to take 4 credits offered in the institute from outside the pool of discipline electives for the **MBA (DS & AI)** Programme.

#### **Project and internship (12):**

Students would get exposure to real world problems, research methodology and industry experience through the Qualitative research workshop, social immersion project, Industry internship and two semester long Management project.

**Curriculum:**

The distribution of credits across types of courses is proposed to be the following:

1	Discipline Core	46
2	Discipline Electives	8
3	Free Electives	4
4	Project and Internship	12
Total		70

Sl. No.	Semester I	Break	Semester II	Break	Semester III	Break	Semester IV	
1	Communication Skills for Managers	Qualitative Research (2 credits in Workshop mode) Social Immersion (0 credits)	Operations Management	Industry Internship (2 credits)	Legal Aspects of Business		Electives (6 – 10 credits)	
2	Financial Statement Analysis		Fundamentals of Data and Analytics		Neural Networks fundamentals for Business			
3	Mathematical Foundations for DS/AI ML		Human Resource Management		Digital Business Strategy, Models and Transformations			
4	Creative Thinking, Problem Solving and Decision Making		Disruptive Technologies for Data Science		Entrepreneurship			
5	Marketing Management		Strategic Management		Electives (2 – 6 credits)			
6	Python Programming		Machine Learning for Business		Management Project I (4 credits)			
7	Decision Analysis		Introduction to AI and Automation					Management Project II (6 credits)
8	Probability and Statistics for Data Science/AI ML		Financial Management					
9	Managerial Economics		Organizational Behavior					
Credits	18	2	18	2	14-18		12 - 16	
Summary	18 credits compulsory		18 credits compulsory		12 credits compulsory		6 credits compulsory	
Total Credits earned	18	20	38	40	54-58		70	

Following is the tentative list of the elective courses that may be revised time to time.

Discipline Elective Minimum 2 courses each in 3<sup>rd</sup> and 4<sup>th</sup> semester

SI No	Course Title	Credits
1	AI in Marketing	2
2	Causal Analytics	2
3	AI for Finance	2
4	Fintech	2
5	Blockchain for Business	2
6	Deep Learning for Business Application	2
7	Natural Language Processing for Business	2
8	Intelligent Automation	2
9	Fuzzy logic for business decision making	2
10	Evolutionary computation for business solutions	2

Free Electives One course each in 3<sup>rd</sup> and 4<sup>th</sup> semester

SI No	Course Title	Credits
1	Product Management	2
2	Design Thinking	2
3	Social Analytics	2
4	Cloud Computing for Business	2
5	Cyber Securities, Ethics and Privacy	2
6	Negotiation Analysis	2
7	Data Strategy	2
8	AI Strategy and Implementation	2
9	Leadership	2

**Revision in the guidelines of Comprehensive Examination for Ph.D. & I-Ph.D.  
research scholars at IIT Mandi**

**1. The Committee observed that given the existing Comprehensive Examination guidelines, most of the schools followed the below mentioned procedure/practice:**

- Conduct Comprehensive Examination in two parts of written Examination (Part A and Part B), followed by a viva-voce.
- Part A of written Examination is designed to test the essential subject knowledge in the core discipline/core specialization, while Part B to test the depth of knowledge in the research area (especially few advanced topics) of the Ph.D.& I-Ph.D. research scholar.
- Part A often consisted of MCQ-type questions (however, not applicable for all Schools).
- Ph.D. & I-Ph.D. research scholars had to pass in both written as well as viva voce examination to pass/qualify the comprehensive examination.
- The performance in both written and oral examinations were expressed separately using categorical adjectives: Very Good, Good, Satisfactory and Not Satisfactory. These categorical attributes were derived from numeric values representing percentage of marks obtained in written and oral examinations.
- If a Ph.D. or I-Ph.D. research scholar passed/qualified the comprehensive examination with grade 'Satisfactory' or above, s/he is eligible to be converted from JRF to SRF after completion of 02 years (as per notification "Guidelines for JRF to SRF and issues related to monthly scholarship for M.Tech. (by Research)/M.Tech./I-Ph.D./Ph.D. Scholars" dated 16.11.2022).

**2. After deliberating on each of these existing points pertaining to the existing guidelines of comprehensive examination, the Committee observes and recommends the following:**

- i. As pointed out in the existing guideline, Comprehensive examination is an integral part of the doctoral programme at IIT Mandi. It evaluates the academic preparedness of the Ph.D. & I-Ph.D. research scholars in terms breadth of their knowledge in their chosen discipline and ability to think independently of solutions for scientific, technical and social challenges in his/her area of research. The assessment provides feedback to the Ph.D. & I-Ph.D. research scholars that are useful for planning future courses of action in the research.
- ii. The Comprehensive examination shall continue to be conducted once every semester for a group of Ph.D. & I-Ph.D. research scholars who opt to take the examination. The completion of 13 credit course work is mandatory in order to be eligible to qualify the comprehensive examination.
- iii. The student have to be physically present in the campus to appear for every component of the comprehensive examination.
- iv. A Ph.D. or I-Ph.D. research scholar is expected to successfully qualify the comprehensive examination within a year after his/her registration in the programme and in any case not later than two years after the registration in the programme [as per R.13 (d) of the Ordinances and Regulations for the Degree of Doctor of Philosophy at IIT Mandi].
- v. The Chairperson of each School will constitute a Comprehensive Examination Committee (CEC) consisting of faculty members of the respective schools to conduct the comprehensive examination. Internal (from other schools at IIT Mandi) or external (outside IIT Mandi) experts may also be a part of CEC, depending on the requirement.

- vi. The syllabi, dates, duration of the examination, etc., must be communicated to the research scholar at least 02 months before the examination date to enable the scholar to prepare for it adequately.
- vii. The objective of the comprehensive examination is to test the broad subject knowledge in the disciplines and the in-depth knowledge in the area of research. Hence, overall, the syllabus of the comprehensive examination should cover the breadth of the discipline, along with specific and advanced topics in the area of research. The relevant School and the CEC of the School may decide the scope of a 'discipline' and the syllabus. Likewise, the advanced topics related to the research area of a scholar and the syllabus on that may be decided by the CEC in consultation with respective supervisors.
- viii. CEC of a School will set question papers for the comprehensive examinations (in consultation with the Ph.D. supervisors for the advanced research-related topics).
- ix. The Comprehensive examination format may remain the same in terms of a written test and a viva voce examination; however, Part A and Part B of the written Examination may be merged. In addition, the CEC may decide the weightage for evaluating the discipline knowledge and in-depth knowledge in the research area.
- x. MCQ is not considered a preferred mode of evaluation for advanced research-related topics in the written part of the examination.
- xi. The doctoral Committee must be invited to the viva-voce examination.
- xii. A Ph.D. or I-Ph.D. candidate must appear and pass the comprehensive examination in the School where s/he is registered.
- xiii. A candidate must pass the written examination to appear for the viva-voce examination.
- xiv. The performance in written and oral examinations may be expressed together using overall categorical attributes: 'Satisfactory' and 'Not- Satisfactory'. 'Satisfactory' would imply that the candidate has qualified/passed the comprehensive examination, while 'Not-Satisfactory' would imply that the candidate has not qualified/ has not passed the comprehensive examination. These categorical attributes may be derived from numeric values representing the percentage of marks obtained in written and oral examinations.
- xv. If the scholar fails to clear the comprehensive examination even after a second attempt, their registration in the Ph.D. program at IIT Mandi will be terminated.
- xvi. If a Ph.D. or I-Ph.D. research scholar qualified/passed the comprehensive examination, s/he is eligible to be converted from JRF to SRF after completion of 02 years (as per notification "Guidelines for JRF to SRF and issues related to a monthly scholarship for M.Tech. (by Research)/M.Tech./I-Ph.D./Ph.D. Scholars" dated 16.11.2022).
- xvii. Any exception to the above procedures needs approval from the Chairman, Senate.

**Revision of B.Tech. Honors guidelines in UG programme**

**Current B.Tech. Ordinance:**

**R.29 Eligibility for Award of the B.Tech. (Honours) Degree**

- R.29.1 In addition to the general eligibility criteria mentioned for the award of regular B.Tech. degree under R.28, **a student must earn additional 12 credits** (over and above the required 160 credits for regular B.Tech. degree) relevant to her/his discipline as recommended by the Faculty Adviser to be eligible for B.Tech. (Honours) degree.
- R.29.2 Student **must do DP401P & DP402P: Major Technical Project and DP-301P: Interactive Socio-Technical Practicum (ISTP)** and obtain **a grade of 'B' or above** in these courses.
- R.29.3 Student should **not have received 'F' grade** throughout the B.Tech. program.
- R.29.4 Student should secure an **overall CGPA of 8.5** or more out of 172-174 credits.

**IIT Mandi (New Proposal for BTech (Hons)/BS (Hons) ; 2023 passing branch onwards)**

	Extra Credits	Extra Credits (% of BTech)	Min. CGPA	MTP Compulsory	Backlog	Additional Rules/Comments	Degree to be awarded
<b>Current Policy</b>	12	7.50%	8.5	MTP in own discipline with min. B grade	No F grade ever	ISTP Compulsory with min. B grade	BTech (Hons) in <Branch>

Proposed New Policy - 2 Modes of earning a BTech (Hons.)/BS (Hons.) degree:							
<b>Mode A</b>	With 12 extra credits in DE	7.50%	>=CGPA of 8 in 172 or more credits (160 Btech/BS + 12 extra credits for Hons)	MTP in own discipline	No F grade ever, (Hons. Will be terminated if F Grade)	ISTP NOT Compulsory	BTech (Hons) in <Branch>
<b>Mode B</b>	With 0 extra credits	0%	>=8.5 CGPA in 160 or more credits	MTP in own discipline	No F grade ever, (Hons. Will be terminated if F Grade)	ISTP NOT Compulsory	
<b>Justification</b>	2 options based on merit		Matches with few other IITs	Minimum Grade in MTP is by default C. Completion of MTP should be enough (like BHU, Hyd, Ropar)		ISTP is not discipline specific	Extra credits are taking from Discipline electives meriting a Hons in Branch

**Recommendations for Eligibility for Award of the B.Tech. (Honours), B.S (Hons) Degree**

- Students admitted to B.Tech./B.S. program can opt for Honours degree during the fourth or fifth semester if they did not earn any 'F' grade till fourth or fifth semester.
- B.Tech./B.S./B.Tech. Double Major students must do DP401P & DP402P: Major Technical Project in their own (parent) discipline. Since B.Tech. - M.Tech. IDD/B.S. - M.S. IDD students are required to do PGP, hence the requirement of 8 credits of MTP are waived off.
- Student should not have received an 'F' grade throughout the program.

- Students opting for Honours can register for additional courses from the Discipline Elective basket over and above the courses prescribed in their regular curriculum from the 5th semester onwards in consultation with the Faculty Adviser. Such students are permitted to register for more than 22 credits in a semester.
- **On fulfilling the above relevant requirements, student can obtain the Honours degree by satisfying either of the modes below**
  - Mode A : Have a CGPA of 8.5 or more out of the total credits completed
  - Mode B : Opt for an extra 12 Discipline Elective credits and have a CGPA of 8 or more out of the total credits completed (i.e 172 or more credits (160 BTech/BS + 12 extra credits for Hons.)
- **Honours degree would be awarded as follows -**
  1. For B.Tech./B.S. students : B.Tech. (Honours) / B.S. (Honours) in <Branch>
  2. For IDD students : B.Tech. (Honours) and M.Tech. / B.S. (Honours) and M.S.
  3. For B.Tech. Double Major students :B.Tech. (Honours) in <Parent Branch> with Second Major in <Second Branch>

**Recommendations for Thesis Credit Structure for M.Tech. (Research), M.Sc. (Research)/MA (Research) and Ph.D. programs**

The committee looked into the credit structure related to the research components of various institutes of national and international repute and compared it with the practice being followed by IIT Mandi. Following points were noted:

- (i) Currently there are no credits assigned to the research component (thesis) required to fulfill the graduation requirements of the research-based programs [e.g., M.Tech. (Research) and Ph.D.] at IIT Mandi.
- (ii) Due to the reason mentioned in Point (i), the students registered for those research-based programs are not required to register every semester for their research component (i.e., thesis).
- (iii) Once a student, registered in a research-based program, completes her/his courses credits requirements, there is nothing to show on the transcript/grade report. This creates confusion regarding the registration status of the student and sometimes the continuity in the program is not properly documented in the transcript/grade report.
- (iv) As the students of the research-based programs do not register the research component (i.e., thesis), their continuous evaluation is not recorded anywhere on the transcript in the present practice. Although the students submit annual progress reports through the doctoral committee/annual progress committee, the performance does not reflect on the transcript.
- (v) There were instances when M.Tech. (Research) students faced difficulties proving the overall credit completion in comparison to the course-based M.Tech. programs while applying for jobs, higher studies etc. Their transcript shows only 16 (minimum including RM600-Research Methodology) credits as compared to 70 (minimum) for the regular M.Tech. students.
- (vi) It was also noted that most of the IITs ask the Ph.D. students to register for their doctoral thesis every semester. However, the credit structure differs significantly (with or without any assigned credits to the thesis component).

*The committee deliberated on the matter and presented a proposal in the BOA meeting. Following are the recommendations accepted by the BoA:*

- (i) No change in credit system or transcript is recommended for the Ph.D. program.
- (ii) The students of M.Tech. (Research)/M.Sc. (Research)/MA (Research) programs need to complete 60 thesis credits to fulfill the requirement of the degree in addition to the prescribed course credits as applicable for individual programs.
- (iii) The course name will be "M.Tech. Thesis" with code XX699P, for the M.Tech. (Research)/M.Sc. (Research)/MA (Research) programs where 'XX' represents the relevant school/center/discipline code. The thesis course will appear in the transcript every semester till a thesis is formally submitted.
- (iv) The thesis course needs to be registered by the student every semester until the thesis submission and the supervisor needs to evaluate it as Satisfactory (P)/ Unsatisfactory (F) during grade submission.
- (v) The course will be shown as 'IP' (in Progress) in the grade report of each semester with awarded performance grade P or F. The total credit for the thesis will be added only in the final grade report. Thesis credit will not be counted towards the grade points (i.e., SGPA/CGPA).
- (vi) The supervisor's evaluation of the thesis credit at the end of every semester is in addition to the evaluation by the concerned APC as applicable.
- (vii) If a student of M.Tech. (Research)/M.Sc. (Research)/MA (Research) programs receive 2 (two) 'F' grades during the entire program duration, s/he will be terminated.
- (viii) If a student's performance is unsatisfactory on medical grounds, maternity leave, semester withdrawal etc., the student may take approval, through the APC, of the competent authority to drop the thesis credit from that semester.
- (ix) Sample of the grade report is attached in Annexure-A for reference.

## Annexure-A: Sample Grade Report



# Indian Institute of Technology Mandi (GRADE REPORT)

ROLL NO. : S16XXX PROGRAMME : Master of Technology (by Research)  
 NAME : TEST STUDENT SCHOOL : SCHOOL OF BIOSCIENCES & BIOENGINEERING

ACADEMIC YEAR/ SEMESTER	SUBJECT CODE	TITLE OF SUBJECT	CREDIT	GRADE OBTAINED	SGPA	CGPA
2016-17 (EVEN)	BY-505	NANOBIOTECHNOLOGY	3	O		
	BY-514	ANALYTICAL BIOTECHNIQUES	3	A		
	BY-518	DIASE BIOLOGY	3	A	9.33	9.33
	RM-600*	RESEARCH METHODOLOGY	1	P		
	BE-699P*	M.TECH. THESIS	60 (IP)	P		
2016-17 (ODD)	CY-554	SCIENCE AND TECHNOLOGY OF NANO MATERIALS	3	A		
	BY515	MOLECULAR BIOTECHNOLOGY	3	A	9.00	9.20
	BE-699P*	M.TECH. THESIS	60 (IP)	F		
2017-18 (EVEN)	BE-699P*	M.TECH. THESIS	60 (IP)	P	0.00	9.20
2017-18 (ODD)	BE-699P*	M.TECH. THESIS	60 (IP)	P	0.00	9.20
2018-19 (EVEN)	BE-699P*	M.TECH. THESIS	60 (IP)	P	0.00	9.20
2018-19 (ODD)	BE-699P*	M.TECH. THESIS	60	P	0.00	9.20

**TOTAL CREDITS EARNED & FINAL CGPA**

**76**

**9.20**

**NOTE:**

- I. \* This course is not considered for final SGPA/CGPA calculations.
- II. Please see overleaf for details of Grading System and SGPA/CGPA calculations.

**RESULT:** The student has successfully completed all requirements for the award of Doctor of Philosophy Degree.

Date: 08<sup>th</sup> March, 2023

Prepared By:

Checked By:

**Deputy Registrar  
(Academics)**

**Selection of Discipline Elective courses and its execution**

<p>Current Practice</p>	<p>FA certifies the discipline electives.</p> <p>Few times, some discipline electives in one year become discipline core or being not offered later years.</p> <p>Courses from Discipline Electives are deleted randomly. If deleted by following appropriate practice, they are not being updated, due to various reasons.</p>
<p>Proposed</p>	<p><b><u>School:</u></b></p> <p>School Chair in consultation with faculty (may be in the school meeting or faculty meeting for this purpose) prepares list of Discipline Electives</p> <p>List will be presented in BOA for approval</p> <p>No deletion of courses from this list. Only additions are allowed, till next curriculum revision happens. New courses/additions are authorized through BOA.</p> <p>School may offer few courses from the list. Elective courses need not be offered every year. They may be offered based on the faculty availability.</p> <p>School will share the discipline electives list with the Academics Section which maintains the list.</p> <p><b><u>Academics Section</u></b></p> <p>Maintains the master file.</p> <p>Additions, after respective BOA will be incorporated.</p> <p>Uploads in the institute website/insite/...</p>
<p>Advantages</p>	<p>FA need not authorize the Discipline Electives every time/year.</p> <p>Academic Office matches the courses with the master list and the compliance of the credit requirements under discipline Electives.</p> <p>The courses from the list will not be removed. There will not be any confusion among the faculty, students, and academic section regarding the discipline electives.</p>

# Proposal for a Human-Computer Interaction (HCI) Centre at IIT Mandi

## Introduction

Allen Newell, Herbert A. Simon, and Alan J. Perlis documented a letter to the journal *Science* in 1967 entitled "What is Computer Science?" In this letter, these researchers **articulated that computer science, a novel discipline, should include an investigation of the phenomena surrounding computers, not just the theory and design of the computation devices themselves.** The **interdisciplinary field of Human-Computer Interaction (HCI) investigates this phenomenon surrounding computers.** HCI is a field of study that focuses on designing, developing, and evaluating computer systems and other interactive technologies that people use. It is an interdisciplinary field that combines concepts and methods from computer science, cognitive science, AI, design, engineering, and other related fields. HCI aims to create computer systems and other interactive technologies that are easy to use, efficient, and effective for human users. This includes designing user interfaces that are intuitive and user-friendly, developing input devices and interaction techniques that are appropriate for the user's needs, and evaluating the system's usability. The scope of HCI is broad, ranging from desktop and mobile applications to augmented and virtual reality environments and from social media platforms to medical devices and applications. HCI researchers and practitioners focus on various topics, such as user experience design, user interface design, usability testing, accessibility, AI, and cognitive science.

Given the importance of HCI as a discipline and the emerging technologies that interact with human users, **it is proposed to have a Human-Computer Interaction (HCI) Centre at IIT Mandi.** The HCI Centre would be a research centre that would significantly impact academia and industry by advancing research in the field of HCI, creating new technologies, and improving the user experience for a wide range of applications.

Most recently, IIT Mandi iHub and HCI Foundation (iHub), a section-8 company, was created by the Government of India on the IIT Mandi campus with a mission to make IIT Mandi a "go-to" place in India for technology development, skill development, translation, and commercialization in the HCI area. **While the iHub focuses on technology development, skill development, incubation of start-ups in HCI and collaborating with industry partners, technology translation, and commercialization in the HCI area, the HCI Centre at IIT Mandi would provide an academic and research environment that would focus on research and prototype development in the HCI area, graduate programs in the HCI areas, and collaborative research with industry via faculty in the HCI area.** Thus, the HCI Centre would actively collaborate with the iHub and **provide the academic and research foundation for several of the outward/industry adoption and societal activities executed by the iHub.** A few motivations for establishing an HCI Centre at IIT Mandi include

- **Interdisciplinary Collaboration:** HCI research requires a broad range of expertise, including computer science, cognitive science, psychology, design, AI, and engineering. An HCI Centre at IIT

Mandi would encourage collaboration among researchers with different backgrounds and skill sets, leading to a more comprehensive understanding of the field and the development of industry-relevant innovative solutions.

- **Addressing Societal Challenges:** HCI can address real-world problems, such as accessibility, health, education, defense and security, environment, and sustainability. An HCI Centre at IIT Mandi could focus on creating technology solutions to address industry problems that would positively impact society and potentially improve the lives of people around the world.
- **Industry Partnerships:** An HCI Centre at IIT Mandi could establish partnerships with industry leaders, providing opportunities for students and researchers to work on real-world problems and gain experience applying HCI research to industry settings. Such partnerships (including those with the iHub) can also provide funding for research and help bring new technologies to market.
- **Education and Training:** An HCI Centre at IIT Mandi could provide educational opportunities at the Certificate, Master, and Ph.D. levels for students and professionals in the field of HCI. This would include degree programs that could help to build the next generation of HCI researchers and practitioners.

Overall, an HCI Centre at IIT Mandi could play a significant role in advancing the field of HCI, developing new technologies, and improving the user experience for a wide range of applications.

## Objectives

The HCI Centre at IIT Mandi will have the following objectives:

**Outcome-based Research:** One of the primary objectives of the HCI Centre is to conduct outcome-based research in human-computer interaction that address societal needs. The Centre can undertake research projects to develop innovative technologies, user interfaces, and interaction techniques. The research can focus on cognitive technologies, brain-computer interfaces, cognitive enhancement, different modalities of smell, taste, and touch, virtual and augmented reality, social computing, machine learning, and intelligent user interfaces.

**Train Students and Professionals:** Another objective of the HCI Centre is to train the next generation of HCI researchers and practitioners. The Centre can offer Certificate, Master, and Ph.D. programs, specializations, training programs, and workshops to students and professionals in the field of HCI. The Centre can also provide opportunities for students to gain practical experience through internships, research projects, and industry collaborations.

**Foster Collaborations:** The HCI Centre will foster collaboration among researchers, academics, industry professionals, and other stakeholders. The Centre can host seminars, conferences, and workshops to bring together experts in the field of HCI and provide a platform for exchanging ideas and sharing knowledge. This can promote interdisciplinary collaboration, essential for solving complex problems in HCI.

**Improve User Experience:** The HCI Centre will work towards improving the user experience of interactive technologies. The Centre can conduct usability studies, user experience evaluations, and accessibility testing to identify and address issues that may hinder the usability and effectiveness of interactive systems.

**Address Societal Challenges:** The HCI Centre will address societal challenges by developing HCI solutions that positively impact society. The Centre can focus on accessibility, health, education, defense and security, environment, sustainability, etc., and develop technologies that can significantly impact people's lives.

**Resource Generation:** The HCI Centre will try to generate monetary resources via teaching, skill development, research, and leasing the bleeding-edge lab equipment and other facilities to become self-sustaining over time eventually.

Overall, the HCI Centre at IIT Mandi will have several objectives, including conducting research, and training students and professionals, fostering collaborations, improving user experience, addressing societal challenges, and resource generation. These activities of the HCI Centre are planned to be undertaken independently or in conjunction with the iHub in HCI.

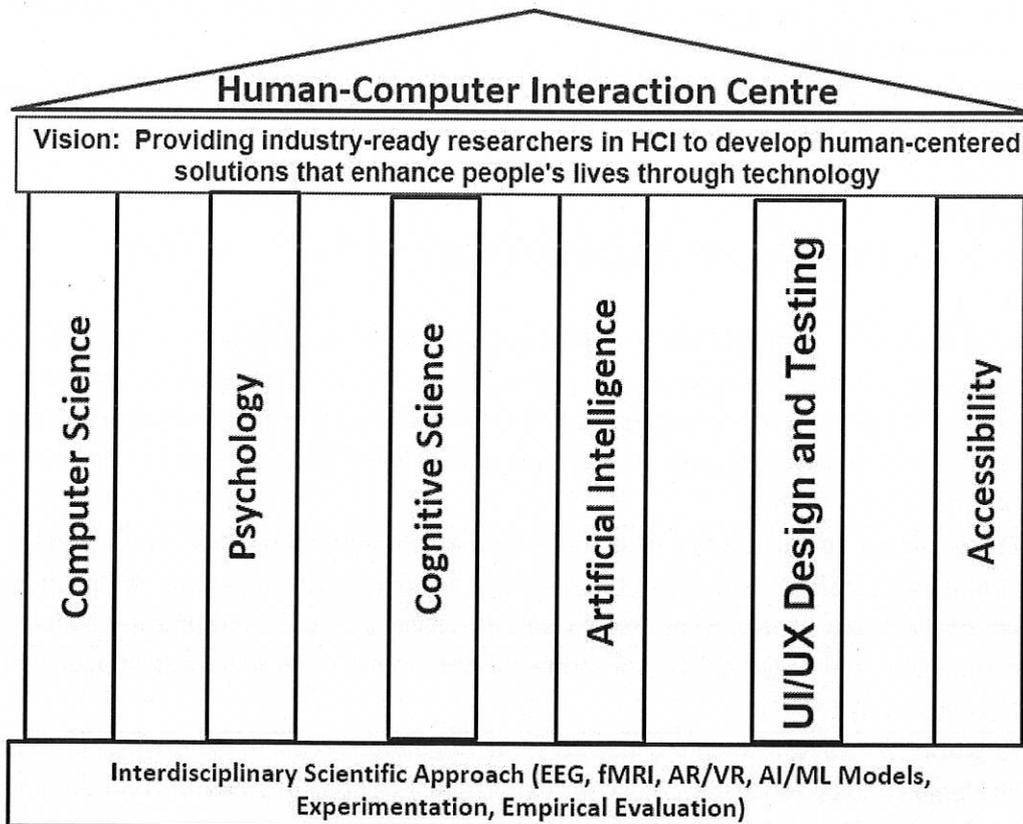


Figure 1: The HCI Centre at IIT Mandi is envisioned to provide industry-ready researchers in HCI to develop human-Centered solutions that enhance people's lives through technology. The pillars provide foundational areas where an interdisciplinary scientific approach is utilized for research.

As shown in Figure 1, the HCI Centre is envisioned to provide industry-ready researchers in HCI to develop human-centered solutions that enhance people's lives through technology. The research and teaching under the Centre would include the following HCI areas: computer science, human factors, psychology, cognitive science, neuroscience, artificial intelligence (AI), user experience design, user interface design, interaction techniques and input devices, accessibility, universal design, and virtual and augmented reality. The Centre's research would be grounded in interdisciplinary scientific methods and involve several methodologies from design, psychology, cognitive science, neuroscience, AI, and computer science.

### Uniqueness

The proposed Centre will be unique because of the following:

1. It will be the first-of-its-kind Centre focused on the Himachali communities with its challenges due to geographical location.
2. It will be the first of its kind Centre at an IIT in India.
3. It will be the first of its kind Centre that brings interdisciplinary topics concerning HCI under a common umbrella.
4. It will be the first of its kind Centre that offers an interdisciplinary mix of faculty and programs in HCI.

### Salient points

The HCI Centre at IIT Mandi has the following salient points:

1. **Interdisciplinary Focus:** IIT Mandi has a strong focus on interdisciplinary research and education, which can be leveraged to create a unique HCI Centre that brings together expertise from multiple fields. By integrating insights from computer science, psychology, design, engineering, and other disciplines, the centre can develop innovative approaches to human-computer interaction.
2. **Emphasis on Social Impact:** IIT Mandi is strongly committed to social impact, and the HCI Centre at the institute can reflect this emphasis by focusing on developing HCI solutions that positively impact society. By addressing societal challenges such as healthcare, education, accessibility, and sustainability, the centre can contribute to the well-being of people in the region and beyond.
3. **Regional Context:** IIT Mandi is located in the Himalayan region of India, which presents unique challenges and opportunities for HCI research and development. The HCI Centre at the institute can leverage the regional context to develop technologies tailored to the needs of people in the area while also addressing broader global challenges.

4. **Industry Collaboration:** IIT Mandi has established partnerships with industry leaders, which can be leveraged to create a unique HCI Centre closely connected to industry needs and trends. By collaborating with industry partners, the centre can ensure that its research and education are relevant to real-world problems and can have a practical impact.
5. **Entrepreneurship:** IIT Mandi strongly focuses on entrepreneurship, which can be leveraged to create a unique HCI Centre that fosters innovation and creativity. By providing opportunities for students and researchers to develop new technologies and start-up companies, the centre can contribute to the growth of the technology ecosystem in the region and beyond.

Overall, the HCI Centre at IIT Mandi can be unique by leveraging the institute's strengths in interdisciplinary research and education, social impact, regional context, industry collaboration, and entrepreneurship. By combining these factors, the centre can develop innovative approaches to human-computer interaction that positively impact society and the economy.

### **Research and Labs**

The Centre would establish research labs like UI/UX and design lab, EEG/MEG lab, Neurostimulation lab, Eye-tracking lab, AR/VR and Motion lab, Psychology, data collection, AI/ML lab, and teaching labs. The Centre would also cater to several specializations and degree programs at the undergraduate and postgraduate levels, respectively. The undergraduate programs may include B. Tech. in Computer Science (with specializations in HCI). Furthermore, some of the postgraduate programs include M.Tech. programs in HCI/Cognitive Science/user-Centered design/AI and ML. Finally, the Centre would include a Ph.D. program in all HCI areas. The teaching programs would be supported via certain teaching labs.

### **Deliverables**

The HCI Centre at IIT Mandi plans to deliver a variety of outputs and outcomes, depending on its goals and objectives. Here are some possible deliverables of such a Centre:

**Research publications:** The HCI Centre will conduct high-quality research in the field of human-computer interaction and publish their findings in top-tier conferences and journals. This can contribute to developing new knowledge and insights that can be applied to the design and development of interactive systems.

**Design solutions:** The HCI Centre will create design solutions that are tailored to specific user needs and contexts. This can include the development of prototypes, mockups, and user interfaces that can be tested and evaluated with real users to ensure their usability and effectiveness.

**Education and training:** The HCI Centre can offer courses, workshops, and training programs to students, professionals, and researchers in the field of human-computer interaction. This can help to build a skilled workforce that can design and develop interactive systems that are user-friendly, efficient, and effective.

**Toolkits and frameworks:** The HCI Centre can develop toolkits, frameworks, and libraries that designers and developers can use to create interactive systems more efficiently and effectively. This can include software libraries, design patterns, and other resources that can streamline the development process and improve the quality of the final product.

**Consulting services:** The HCI Centre can offer consulting services to industry partners and government agencies to help them design and develop interactive systems that are user-friendly and effective. This can include user research, design evaluation, and usability testing services that can provide valuable insights into user needs and preferences.

**Start-up companies:** The HCI Centre can encourage and support the creation of start-up companies focused on developing innovative solutions in the field of human-computer interaction. This can contribute to the growth of the technology ecosystem in the region and create new job opportunities for students and researchers.

Overall, the HCI Centre at IIT Mandi can deliver a range of outputs and outcomes that can contribute to developing high-quality research, innovative design solutions, a skilled workforce, and practical applications of human-computer interaction.

## **Academic and Industry Collaborations**

Some of the Institutes in India and abroad that have expressed interest in collaborating with the HCI Centre include

1. IIT Mandi iHub and HCI Foundation
2. IIT Mandi Catalyst
3. IISc Bangalore
4. IIT Delhi
5. IIT Bombay
6. IIT Guwahati
7. INMAS, DRDO
8. AIIMS Bilaspur
9. PGIMER Chandigarh
10. Indian Airforce
11. Carnegie Mellon University, USA
12. The University of Texas, El Paso, USA
13. Unity 3D
14. Epic Games
15. Furhat Robotics
16. Rubiscape
17. Think Design
18. Naxon Labs

19. Neuphony
20. ITRA
21. Neuroleap
22. Icuro
23. Revenue Mantra

### **IIT Mandi Faculty Involved**

Several faculty at IIT Mandi has expressed interest in participating in the HCI Centre. These include

Prof. Arnav Bhavsar  
Prof. A D Dileep  
Prof. Aditya Nigam  
Prof. Satyajit Thakor  
Prof. Shubhajit Roy Chowdhury  
Prof. Gopi Shrikanth Reddy  
Prof. Erwin Fuhrer  
Prof. Dinesh Singh  
Prof. Narendra Dhar  
Prof. Radhe Shyam Sharma  
Prof. Varun Dutt  
Mr. Somjit Amrit, CEO, iHub  
Postdocs, Faculty Fellows, and Research Staff at iHub

Other faculty, including newer faculty, will be invited from time-to-time to become a part of the proposed HCI Centre.

Revised Curriculum (April 2023)  
B.Tech. Bioengineering

[Note: Intended for BTech Bioengineering or BTech-MTech Bioengineering students intake from 2022 onwards. Others follow old curriculum]

### Semester 1

Course Code	Course Name	L - T - P - C
IC110	Engineering Mathematics – 1	2.5-0.5-0-3
IC140	Engineering Graphics for Design	2-0-3-4
IC152	Introduction to Python and Data Science	3-0-2-4
IC136	Understanding Biotechnology and its Applications (IC Core basket – 1)	2.5-0.5-0-3
HSXXX	HSS Course	3-0-0-3
YYXXX	Ikshma Course	1-0-0-1
	Total	18

### Semester 2

Course Code	Course Name	L - T - P - C
IC111	Engineering Mathematics - 2	2.5-0.5-0-3
IC161	Applied Electronics	3-0-0-3
IC 161P	Applied Electronics Lab	0-0-3-2
IC252	Probability and Statistics	3-0-2-4
IC240	Mechanics of Rigid Bodies (IC Basket-2)	2.5-0.5-0-3
ICXXX	Foundations of Design Practicum	1-0-6-4
	Total	21

### Semester 3

Course Code	Course Name	L - T - P - C
IC201P	Design Practicum	0-0-6-4
IC272	Machine Learning	2-0-2-3
BE201	Cell Biology	3-0-2-4
BE202	Biochemistry and Molecular Biology	3-0-2-4
BE3XX	Biosensing & Bioinstrumentation	3-0-2-4
HSXXX	HSS Course	3-0-0-3
	Total	22

### Semester 4

Course Code	Course Name	L - T - P - C
BE301	Biomechanics	3-0-2-4
BE3XX	Introduction to Biomanufacturing	3-0-2-4
BE203	Enzymology and Bioprocessing	3-0-2-4

BE304	Bioinformatics	3-0-2-4
HSXXX	HSS Course	3-0-0-3
FE-1	Free Elective	3-0-0-3
	Total	22

### Semester 5

Course Code	Course Name	L - T - P - C
BE3XX	Genetic Engineering	3-1-0-4
BE3XX	Biomaterials	3-0-2-4
BE303	Applied Biostatistics	3-0-2-4
BE305	Bioethics & Regulatory Affairs	1-0-0-1
DE-1	Discipline Elective	3-0-0-3
FE-2	Free Elective	3-0-0-3
HSXXX	HSS Course	3-0-0-3
	Total	22

### Semester 6

Course Code	Course Name	L - T - P - C
BEXXX	Reverse Engineering for Bioengineers	0-0-2-1
DE-2	Discipline Elective	3-0-0-3
DE-3	Discipline Elective	3-0-0-3
DE-4	Discipline Elective	3-0-0-3
DE-5	Discipline Elective	3-0-0-3
FE-3	Free Elective	3-0-0-3
DP301P	ISTP	0-0-8-4
	Total	20

### Semester 7

Course Code	Course Name	L - T - P - C
IC010	Internship	0-0-0-2
DE-6	Discipline Elective	3-0-0-3
DE-7	Discipline Elective	3-0-0-3
FE-4	Free Elective	3-0-0-3
FE-5	Free Elective	3-0-0-3
MTP-1	MTP-1	0-0-8-4
	Total	18

## Semester 8

Course Code	Course Name	L - T - P - C
DE-8	Discipline Elective	3-0-0-3
FE-6	Free Elective	3-0-0-3
FE-7	Free Elective	3-0-0-3
FE-8	Free Elective	3-0-0-3
MTP-2	MTP-2	0-0-10-5
	Total	17
	<b>Grand Total</b>	<b>160</b>

### Compulsory IC courses in Science Baskets:

#### *Science I:*

Material Science for Engineers

#### *Science II:*

Understanding Biotechnology and its applications

### Electives leading to specializations (any seven):

#### **A. Biomedical Engineering:**

1. Anatomy and Physiology
2. Biomedical Systems
3. Analytical biotechniques
4. Embedded Systems
5. Tissue Engineering
6. Nanobiotechnology
7. Design and Analysis of Bioalgorithms
8. Analytical Biotechniques
9. Biosensing and Bioinstrumentation
10. Bioelectric Systems Modelling
11. Practical Metabolomics
12. Any other relevant courses to be floated by School

#### **B. Computational Bioengineering:**

1. Computational Biology
2. Design and Analysis of Bioalgorithms
3. Introduction to Proteomics
4. Practical Metabolomics
5. Biological Modelling and Simulation
6. Metabolic Systems Biology
7. Metagenomics, and Next Generation Sequencing Technologies
8. Introduction to OMICS and Systems Analysis
9. Quantitative and Computational Biology
10. Bioinformatics Applications for Systems Analysis

11. Any other relevant courses to be floated by School

## Proposals from School of Biosciences & Bioengineering

The following points were proposed by the School of Biosciences and Bioengineering in the 49th BoA meeting held on 28.03.2023 and approved by the BOA

**Agenda 1.** It is proposed to convert IDD Bioengineering to BTech Bioengineering (4 years) with provision for additional 1 Year MTech conversion to get a Dual Degree in Bioengineering with/without Specialisations. Number of seats will remain the same.

**Agenda 2.** Revision of the IDD Bioengineering syllabus is proposed to align with the institutional BTech curriculum that is in effect for 2022 intake.

The following changes are discussed to the existing curriculum and agreed upon.

a) **Credit Changes-** The change of credits of the following courses are proposed to align with the requirements of the BTech Bioengineering curriculum (*to be applicable for all batches now onwards*). The content is appropriate, and no changes are proposed:

Course No.	Course Name	Existing	Proposed
BE202	Biochemistry and Molecular Biology	2-0-2-3	3-0-2-4
BE203	Enzymology and Bioprocessing	2-0-2-3	3-0-2-4
BE304	Bioinformatics	2-0-2-3	3-0-2-4

b) **Level Changes-** The levels of the following courses are proposed to be revised to the new curriculum. *These changes will be applicable to all batches now onwards.*

Course No.	Course Name	Existing	Proposed
BE3XX	Biosensing and Bioinstrumentation	5	3
BE3XX	Biomaterials	5	3

*The revised contents of these courses are also proposed and attached in Annexure 1 & 2.*

**Agenda 3.** A new course **BE3XX: Introduction to Biomanufacturing (3-0-2-4)** is proposed to be introduced as a Discipline Core. It will be replacing **BE302: Bioelectric Systems Modelling** which will now become a Discipline Elective.

*After the proposed changes, the revised BTech Bioengineering curriculum structure is shared in Annexure 3.*

**Agenda 4.** Three new courses are being introduced, the proposals for which have been discussed in School of Biosciences & Bioengineering and approved by BOA. The list is given below-

BE3XX: Genetic Engineering (3-1-0-4)

BEXXX: Reverse Engineering for Bioengineers (0-0-2-1)

BE3XX: Introduction to Biomanufacturing (3-0-2-4)

*The course contents of the same are attached in Annexures- 4, 5, 6.*

**List of Core Courses**

Sl. No	Course Code	Course Name	L	T	P	Cr	L-T-P-C
1	BE 201	Cell Biology	3	0	2	4	3-0-2-4
2	BE 202	Biochemistry & Molecular Biology	3	0	2	4	3-0-2-4
3	BE 203	Enzymology & Bioprocessing	3	0	2	4	3-0-2-4
4	BE 301	Biomechanics	3	0	2	4	3-0-2-4
5	BE 3XX	Introduction to Biomanufacturing	3	0	2	4	3-0-2-4
6	BE 303	Applied Biostatistics	3	0	2	4	3-0-2-4
7	BE 304	Bioinformatics	3	0	2	4	3-0-2-4
8	BE 305	Bioethics & Regulatory Affairs	1	0	0	1	1-0-0-1
9	BE 3XX	Genetic Engineering	3	1	0	4	3-1-0-4
10	BE 3XX	Biosensing & Bioinstrumentation	3	0	2	4	3-0-2-4
11	BE 3XX	Biomaterials	3	0	2	4	3-0-2-4
12	BE XXX	Reverse Engineering	0	0	2	1	0-0-2-1
		<b>Total Credits</b>				42	

## Revised Curriculum (April 2023)

### B.Tech. Bioengineering

[Note: Intended for BTech Bioengineering or BTech-MTech Bioengineering students intake from 2022 onwards. Others follow old curriculum]

#### Semester 1

Course Code	Course Name	L - T - P - C
IC110	Engineering Mathematics – 1	2.5-0.5-0-3
IC140	Engineering Graphics for Design	2-0-3-4
IC152	Introduction to Python and Data Science	3-0-2-4
IC136	Understanding Biotechnology and its Applications (IC Core basket – 1)	2.5-0.5-0-3
HSXXX	HSS Course	3-0-0-3
YYXXX	Ikshma Course	1-0-0-1
	Total	18

#### Semester 2

Course Code	Course Name	L - T - P - C
IC111	Engineering Mathematics - 2	2.5-0.5-0-3
IC161	Applied Electronics	3-0-0-3
IC 161P	Applied Electronics Lab	0-0-3-2
IC252	Probability and Statistics	3-0-2-4
IC240	Mechanics of Rigid Bodies (IC Basket-2)	2.5-0.5-0-3
ICXXX	Foundations of Design Practicum	1-0-6-4
	Total	21

#### Semester 3

Course Code	Course Name	L - T - P - C
IC201P	Design Practicum	0-0-6-4
IC272	Machine Learning	2-0-2-3
BE201	Cell Biology	3-0-2-4
BE202	Biochemistry and Molecular Biology	3-0-2-4
BE3XX	Biosensing & Bioinstrumentation	3-0-2-4
HSXXX	HSS Course	3-0-0-3
	Total	22

#### Semester 4

Course Code	Course Name	L - T - P - C
BE301	Biomechanics	3-0-2-4
BE3XX	Introduction to Biomanufacturing	3-0-2-4
BE203	Enzymology and Bioprocessing	3-0-2-4

BE304	Bioinformatics	3-0-2-4
HSXXX	HSS Course	3-0-0-3
FE-1	Free Elective	3-0-0-3
	Total	22

### Semester 5

Course Code	Course Name	L - T - P - C
BE3XX	Genetic Engineering	3-1-0-4
BE3XX	Biomaterials	3-0-2-4
BE303	Applied Biostatistics	3-0-2-4
BE305	Bioethics & Regulatory Affairs	1-0-0-1
DE-1	Discipline Elective	3-0-0-3
FE-2	Free Elective	3-0-0-3
HSXXX	HSS Course	3-0-0-3
	Total	22

### Semester 6

Course Code	Course Name	L - T - P - C
BEXXX	Reverse Engineering for Bioengineers	0-0-2-1
DE-2	Discipline Elective	3-0-0-3
DE-3	Discipline Elective	3-0-0-3
DE-4	Discipline Elective	3-0-0-3
DE-5	Discipline Elective	3-0-0-3
FE-3	Free Elective	3-0-0-3
DP301P	ISTP	0-0-8-4
	Total	20

### Semester 7

Course Code	Course Name	L - T - P - C
IC010	Internship	0-0-0-2
DE-6	Discipline Elective	3-0-0-3
DE-7	Discipline Elective	3-0-0-3
FE-4	Free Elective	3-0-0-3
FE-5	Free Elective	3-0-0-3
MTP-1	MTP-1	0-0-8-4
	Total	18

## Semester 8

Course Code	Course Name	L - T - P - C
DE-8	Discipline Elective	3-0-0-3
FE-6	Free Elective	3-0-0-3
FE-7	Free Elective	3-0-0-3
FE-8	Free Elective	3-0-0-3
MTP-2	MTP-2	0-0-10-5
	Total	17
	<b>Grand Total</b>	<b>160</b>

### Compulsory IC courses in Science Baskets:

#### *Science I:*

Material Science for Engineers

#### *Science II:*

Understanding Biotechnology and its applications

### Electives leading to specializations (any seven):

#### **A. Biomedical Engineering:**

1. Anatomy and Physiology
2. Biomedical Systems
3. Analytical biotechniques
4. Embedded Systems
5. Tissue Engineering
6. Nanobiotechnology
7. Design and Analysis of Bioalgorithms
8. Biosensing and Bioinstrumentation
9. Bioelectric Systems Modelling
10. Practical Metabolomics
11. Any other relevant courses to be floated by School

#### **B. Computational Bioengineering:**

1. Computational Biology
2. Design and Analysis of Bioalgorithms
3. Introduction to Proteomics
4. Practical Metabolomics
5. Biological Modelling and Simulation
6. Metabolic Systems Biology
7. Metagenomics, and Next Generation Sequencing Technologies
8. Introduction to OMICS and Systems Analysis
9. Quantitative and Computational Biology
10. Bioinformatics Applications for Systems Analysis
11. Any other relevant courses to be floated by School



## IIT Mandi Proposal for a New Course

**Course number** : BE503  
**Course Name** : Biosensing and Bioinstrumentation  
**Credit** : 3  
**Distribution** : 2-0-2-3  
**Intended for** : B.Tech M.Tech Integrated Dual Degree Programme in Bioengineering (B.Tech Core course), elective for others  
**Prerequisite** : IC161 (Applied Electronics) and IC161P (Applied Electronic Lab) or equivalent, IC260 (Signals and Systems) or equivalent  
**Mutual Exclusion**: Not applicable

---

### 1. Preamble:

The course aims at studying techniques of measurement, obtaining signals from biological systems and processing those signals for estimating various biological parameters. The general principles of measurements, sensing and instrumentation will be applied in various bio-instruments. The students will also have a current background on the basic principles of key analytical biotechnologies, and how these technologies allow sensitive and accurate detection, purification, and characterization of biomolecules.

### 2. Course Modules with quantitative lecture hours:

**Topic 1: Measurement** – SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors, systems approaches for bioinstrumentation (Transformation of Input-to-output signal). **(3 Hours)**

**Topic 2: Biosignals** – Origin, nature, and types of Biosignals, Bioelectric signals - ECG, EMG, EEG; Biomechanical signals, Biomagnetic signals. **(6 hours)**

**Topic 3: Sensors** – Static and dynamic characteristics of sensors, Sensing principles – e.g. Chemical, Mechanical/MEMS, Voltage/Resistance, Strain, Piezoelectric, Optical, Acoustic, Thermal, etc. Specific examples – e.g. Electrodes, Strain gauge, Piezoelectric

pressure sensor, pulse oximeters, thermocouples, accelerometers, antibody based sensors, Immunoassays, ELISA, etc. (9 Hours)

**Topic 4: Bioinstrumentation** – Foundational principles – KCL, KVL, Ohm’s law, Loading effects, noise, SNR; Signal conditioning principles – operational and instrumentation amplifiers, passive and active filters, noise isolation and electrical hazards safety; Signal analysis – introduction to time series and frequency domain approaches; Bioinstrumentation systems design approaches. (6 hours)

**Topic 5: Analytical bio-techniques** - Principles and applications of UV-Visible-NIR spectroscopy, fluorescence spectroscopy, MR spectroscopy, basics of chromatographic techniques, imaging techniques – principles and applications of microscopy. (4 hours)

**Laboratory Modules:** Design of measurement circuits, extraction of bio-signals, amplification of bio-signals, signal conditioning, circuit isolation principles (e.g. optical, magnetic), systems design; lab visits for demonstration of state-of-art microscopy, spectroscopy, wet-lab approaches, etc.

### 3. Text books:

1. A.G. Webb, Principles of Biomedical Instrumentation, Cambridge University Press, United Kingdom, 2018.
2. J. G. Webster, Medical Instrumentation – Application and Design, 4e, John Wiley and Son, USA, 2020.

### 4. References:

1. R.S. Khandpur, Biomedical Instrumentation – Technology and Applications, Tata McGrawHill, India, 2017.
2. S.C. Mukhopadhyay, A.L. Ekuakille, Advances in Biomedical Sensing, Measurements, Instrumentation and Systems, Springer-Verlag, Germany, 2018.
3. J. R. Lakowicz, Principles of Fluorescence Spectroscopy, Springer Science & Business Media, 2013.
4. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, CBS publishers and Distributors, 2015.

### 5. Similarity with the existing courses:

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

S. No.	Course Code	Similarity	Approx. % of Content
--------	-------------	------------	----------------------

			Content	
1.	Bioelectric Systems Modelling	BE302	Bioelectric signals and their characteristics, Generation, Acquisition, and signal conditioning and analysis of biosignals	7%
2.	Analytical Biotechniques	BY514	Brief introduction to different analytical techniques	5%

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

Not applicable

**Approvals:**

**Other Faculty interested in teaching this course: –**

Dr. Shubhajit Roy Chowdhury, Dr. Erwin Fuhrer.

**Proposed by:** Dr. Srikanth Sugavanam

**School:** SCEE

**Signature:**

**Date:** 17<sup>th</sup> April 2023

***Recommended/Not Recommended, with Comments:***

\_\_\_\_\_  
Chairperson, CPC

**Date:** \_\_\_\_\_

***Approved / Not Approved***

\_\_\_\_\_  
Chairperson, BoA

**Date:** \_\_\_\_\_



**Approved in 49<sup>th</sup> BoA Meeting (28.03.2023)**

<b>Course number</b>	: BE3XX
<b>Course Name</b>	: Biomaterials
<b>Credit Distribution</b>	: 3-0-2-4
<b>Intended for</b>	: B. Tech-M. Tech. Integrated Dual Degree Bioengineering, Core for IDD BE and elective for others
<b>Prerequisite</b>	: IC 136 Understanding Biotechnology and its Applications and IC 241 Materials Science for Engineers or Consent of Faculty Member
<b>Mutual Exclusion</b>	: NA

---

**1. Preamble:** The objective of this course is to introduce the students to biomaterial science and technology. The target is to teach the physical and biological principles that serve as the scientific basis for understanding the interactions of biological molecules and cells with biomaterials employed for different biomedical applications.

**2. Course Modules with quantitative lecture hours:**

**Module 1: Introduction to Biomaterials (8 hours)**

Introduction to biomaterials and its history, Properties of Biomaterials- physico-chemical, mechanical, biocompatibility and biodegradability, Surface properties of biomaterials, Biological responses and Cell-Biomaterial interaction

**Module 2: Classes of Biomaterials (8 hours)**

Polymeric materials and blends, Biopolymers and hydrogels, Metal based biomaterials, Ceramics and bioglasses

**Module 3: Biomaterials Applications (20 Hours)**

Applications of biomaterials in cardiology, ophthalmology, dentistry and orthopaedics; Wound healing and dressing materials, skin substitutes and sutures, Applications of Biomaterials in Functional Tissue Engineering and drug delivery systems

**Module 4: Device development, Standards and regulatory compliance (6 Hours)**

Biomaterial device development and Regulation, Voluntary consensus standards, Commercialization, Ethical issues, Clinical trials

### Lab component: (28 Hours)

Lab component of the course will include synthesis/fabrication, characterisation, biocompatibility testing and application of biomaterials. The experiments include.

- Preparation of polymeric nanosphere and characterization
- Drug/Protein loading and release study with polymeric nanospheres
- Preparation and characterization of hydrogels/nanosponges
- Preparation and characterization of electrospun nanofibrous mats
- Biocompatibility Testing
- Preparation of Bioceramics and its characterization

### 3. Text books:

1. Biomaterials Science (Third Edition), An Introduction to Materials in Medicine, ISBN 978-0-12-374626-9, Academic Press, Edited by: Buddy D. Ratner et al.
2. Bikramjit Basu; Biomaterials Science and Tissue Engineering: Principles and Methods; Cambridge University Press; [ISBN: 9781108415156]; 2017.

### 4. References:

1. Bikramjit Basu; Biomaterials for Musculoskeletal regeneration: Concepts; Springer Nature, 2017 [ISBN: 978-981-10-3059-8].
2. Advanced Biomaterials: Fundamentals, Processing and Applications; John Wiley & Sons, Inc., USA (ISBN: 978-0-470-19340-2), September, 2009.
3. Biomaterials Science and Biocompatibility, Fredrick H. Silver and David L. Christiansen, Piscataway, Springer, New Jersey.
4. Related journal articles

### 5. Similarity Content declaration with existing courses: NA

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

6. Justification of new course proposal if cumulative similarity content is >30%: NA  
Other Faculty interested in teaching this course: – NA

Proposed by: Dr. Sumit Murab

School: SBS

Signature:



Date: 20-03-23

*Recommended/Not Recommended, with Comments:*

\_\_\_\_\_  
Chairperson, CPC

Date: \_\_\_\_\_

*Approved / Not Approved*

\_\_\_\_\_  
Chairperson, BoA

Date: \_\_\_\_\_

7.



## IIT Mandi - Proposal for a New Course

<b>Course Number</b>	: BE3xx
<b>Course Name</b>	: Genetic Engineering: principles and applications
<b>Credit Distribution</b>	: 3-1-0-4
<b>Intended for</b>	: UG (IDD Bioengg, 3rd year)
<b>Prerequisites</b>	: IC136 or consent of the faculty member
<b>Elective or Core</b>	: Discipline core
<b>Semester</b>	: Odd
<b>Mutual Exclusion</b>	: None

---

**1. Preamble:** The main objective of this course is to introduce the concepts, developments, and applications of genetic engineering or recombinant DNA technology (rDNA tech). This course provides a comprehensive understanding of plasmids/vectors, DNA modifying enzymes such as restriction enzymes that cut DNA, ligases that join DNA fragments, and polymerases that amplify DNA fragments. The students will learn how rDNA technology works by exploring various DNA cloning methods. By the end of this course, students will be able to understand the principles of recombinant DNA technology and methods associated with it such as cutting, joining, and amplifying DNA fragments. They will also get hands-on training on gene cloning methods and learn to use online tools to analyze DNA sequences and design primers. As a result of this course, the students will have strong foundations and first-hand scientific understanding and hands-on training in genetic engineering and how it can be used to generate genetically modified organisms for commercial, agricultural, and medical purposes.

### **2. Course Modules with quantitative lecture hours:**

#### ***Module-1 Introduction***

***[12 hours]***

Gene and mRNA structure and properties; analysis of DNA and RNA sequences, DNA and RNA modifying enzymes (Restriction Enzymes, DNA ligase, Klenow enzyme, T4-DNA polymerase, Polynucleotide kinase, Alkaline phosphatase). Introduction to genetic engineering and GMOs.

#### ***Module-2 PCR and Its Applications***

***[11 hours]***

Primer, Primer designing, Thermostable DNA polymerases, PCR, Types of PCR – multiplex, nested, reverse transcriptase, cDNA synthesis, real-time PCR, touchdown PCR, hot start PCR, colony PCR. Site-directed mutagenesis, Mutation detection, PCR in molecular diagnostics, Viral and bacterial detection.

#### ***Module-3 Cloning Vectors***

***[8 hours]***

Bacterial and viral based plasmids (PUC19, Bluescript vectors, M13 vectors, SV-40 vectors, Phagemids, Cosmids); Artificial chromosome vectors (YACs; BACs); Plant based vectors, Ti and Ri as vectors, Selection of vectors, Expression vectors (pMal; GST; pET-based vectors)

**Module-4 Cloning Methodologies****[12 hours]**

Restriction Enzyme Based Cloning; PCR Cloning (TOPO or TA); Ligation Independent Cloning (LIC); Seamless Cloning (SC); Recombinational Cloning; Gibson Assembly (Isothermal Assembly Reaction); Expression cloning, Construction of genomic and cDNA libraries.

**Module-5 Introduction of DNA into cells****[7 hours]**

Introduction of DNA into bacterial cells (transformation methods), viruses (transduction methods), mammalian cells (Transfection techniques), plant tissues (Transfection techniques, particle bombardment), and model organisms (microinjections).

**Module-6 Genetic engineering applications, case studies and ethical issues [6 hours]**

Recent developments in genetic engineering methods; Applications of genetic engineering in agriculture and medicine; GMOs and GEMs; Socio-economic, cultural, and ethical issues.

**3. Textbooks:**

1. Terry A. Brown, Gene Cloning: An Introduction. 8th edition, Wiley-Blackwell, 2021; ISBN 978-1119640783.
2. Sandy B. Primrose, Richard Twyman, Principles of Gene Manipulation and Genomics. 8th edition, John Wiley Blackwell, 2016; ISBN 978-8126548392.

**4. References:**

1. Michael R. Green and J. Sambrook. Molecular Cloning: A Laboratory Manual (Fourth Edition), Vols 1-3, Cold Spring Harbor Laboratory Press, CSHL, 2012; ISBN 1936113422.
2. B. Alberts, R. Heald, A. Johnson, D. Morgan, M. Raff. Molecular Biology of the Cell, 7th edition, W.W. Norton & Co Inc, 2022; ISBN 978-0393884821

- Relevant research articles/reviews will be advised relating to the topic being taught.

**5. Similarity with the existing courses:**

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

S. No.	Course Code	Similarity Content	Approx. % of Content
1.	BE202	PCR lab	5%

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

None

**Approvals:**

Other Faculty interested in teaching this course:

**Proposed by:** Dr. Prasad Kasturi

**School:** SBB



**Signature:**

**Date:** 07.03.2023

***Recommended/Not Recommended, with Comments:***

\_\_\_\_\_  
Chairperson, CPC

Date: \_\_\_\_\_

***Approved / Not Approved***

\_\_\_\_\_  
Chairperson, BoA

Date: \_\_\_\_\_



Indian  
Institute of  
Technology  
Mandi



## IIT Mandi Proposal for a New Course

<b>Course number</b>	: BE3XX
<b>Course Name</b>	: <b>Introduction to Biomanufacturing</b>
<b>Credit Distribution</b>	: 3-0-2-4
<b>Intended for</b>	: B.Tech.-M.Tech. Integrated Dual Degree in Bio-Engineering
<b>Prerequisite</b>	: IC 136 Understanding Biotechnology and its Applications or Consent of Faculty Member
<b>Mutual Exclusion</b>	: NA

---

### **1. Preamble:**

The course is designed to introduce **Principles of Biomanufacturing** including the biological, material and engineering aspects. The course will provide a thorough understanding of biomanufacturing concepts, design, good manufacturing practices and translation for both biologicals and tissue engineered/ 3D printed/ 3D Bio-printed products. The course will also focus on the regulatory and process development aspects of the biomanufacturing process.

### **Course Modules with quantitative lecture hours (42 total hours):**

#### ***Module 1: Manufacturing of Biomolecules*** (12 Hours)

Introduction to Biologicals, Biomolecules for industrial application, Stages of biomanufacturing, Case studies, Expression systems, Nutritional strategies/cell culture media, Cell growth, Bioreactor design, operation, and control,

#### ***Module 2: Production, Isolation & Purification*** (12 Hours)

Cell separation: centrifugation and depth filtration, Chromatography, Viral clearance, Ultrafiltration and diafiltration, Bulk filling

#### ***Module 3: Industrial Scaleup*** (12 Hours)

Applicable Regulations and Guidelines, GMP and GDP. Clinical evaluation, Registration or licensing, Quality assessment, Stages of Process Development- early, mid, late, Process characterization, Process validation, Scale-up considerations

#### ***Module 4: Policies & Future Directions in Biomanufacturing*** (6 Hours)

Bench to bedside concept, Development of new stem-cell- based therapies, tissue engineered,

3D-Bioprinted tissues/ organs, Preclinical studies for first-in-human studies, Discovery process in cell and gene therapy/ tissue engineering, First-in-humans studies, Phase 1 first-in-human studies, target product profile (TPP), Human subject ethical issues.

**Laboratory Experiments (28 Hours):**

1. Alginate bead encapsulation
2. Chromatography
3. Ultrafiltration and diafiltration
4. Cell separation

**2. Text books:**

1. Gilleskie, Gary, Charles Rutter, and Becky McCuen. **Biopharmaceutical Manufacturing: Principles, Processes, and Practices.** Walter de Gruyter GmbH & Co KG, 2021.
2. Atala, Anthony, and Julie Allickson, eds. **Translational regenerative medicine.** Academic Press, 2014.
3. **Biological Drug Products: Development and Strategies;** Wei Wang , Manmohan Singh ; Wiley,2013

**3. References:**

1. **Online Textbook:** <https://biomanufacturing.org/curriculum-resources/textbooks-manuals/introduction-to-biomanufacturing>
2. **Related journal article**

**4. Similarity with the existing courses:**

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

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Tissue Engineering	BE507	Development of tissue engineered products	2%
2.	Enzymology and Bioprocessing	BE 203	Bioreactor operation	3%

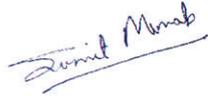
**6. Justification of new course proposal if cumulative similarity content is >30%: NA Approvals:**

**Other Faculty interested in teaching this course: – NA**

Proposed by: Dr. Sumit Murab

School: SBS

Signature:



Date: 20-03-23

*Recommended/Not Recommended, with Comments:*

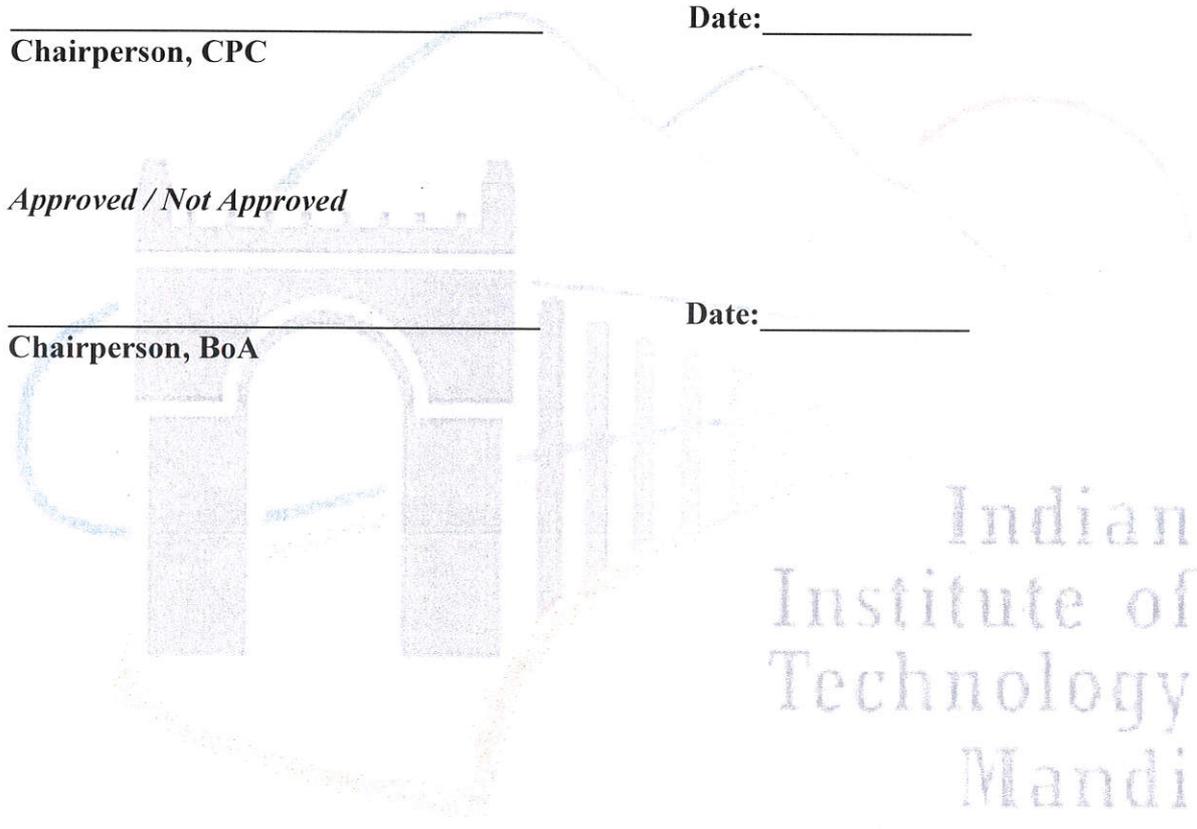
\_\_\_\_\_  
Chairperson, CPC

Date: \_\_\_\_\_

*Approved / Not Approved*

\_\_\_\_\_  
Chairperson, BoA

Date: \_\_\_\_\_



Indian  
Institute of  
Technology  
Mandi



## IIT Mandi Proposal for a New Course

<b>Course number</b>	: BE101P
<b>Course Name</b>	: Reverse Engineering for Bioengineers
<b>Credit Distribution</b>	: 0-0-2-1
<b>Intended for</b>	: B.Tech.-M.Tech. Integrated Dual Degree in Bioengineering (Core Course)
<b>Prerequisite</b>	: No prerequisite (compulsory for Bioengineering students)
<b>Mutual Exclusion</b>	: NA

---

### 1. Preamble:

The course is designed to introduce the students to:

- Understanding of basic biomedical engineering systems.
- Understand the terminologies related to re-engineering, forward engineering, and reverse engineering.
- Disassemble products and specify the interactions between its subsystems and their functionality
- Understand Reverse Engineering methodologies.
- Understand Reverse engineering of Biotechnological/ Biomedical devices.

### Course Modules (28 total hours):

The students focus on hardware reverse engineering (RE). In the process of RE students understand existing technologies, functions, features, objects, components and systems. By carefully disassembling, observing, testing, analyzing and reporting, students can understand how something works and suggest ways it might be improved. This process requires careful observation, disassembly, documentation, analysis and reporting. Many times, the reverse engineering process is non-destructive. This means that the object or component can be reassembled and still function just as it did before it was taken apart. Throughout the reverse engineering project, the students are able to think of ways these objects could be improved. Is there some way it could function better? or manufactured less expensively? The students will use observations to make suggestions for improvement of the product.

**Learning Topics:** Reverse Engineering of Biotechnological/Biomedical- Devices/ prototypes.

### 2. Text books:

1. Lam, R.H. and Chen, W., 2019. Biomedical Devices. Materials, Design, and Manufacturing. Springer, Reading, Massachusetts, 1.
2. Boccato C, Cerutti S, Vienken J, editors. Medical devices: improving health care

through a multidisciplinary approach [Internet]. Cham: Springer International Publishing; 2022

**3. References:**

1. RE as necessary phase by rapid product development by Sokovic and Kopac. Journal of Materials Processing Technology 2005
2. Reversing: Secrets of Reverse Engineering by Eldad Eilam Publisher: Wiley (April 15, 2005)
3. The IDA Pro Book: The Unofficial Guide to the World's Most Popular Disassembler by Chris Eagle

**4. Similarity with the existing courses:**

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

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

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

**Approvals:**

**Other Faculty interested in teaching this course: –**

NA

**Proposed by: Dr. Sumit Murab**

**School: SBS**

**Signature:**



**Date: 20-03-23**

**Recommended/Not Recommended, with Comments:**

\_\_\_\_\_ **Date:** \_\_\_\_\_

**Chairperson, CPC**

*Approved / Not Approved*

**Date:** \_\_\_\_\_

\_\_\_\_\_  
**Chairperson, BoA**



Indian  
Institute of  
Technology  
Mandi

**Proposal of modification in ISTP, MTP, Outside Electives, Free Electives etc. in UG & PG programmes**

<b>Proposal for Free Elective in lieu of Outside Discipline Elective</b>	<p>Currently, there is lot of confusion regarding the Outside Discipline Elective. For a student in PED, VLSI course is outside discipline elective, if we consider each program as one discipline. However, if we see the course codes, both have EEXXX and the PED student cannot take VLSI course as outside discipline electives.</p> <p>Lot of times, students are interested to take discipline elective course rather than opting outside discipline course, if choice is there.</p>
<b>The Proposal is to</b>	Change the outside discipline elective to free elective, which provides more flexibility to the student.
<b>Proposal for Credit Substitutes for ISTP and MTP</b>	
<b>ISTP Substitute Credits</b>	
<b>Existing (4 credits)</b>	<b>Proposed</b>
3 Cr Discipline Electives + 1 cr Free Elective	4 Cr Free Electives, if ISTP is not opted
<b>Reasons</b>	<p>ISTP is Interactive Socio-Technical Practicum, which involves both Social Component and Technical Component. Technical component need not be from the parent branch.</p> <p>It makes more sense to allow the student to take Free Electives in lieu of ISTP, where the student can take any course of his/her choice.</p> <p>Often it makes difficult for the students to follow the ratio of 3 Discipline Elective Credits and 1 Free Elective Credits.</p>
<b>MTP Substitute Credits</b>	
<b>Existing (3+5=8 credits)</b>	<b>Proposed (3+5=8 credits)</b>
6 Cr Discipline Electives + 2 Cr Free Elective, if MTP is not opted	3+5 Cr Discipline Electives, if MTP is not opted
	5 Cr Discipline Electives, if MTP-2 is dropped
<b>Reasons</b>	<p>MTP is Major Technical Project, which involves Technical Component from the parent branch.</p> <p>It makes more sense to allow the student to take Discipline Electives in lieu of MTP, where the student can take any Discipline course of his/her choice.</p> <p>Often it makes difficult for the students to follow the ratio of 3 Discipline Elective Credits and 1 Free Elective Credits.</p> <p>The credit requirements of MTP-1 and MTP-2 are different. Sometimes, the students drop MTP-2, due to minimum requirement of grades in MTP-1 or due to other reasons. It is becoming difficult to distribute the credits under Discipline Electives and Free Electives.</p> <p>There is confusion regarding the credits of MTP-1, in case of MTP-2 drop.</p>

## Proposal for Revised Course Proposal Process

### Current Procedure:

The process to be followed from the initiation of a course proposal to its final acceptance is listed below:

1. Any proposal for a new course or modification to an existing course is initiated by a faculty member and submitted in the prescribed format to the relevant PFG chair. The format is available on the IIT Mandi intranet. (Note: In the case where the course doesn't fit into one specific program, it may be submitted directly to the AD courses through the CPC chair)
2. The PFG chair discusses the proposal within the PFG. If the PFG (with adequate quorum) finds that the proposal can be taken forward, then the PFG identifies the corresponding reviewers for detailed feedback on the course content, and the PFG chair sends this information along with the PFG discussion minutes/ recommendations to the CPC Chair.
3. The CPC chair identifies a coordinator within the CPC to guide the course proposal process. The coordinator posts the course proposal on an IIT Mandi platform (faculty discussion board/mail to faculty local/ or other means) to make the course proposal available for a sufficient time duration to all faculty for their feedback.
4. After obtaining feedback from the internal faculty, if any, the coordinator in consultation with PFG chair will consult at least two subject experts for review. These experts should be from reputed institutions in India or abroad. In rare cases, they may be internal members of IIT Mandi.
  - When course proposals are sent to outside experts, the experts shall also be given relevant documentation related to the programme curriculum and the syllabi of related courses (or links to these documents/courses) so that they can provide their comments in the context of the IIT Mandi curriculum.
5. On receipt of the review comments from the experts, the CPC coordinator will send the same to the course proposers for their consideration and action. The course proposer will modify the course proposal as appropriate and prepare a point-wise response to the reviewers' comments. These comments should be accepted by the PFG and then sent back to the CPC coordinator through the PFG chair.
6. The CPC coordinator will send the modified course proposal along with the reviewers' comments and point-wise response, along with the recommendation of the PFG to the CPC chair.
7. The CPC chair conducts one final inspection to ensure that due diligence has been carried out (checking for format, prerequisites, exclusions and other such issues) and asks the coordinator to post the final version on the IIT Mandi internal forum (as mentioned earlier). Normally, a few days' time will be given to the faculty members to post their comments on the forum.
8. The CPC Chair will then present the course proposals to the Board of Academics (BoA). If required, the BoA may invite the CPC coordinator and/or course proposer to the respective BoA meeting for assisting the board in its deliberations. The BoA will decide whether or not to provide the final approval to the course. The board may also require the course proposer to make changes to the proposal and resubmit the same.
9. The finalized course proposals will be compiled and submitted to the AD (Courses) and Dean Academics by the CPC Chair after approval by the BoA. The approval of the course will then be included as a reporting item in the subsequent senate meeting.
10. In case of any issues in the above process, an appeal can be made by the course proposer/any other person to Dean Academics. Further, the Chairperson Senate, on the recommendation of the Dean Academics, or otherwise may relax any of the above processes, as the chairperson deems fit.
11. Modification in the content of existing courses that amounts to  $\geq 25\%$  change, in terms of course hours, will follow the same process as detailed in points 1-10. In such cases, the CPC chair may recommend the creation of a new course and the retirement of the earlier course.
12. Modification in the content of existing courses that amount to  $< 25\%$  change, in terms of course hours, may be sent directly to BoA through the CPC Chair, without involving any external reviewers. Such modification requires due deliberation within the respective PFG, and such deliberations of the PFG and justification for changing the content shall also be sent along with the proposed course modification. The BoA will then take the decision on whether to accept the course modification. The BoA may also recommend sending the proposal to external reviewers.

### Reasons for Modification:

1. Institute is grown over the years.
2. New Programs are started and new programs may start in future.
3. Four Schools were splitted into 8 Schools recently. New Schools and Centres are being setup at the institute.
4. CIG and PFG are dissolved and the charges related to program and course executions deliberated to schools.
5. It becomes difficult for the CPC and school/center coordinators to execute the Course Proposals in the existing methods. Faculty may need to spend lot of time for visiting the Faculty Discussion Forum / check the emails / other means regarding the course proposals. Lot of times, faculty from other areas may not be interested to comment.
6. Currently, we have sufficient number of faculty in lot of schools/centers. Some of the schools have reasonable number of full Professors, with good professional experience.
7. Faculty at the Institute are in a position to propose new course/program after necessary discussions and reviews.

**Reference for the Proposal:** Item 9.6, 9<sup>th</sup> Senate Meeting Minutes

*Further, the Senate advised that courses need not be sent for external review when the Course Interest Group (CIG) of the programme recommends that there is sufficient independent internal expertise available to review the course.*

**Proposal in lieu of Current CPC:**

CPC will be dissolved.

**A. Where the Schools/Centres are Equipped with Sufficient Expertise:**

1. Charges of CPC may be deliberated to respective schools/centres.
2. Specialized faculty from Schools/Centres will propose the course after appropriate discussions and reviews, if necessary. Faculty may meet multiple times before proposing the course in BoA.
3. School/Centre Chair will authorize the proposal, to be presented in BoA.
4. BoA may pass the course with comments, if any.
5. Course Numbers will be maintained by School Offices.
6. IC Courses' Numbers will be maintained by the Academic Section.
7. Faculty of School are responsible for the checking the duplication of contents, courses etc.
8. If the course needs involvement from different schools, the proposal needs to be proposed by combined members of the different schools. However, one School should take the ownership of the course. Both School Chairs should authorize the Proposal.

**B. Where the Schools are not Equipped with Sufficient Expertise:**

1. Schools will send the proposal to at least Two Experts outside the Institute.
2. Comments may be discussed in the School Meetings.
3. After Addressing the comments, School may present the Course in BoA.
4. Points 3-8 for Proposal A are applicable here also.

**C. Where the Schools are newly formed and Courses are to be proposed:**

1. School will propose a committee, with Experts (after getting the consent from experts) from Other Reputed Institutes from India and/or abroad, to the Dean Academics. Upon the approval of the Dean Academics, the Committee will propose the curriculum along with the contents of the courses.
2. Alternatively, expert(s) from the Other Reputed Institutes may be requested for the course contents.
3. After receiving the proposals from experts, School may present the Course in BoA.
4. Points 3-8 for Proposal A are applicable here also.