INDIAN INSTITUTE OF TECHNOLOGY MANDI

KAMAND, DISTT. MANDI – 175075 (HIMACHAL PRADESH)

MINUTES OF 54TH BOARD OF ACADEMICS MEETING

VENUE	:	GUEST HOUSE (NC)CONFERENCE ROOM + ONLINE
DATE	:	14th May, 2024 (TUESDAY)
TIME	:	3:00 P.M.

Following members attended the meeting

1.	Dean Academics	Prof. Aniruddha Chakraborty
2.	Associate Dean (Research) I/c	Dr. P. Anil Kishan
3.	Associate Dean (Courses)	Dr. P Anil Kishan
4.	Nominee-1: School of Computing and Electrical Engineering	Dr. Padmanabhan Rajan
5.	Nominee-2: School of Computing and Electrical Engineering	Dr. Gopi Shrikanth Reddy
6.	Nominee-1: School of Chemical Sciences	Dr. Bhaskar Mondal
7.	Nominee-2: School of Chemical Sciences	Dr. Garima Agrawal
8.	Nominee-2: School of Biosciences and Bioengineering	Dr. Kasturi Prasad
9.	Nominee-2: School of Mathematical and Statistical Sciences	Dr. Syed Abbas
10.	Nominee-1: School of Mechanical and Materials Engineering	Dr. Gaurav Bhutani
11.	Nominee-1: School of Civil and Environmental Engineering	Dr. Maheshreddy Gade
12.	Nominee-2: School of Civil and Environmental Engineering	Dr. Prasanna Rousseau
13.	CnP Advisor	Dr. Kala Venkata Uday
14.	PG Academic Secretary	Mr. Sudama Babu Singhal
15.	Deputy Registrar (Academics): Secretary	Mr. Suresh Rohilla

Following members could not attend the meeting

Sl. No.		Name	
1.	Chairman Senate Library Committee	Prof. Anjan Kumar Swain	Member
2.	Nominee-1: School of Physical Sciences	Dr. Arko Roy	Member
3.	Nominee-2: School of Physical Sciences	Dr. Gargee Sharma	Member
4.	Nominee-1: School of Biosciences and Bioengineering	Dr. Sumit Murab	Member
5.	Nominee-1: School of Mathematical and Statistical Sciences	Dr. Rajendra K Ray	Member
6.	Nominee-2: School of Mechanical and Materials Engineering	Dr. Sudhir Pandey	Member
7.	Nominee-1: School of Humanities & Social Sciences	Dr. Rajeshwari Dutt	Member

8.	Nominee-2: School of Humanities & Social Sciences	Dr. Ramna Thakur	Member
9.	Nominee-1: Centre of AI and Robotics	Dr. Narendra Dhar	Member
10.	Nominee-2: Centre of AI and Robotics	Dr. Jagadeesh	Member
11.	Nominee-1: IKSHMA	Dr. Aniruddha Chakraborty	Member
12.	Nominee-2: IKSHMA	Dr. Sumit Murab	Member
13.	Industry Member – 1	Dr. Nadeem Akhtar	Member
14.	Academic Affairs Secretary	Ms. Dishti Oberai	Member
15.	Research Affairs Secretary	Mr. Saurabh Patel	Member

Special Invitee

Sl. No.	Name	
1	Dr. C.S Yadav	Assoc. Prof. SPS
2	Dr. Ramajayam Govindaraji	Asst. Prof. IKSMHA
3	Dr. Arnav Bhavsar	Assoc. Prof., SCEE
4	Dr. Dericks P Shukla	Assoc. Prof., SCENE
5	Prof. Manoj Thakur	Prof., SoM
6	Dr. Nitu Kumari	Assoc. Prof., SMSS
7	Dr. Saswata Adhikari	Asst. Prof. SMSS
8	Dr. Muslim Malik	Assoc. Prof., SMSS
9	Dr. Dinesh Singh	Asst. Prof. SCEE
10	Dr. Rohit	Asst. Prof. SCEE
11	Dr. Akhaya Nayak	Assoc. Prof., SoM
12	Dr. Satavasheel Powar	Assoc. Prof., SMME
13	Dr. Rahul Kothari	Asst. Prof. SPS
14	Dr. Kaustav Sarkar	Assoc. Prof., SCENE
15	Dr. Aditya Nigam	Assoc. Prof., SCEE
16	Dr. Indu Bala	Asst. Prof. SCS
17	Dr. Shyamasree Dassgupta	Assoc. Prof., SHSS

PART-A

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

54.1 Confirmation of the minutes of 53rd meeting of the Board of Academics:

The minutes of the 53rd meeting of the Board of Academics held on 22nd December, 2023 were confirmed.

54.2 To consider applicability of reservation in admissions/upgradation/conversion etc:

Associate Dean (Research) I/c, presented the proposal for applicability of reservation in admission/upgradation/conversion etc.

As per 42nd Senate Item No. 42.15, the reservation as per GoI norms was made applicable for the admissions where eligibility criteria for admission is 7.5. and criteria was relaxed as under:

- OBC (NCL): 7.00 GGPA
- SC/ST/PwD: 6.5 CGPA

There are few aligned issues to be regularized and executed in line with these approved norms, as per existing norms CGPA 8.0 is the criteria:

(i) for upgradation, conversion etc. for all programme.
(ii) For M.Tech Research +Ph.D. Dual Degree Programme
(iii) For M.Tech admissions of B.Tech from IITs

It is recommended that the CGPA 7.5 criteria may be kept at par with direct admissions as mentioned above and also the reservation may be made applicable accordingly. After due deliberations, the BoA recommended the proposal for the consideration of the senate and its approval.

54.3 To consider the proposal for processing of various scholarships:

Associate Dean (Courses) presented the proposal for processing of various online/offline UG Scholarships. While processing the scholarships, the recommendations of the designated committees and available guidelines of the scholarships are followed also Institute norms as applicable are also taken into consideration. while processing the scholarship the following observation/difficulty have been noticed:

There is a condition of passing previous year for renewal/claiming of the scholarship for the Academic Year. Few students who obtained "F" (Fail) grade in few courses are not eligible for the scholarship. However, as per norms they are promoted to the next semester/year. In addition to the "F" grade in few courses, some students are also able to maintain CGPA more than 5 which is considered as minimum Pass grades as per O&R of the programmes.

BoA recommended the following for the consideration of Senate and its approval:

(i) If student obtains CGPA >= 5 without F grade he/she will be considered passed.
(ii) If student obtains CGPA >= 5 with F grade he/she will be considered passed for **ONLY** for the purpose of the eligibility of scholarship.
(iii) If student obtains CGPA <5 without any F Grade then he will be considered passed for **ONLY** for the purpose of the eligibility of scholarship.

54.4 To consider the proposal to establish a new Centre for Entrepreneurial Development:

Dr. Satavasheel Powar, presented the proposal to establish a new Centre for Entrepreneurial Development. After due deliberations, the BoA recommended the proposal with minor modifications for consideration of the Senate and approval.

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

54.5 To consider, curriculum Revision and Associated Course Content Modification for MSc Chemistry:

Dr. Bhaskar Mondal presented the proposal for curriculum revision and Associated Course Content Modification for MSc Chemistry. After due deliberations, the BoA approved the proposal and the same shall be reported to the Senate.

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

54.6 To consider the revision of M.Tech. (Biotechnology) Curriculum:

Dr. Kasturi Prasad presented the proposal for revision in M.Tech Biotech Curriculum. After due deliberations, the BoA approved the proposal and the same shall be reported to the Senate.

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

54.7 To consider proposal for Ordinance & Regulations for MBA Data Science & Artificial Intelligence.

Dr. Akhaya Naik presented the proposal for Ordinance and Regulations for MBA Data Science & Artificial Intelligence. After due deliberations, the BoA recommended the proposal for consideration of the Senate and approval

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

54.8 To consider the new courses from SoM:

Dr. Akahya Naik presented the proposal for new courses from SoM. After due deliberations, the BoA approved the following courses in new format with minor modifications and the same shall be reported to the Senate.

Sl.No.	Course No.	Course Name	Credits
1.	MB-201	Foundations of Business Management	3-0-1-4
2.	MB-202	Microeconomics	3-0-0-3
3.	MB-550	AI in Marketing	2-0-0-2
4.	MB-551	Causal Analytics	2-0-0-2
5.	MB-552	Financial Analytics	2-0-0-2
6.	MB-553	Fintech	2-0-0-2
7.	MB-555	Deep Learning for Business Application	2-0-0-2
8.	MB-556	Natural Language Processing for Business	2-0-0-2
9.	MB-559	Fuzzy logic for business decision making	2-0-0-2

10.	MB-560	Evolutionary computation for business solutions	2-0-0-2
11.	MB-572	Social Analytics	2-0-0-2
12.	MB-573	Cloud Computing For Business	2-0-0-2
13.	MB-574	Cyber Securities, Ethics and Privacy	2-0-0-2
14.	MB-579	Marketing Analytics	2-0-0-2
15.	MB-580	AI for Finance	2-0-0-2
16.	MB-581	Leadership lessons from Indian Knowledge Systems	2-0-0-2
17.	MB-582	Consumer Behavior	2-0-0-2
18.	MB-583	Digital marketing	2-0-0-2
19.	MB-584	Supply Chain Management	2-0-0-2

The course descriptions are placed as **Annexure- E**.

54.9 To consider proposal for Credit distribution for internships and application process:

Dr. Kala Venkata Uday presented the proposal for Credit distribution for internships and application process and New course approval based on the internship approval. After due deliberations, the BoA recommended the proposal with minor modifications for consideration of the Senate and approval.

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

54.10 To consider the new courses from SCEE:

BoA approved the following courses from SCEE and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1.	CS-212	Design and Analysis of Algorithms	3-0-2-4
2.	CS-305	Artificial Intelligence	3-0-0-3
3.	CS-312	Operating System	3-0-0-3
4.	CS-313	Computer Networks	3-0-2-4
5.	CS-362	Artificial Intelligence	3-0-0-3
6.	CS-673	Advanced Computer Vision	3-0-2-4
7.	CS-683	Generative AI	3-0-1-4
8.	CS-685	Natural Language Processing	3-0-0-3
9.	CS-686	Large Language Models: Core Concepts to Custom Applications	3-0-2-4
10.	DS-313	Statical Foundations for Data Science	3-1-0-4
11.	DS-411	Optimization for Data Science	3-1-0-4
12.	DS-412	Matrix Computations for Data Science	3-0-2-4
13.	DS-413	Introduction to Statistical Learning	3-1-0-4
14.	EE-500	Network Control System	3-0-0-3
15.	EE-557	Adaptive Control	3-0-0-3
16.	EE-552	Power Energy Systems	3-1-0-4
17.	EE-553	Foundations of Intelligent Communication Systems-I	3-0-2-4
18.	EE-554	Low Power VLSI Design	3-0-0-3

19.	EE-555	Intelligent Control System	3-0-0-3
20.	EE-556	Nuclear Reactor Control	1-0-01
21.	EE-570	Advanced Communication Theory	3-0-2-4
22.	EE-571	Digital Signal Processing	3-0-2-4
23.	EE-574	Biomedical Signal and Image Analysis	3-0-0-3
24.	EE-575	Applied statistics for data and signals	3-0-2-4
25.	EE-581	Foundations of Intelligent Communication Systems-II	3-0-2-4
26.	IC-253	Programming and Data Structures	2-0-2-3

The course descriptions are placed as **Annexure- G**.

54.11 To consider the revision of DE courses in the Civil Engineering students:

Nominee from SCENE, presented the addition of following courses in Discipline Elective Course list for B.Tech, Civil Engineering students:

Course No.	**Name of the Course**
CE-404	Analysis of Structures
CE-503	Fundamentals of Project Management
CE-514	Rock Mechanics
CE-515	Environmental Impact Assessment
CE-516	Uncertainty Analysis in Civil Engineering
CE-517	Hydroinformatics
CE-518	Structural Reliability and Risk Assessment
CE-519	Chemistry of Natural Waters
CE-520	Environmental Reaction Modeling
CE-521	Ecology and Environment Microbiology
CE-551	Geosynthetics and their applications
CE-561	The Science of Climate Change
CE-602	Blast Engineering
CE-604	Theory of Plasticity
CE-613	Unsaturated Soil Mechanics

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

It has been discussed and agreed by BoA members that for B.Tech students:

1. All discipline courses other than discipline core will be discipline elective for students of the discipline (eg. All EE courses other than discipline core are Discipline Elective for EE student)
2. List of Discipline Elective courses from outside discipline will be shared separately by schools for inclusion.

54.12 To consider the revision of DE courses in the Electrical Engineering students:

Dr. Gopi Shrikant Reddy presented the proposal for revision of Discipline courses Course list for B.Tech, Electrical Engineering students:

Course No.	**Name of the Course**	**Remarks**
CS507	Computer Architecture (3-0-2-4)	for all EE batches
CS549	Performance Analysis for Computer Networks (3-0-0-3)	as discipline electives for all EE batches

DS303	Statistical Foundations of Data Science (3-0-0-3)	EE 2020 batch only

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

54.13 To consider the addition of courses for CSE minor requirements:

Dr. Padmanabhan Rajan, presented the proposal for addition of following course for CSE minor requirements.

Course No.	Name of the Course	Remarks
CS-212	Design and Analysis of Algorithms (3-0-2-4)	Core Course

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

54.14 To consider the new courses from SHSS:

BoA approved the following courses from SHSS in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	HS-307	Macroeconomics I	3-0-0-3
2	HS-308	Introduction to Modern European Literature	2-0-0-2
3	HS-505	Circularity in Modern European Literature	3-0-0-3
4	HS-506	Population Studies: Theory and Basic Analysis	3-0-0-3
5	HS-555	Infrastructural Development in Highland South Asia	3-0-0-3
6	HS-600	Research Methodology	1-0-0-1

The course descriptions are placed as **Annexure- H**.

54.15 To consider proposal for inclusion of courses in Minor in Management basket:

Dr. Shyamasree Dassgupta, presented the proposal for inclusion of following courses in Minor in Management Basket.

Sl.No.	Course No.	Course Name
1	HS-307	Macroeconomics I
2	HS-481	International Economics
3	HS-504	Personal Finance and Portfolio Management

After due deliberations, the BoA approved the proposal for one time for B.Tech batch admitted in 2020 and 2021 and the same shall be reported to the Senate.

54.16 To consider the new courses from IKSMHA:

BoA approved the following courses from IKSMHA in new format and the same shall be reported to the Senate:

Sl. No.	Course No.	Course Name	Credits

1	IC- 181	Introduction to Consciousness and Holistic Wellbeing	2-0-2-3
2	IK- 510	Cognitive Neuroscience	3-1-0-4

The course descriptions are placed as **Annexure- I**.

54.17 To consider the new courses from SCENE:

BoA approved the following courses from SCENE in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	CE-600	Research Methodology for Civil Engineering	1-0-0-1
2	CE-356	Reverse Engineering	0-0-2-1
3	CE-523	Building Science	3-0-0-3

The course descriptions are placed as **Annexure- J**.

54.18 To consider the new courses from SMME:

BoA approved the following courses from SMME in new format and the same shall be reported to the Senate

Sl.No.	Course No.	Course Name	Credits
1	ME-303P	Heat Transfer Lab	0-0-3-1
2	ME-526	Programming Paradigm for Open-source Codes	2-0-2-3
3	GE-501	Creative Engineering Design	2-0-2-3
4	GE-502	Consciousness and professional ethics	2-1-0-3
5	GE-522	Entrepreneurship and Technology Commercialization	3-0-2-4
6	GE-523	Startup Framework: Finance, Valuation, and Structure	3-0-0-3
7	GE-521	Essentials of Entrepreneurship	3-0-0-3 (Course Code change from HS-510)

The course descriptions are placed as **Annexure- K**.

54.19 To consider the new courses from SMSS:

Nominee from SMSS, presented the proposal of the following new courses from SMMS. After due deliberations, the BoA approved the following courses in new format with minor modifications and the same shall be reported to the Senate

Sl.No.	Course No.	Course Name	Credits
1	MA-210	Real and Complex Analysis	2.5-0.5-0-3
2	MA-211	Ordinary Differential Equations	3-1-0-4
3	MA-570	Data-driven Dynamical Systems	2.5-0-0.5-3

The course descriptions are placed as **Annexure- L**.

54.20 To consider the new courses from SBB:

BoA approved the following courses from SBB in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	BY-528	Sensory Biology	3-0-0-3
2	BY-530	Advanced Cell and Molecular Biology	3-0-0-3
3	BY-531	Quantitative Biology and Data Analytics	3-0-0-3
4	BY-532	Immunotechnology	3-0-0-3
5	BY533P	Advanced Cell and Molecular Biology Lab	0-0-2-1
6	BY534P	Cellular Bioprocess Technology Lab	0-0-2-1
7	BY535P	Analytical Biotechniques Lab	0-0-2-1
8	BY536P	Immunotechnology Lab	0-0-2-1
9	BY537	Computational Biology-1	3-0-2-4

The course descriptions are placed as **Annexure- M**.

54.21 To consider the new courses from SCS:

BoA approved the following new course in new format from SCS and the same shall be reported to the Senate"

Sl.No.	Course No.	Course Name	Credits
1	CY-600	Research Methodology for Chemistry	1-0-0-1

The course descriptions are placed as **Annexure- N**

54.22 To consider proposal for a new elective course for BS Chemical Sciences:

BoA approved the following new elective course for BS Chemical Sciences and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	CY-404	Fundamentals of Soft Matter Science and Applications	3-0-0-3

The course descriptions are placed as **Annexure- O**.

54.23 To consider the new courses from SPS:

BoA approved the following courses from SPS in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	PH-600	Research Methodology	1-0-0-1
2	PH-530	Cosmology – I	3-0-0-3

The course descriptions are placed as **Annexure- P**

54.24 To consider the new courses from CQST:

BoA approved the following courses from CQST in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	QS-501P	Experiments in Quantum Optics	0-0-5-3

The course descriptions are placed as **Annexure- Q.**

54.25 To consider the new courses from CAIR:

BoA approved the following course from CAIR in new format and the same shall be reported to the Senate:

Sl.No.	Course No.	Course Name	Credits
1	AR-516	Introduction to Blockchain and Web3	3-0-0-3
2	AR- 517	Introduction to Cyber security	3-0-0-3

The course descriptions are placed as **Annexure- R.**

54.26 Any other item with the permission of the Chair:

-NIL-

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.

Secretary, Board of Academics

Chairman, Board of Academics

Annexure A

Centre for Entrepreneurship Development
IIT Mandi

1. Introduction

India's startup ecosystem has witnessed remarkable growth in recent years, solidifying its position as the third-largest globally (DPIIT, 2023). This surge is fueled by advancements in technology, proactive government initiatives, a burgeoning young talent pool, and a passion for social impact. Amidst a thriving economy and rapid technological advancements reshaping conventional business paradigms, India offers a vast landscape of opportunities for startups, particularly in sectors like green energy, health tech, deep tech, disaster management, and clean mobility. However, while established hubs in metro cities flourish, regional ecosystems require support to bridge the gap in resources and access to funding.

Globally, leading technology institutes like MIT, Stanford, and Cambridge have played a pivotal role in fostering vibrant startup ecosystems at their respective locations by acting as hubs for research, talent cultivation, and incubation, translating innovative ideas into real-world solutions. Similarly, the Indian premium technology institute such as IITs has played a vital role in building a vibrant startup ecosystem in the nation. On a similar note, IIT Mandi irrespective of its remote location has played an important role in building a vibrant startup ecosystem in the Himalayan region. IIT Mandi established IIT Mandi Catalyst (Catalyst) in 2016 as the first technology business incubator in Himachal Pradesh. Despite its geographical remoteness, Catalyst has supported over 420 startups so far, showcasing its commitment to fostering entrepreneurship in the region.

The proposed Centre for Entrepreneurship Development (CED) endeavors to fortify the entrepreneurial ecosystem at IIT Mandi and the larger Himalayan region. Serving as a centralized hub for all entrepreneurship-related initiatives within the institute, CED will engage in various activities aimed at advancing the realm of entrepreneurship. This includes conducting comprehensive research on entrepreneurship, with a specific emphasis on addressing regional challenges and identifying opportunities for growth. Additionally, CED will orchestrate workshops, certification courses, and educational programs targeting diverse stakeholders, fostering an environment conducive to innovation and entrepreneurial mindset cultivation.

Furthermore, CED will play a pivotal role in facilitating the practical application of acquired knowledge. Through establishing and operating an incubation center, corporate innovation programs, research parks, and collaborative ventures between academia and industry, CED will provide startups with invaluable resources, industry connections, and hands-on experience essential for their development and success. Lastly, CED will endeavor to bridge the gap between academia and industry by fostering partnerships and collaborations that offer avenues for product deployment, pilot opportunities, corporate innovation initiatives, and other avenues for startup engagement within the industrial sphere.

2. Objectives

a. **Ignite Entrepreneurial Spark:** Cultivate leaders across students, faculty, and staff to identify societal challenges and launch impactful startups. Build resilience and vision to navigate the startup landscape.

b. **Spark Interdisciplinary Innovation:** Foster collaboration across departments and research centers, leveraging diverse expertise for holistic solutions driving sustainable growth and societal progress.

c. **Propel Ventures to Scale:** Provide comprehensive support for high-potential ventures with commercial viability and societal impact. Empower entrepreneurs to refine ideas, validate opportunities, and overcome scaling hurdles.

d. **Champion Sustainable Development:** Align ventures with UN SDGs, encouraging solutions that generate economic value while addressing environmental, social, and community concerns. Prioritize sustainable practices, ethical governance, and inclusive growth for regional and global prosperity.

3. Mission

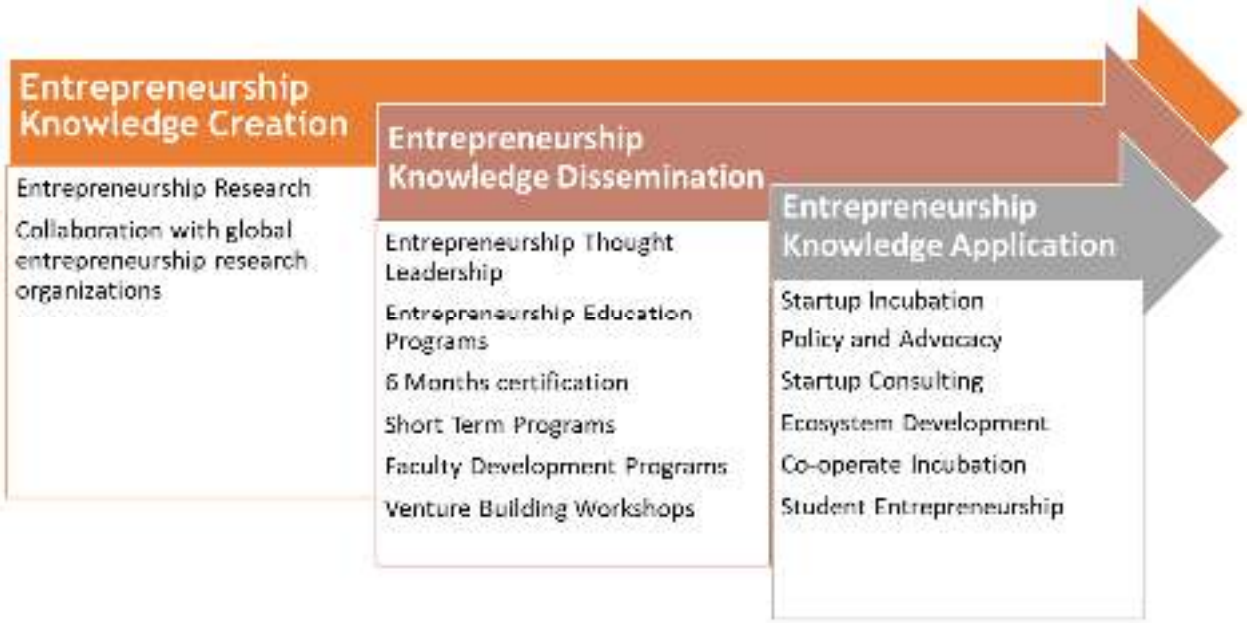
Ignite, nurture, and support entrepreneurial ambition among students, fostering their development into successful future entrepreneurs.

4. Vision

To cultivate a community of innovative, entrepreneurial, and socially responsible business leaders to shape the future of entrepreneurship on a global scale.

5. Salient Features and Key Activities

- **Thought Leadership**: Shape the future of Himalayan entrepreneurship through research, publications, and industry engagement.
- **Umbrella Entity:** Consolidate all IIT Mandi entrepreneurship activities, maximizing impact and serving as a central hub.



- **Interdisciplinary Innovation:** Bridge the gap between research and application, fostering cross-departmental collaboration for impactful solutions.
- **Comprehensive Education:** Through workshops, boot camps, and certification programs, equip students, faculty, and staff with the knowledge and skills to launch successful ventures.
- **Policy Advocacy:** Drive supportive policies within IIT Mandi and regionally, influencing the broader entrepreneurial ecosystem.
- **Global Collaborations**: Partner with leading research organizations and corporations to access expertise, facilitate international exchange, and fuel innovation.
- **Ecosystem Development:** Organize events, connect stakeholders, and collaborate regionally to build a thriving Himalayan startup landscape.
- **Incubation & Acceleration:** Provide dedicated space, mentorship, and resources to nurture promising startups through their early stages.
- **Funding Support:** Assist entrepreneurs in securing funding through grants, investors, and venture capitalists.
- **Performance Tracking:** Regularly evaluate CED's impact and effectiveness to ensure continuous improvement.

- The currently offered entrepreneurship courses will be provided by the center. The courses include Essentials of Entrepreneurship, entrepreneurship Practicum, and Startup Practicum, i.e., Young Innovator Fellowship.
- The center will also offer a minor in entrepreneurship and a specialization in entrepreneurship.

6. Structure of CED

The Centre for Entrepreneurship Development will have a structure as mentioned in the figure below. The Faculty in charge of IIT Mandi Catalyst will be the Chairperson of the CED. The Chairperson will be responsible for driving various initiatives that align with the centre's mission and vision.

7. Faculty Involved in Entrepreneurship

As a second-generation IIT, IIT Mandi is enriched by a vibrant cohort of youthful and dynamic faculty members who are firmly committed to partnering with startups and advancing the commercialization and implementation of technologies. The faculty members involved in the entrepreneurship system, along with their own entrepreneurial experience, will be involved in the center’s activities.

For example:

1. Dr. Satvasheel Powar
2. Dr. Amit Shukla
3. Dr. Shyam Kumar Masakapalli
4. Dr. Gajendra Singh
5. Dr. Atul Dhar

Annexure B

BoA Meeting, 14th May 2024

Proposal for
M.Sc. Chemistry Curriculum Revision

Garima Agrawal
Bhaskar Mondal
School of Chemical Sciences (SCS)

Semester-Wise Curriculum (Current, Since 2014)

Semester-I (20)		Semester-II (20)	
• Organic Reactions & Mechanisms (C)	4	• Photochemistry & Pericyclic Reactions (C)	4
• Chemistry of Transition Elements (C)	4	• Chemistry of Main Group Elements (C)	4
• Advanced Quantum Chemistry (C)	3	• Group Theory & Spectroscopy (C)	3
• Mathematics for Chemists (CC)	3	• Discipline Elective I (E)	3
• Design and Innovation Practicum I (CC)	2	• Organic Chemistry Laboratory (L)	4
• Physical Chemistry Laboratory (L)	4	• Design and Innovation Practicum II (CC)	2
Semester-III (21)		**Semester-IV (20)**	
• Computational Chemistry (CC)	3	• Reaction Dynamics, Kinetics and Catalysis (C)	3
• Chemical Thermodynamics & Electrochemistry (C)	3	• Heterocyclic Chemistry (C)	2
• Organometallic Chemistry (C)	2	• Outside Discipline Elective I (E)	3
• Basic Mechanical and Electronics Workshop (CC)	2	• Outside Discipline Elective II (E)	3
• Inorganic Chemistry Laboratory (L)	4	• Post Graduate Project II (P)	9
• Discipline Elective II (E)	3		
• Post Graduate Project I (P)	4		

To align both M.Sc. Chemistry (1st and 2nd year) **and BS Chemical Sciences** (3rd and 4th year) **curriculum**

C = Core Courses; CC = Common Core; L = Laboratory; P = Research Project; E = Elective

Semester-Wise Curriculum (Revised)

1st and 2nd Year (Total Credit: 80)			
Semester-I		**Semester-II**	
• Organic Reactions & Mechanisms (CY)	3~~4~~	• Photochemistry & Pericyclic Reactions (CY)	3~~4~~
• Chemistry of Main Group Elements (CY)	3~~4~~	• Chemistry of Transition Elements (CY)	3~~4~~
• Advanced Quantum Chemistry (CY)	3	• Symmetry and Group Theory (CY)	3
• Discipline Elective I (DE)	3	• Discipline Elective II (DE)	3
• Physical Chemistry Laboratory (CY)	3~~4~~	• Discipline Elective III (DE)	3
• Inorganic Chemistry Laboratory (CY)	3~~4~~	• Organic Chemistry Laboratory (CY)	3~~4~~
• Design Practicum I (P)	P/F(1)~~2~~	• Design Practicum II (P)	P/F(1)~~2~~
	19		**19**
Semester-III		**Semester-IV**	
• Discipline Elective IV (DE)	3	• Reaction Dynamics, Kinetics & Catalysis (CY)	3
• Chemical & Statistical Thermodynamics (CY)	3	• Heterocyclic Chemistry (CY)	2
• Introduction Organometallic Chemistry (CY)	3~~2~~	• Discipline Elective V (DE)	3
• *Free Elective I (FE)*	3	• *Free Elective III (FE)*	3
• *Free Elective II (FE)*	3	• *Free Elective IV (FE)*	3
• Post Graduate Project I (P)	5~~4~~	• Post Graduate Project II (P)	8~~9~~
	20		**22**

Post Graduate Project (PGP) (Revised)

… from M.Sc. ORDINANCES & REGULATIONS

R.9.4 Project/~~Thesis~~ work: 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. The assessment should include evaluation by the ~~thesis/research~~ project supervisor(s), one or more presentation(s) to a Committee appointed by the course coordinator and the final ~~thesis~~ project presentation in terminating semester. The composition of committee will be as follows:

(a) Faculty advisor or nominee– Chair of the committee

(b) One faculty from the same discipline (preferably senior faculty) - Member

(c) One faculty from other discipline – Member

(d) ~~Thesis~~ Project supervisor - Member

The committee Chair may invite an external examiner from other institute or industry during final ~~thesis defense~~ project evaluation. In that case, the external examiner will be a member of the above committee board.

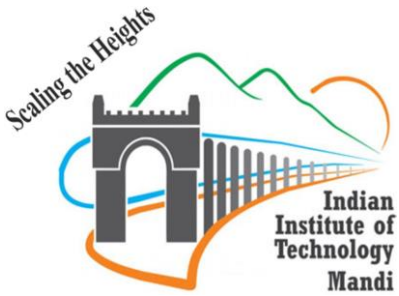
The detailed assessment process will be framed by the course interest group (CIG). However, in these assessments, the contribution of supervisor evaluation should not exceed 50% and the contribution of the evaluation committee should not be less than 50%. The ~~thesis~~ project will be evaluated internally for which the evaluation mechanism will be framed by the course interest group (CIG) and approved by the program coordinator.

Based on the performance, each student is awarded a final letter grade at the end of the semester for each of the ~~thesis~~/project.

A student is deemed to have completed a course successfully and earned the specified credits if he/she secures in the course a letter grade other than F, which implies a failure**.**

Annexure C

Master of Technology in Biotechnology



School of Biosciences and Bioengineering

IIT Mandi

Programme Level	Post Graduate
Year of Commencement	2024 (revised)
Minimum Duration	2 Years (4 Semesters)
Maximum Duration	3 Years (6 Semesters)
Senate Meeting Reference	42.13

Motivation and Preamble

The Biosciences and Biotechnologies (BioX) at the School of Biosciences and Bioengineering (SBB), IIT Mandi is motivated by the needs in the field of human healthcare, food/agriculture, and environment sustainability in terms of development of new technologies for better disease diagnosis and management, identification and development of rare medicinally important molecules from various sources, and to clean and protect environment. Being present in the Himalayas, it aims to utilize the diverse resources easily available in the region to fulfil the above-mentioned goals. Motivated by the goals, IIT Mandi is committed to intensify academic teaching, research and development in several areas of BioX. M. Tech in Biotechnology programme is mainly initiated with the goal to train the next generation of students with cutting edge knowledge andskills suitable towards biotechnological research and Bio-industry needs such as biomedical/ biopharma etc.

The curriculum of M.Tech in Biotechnology programme at SBB, IIT Mandi is directed towards fundamental and practical understanding of the core biotechnology areas along with specialized fields in "Systems Biology" and "Medical Biotechnology". In addition, elective courses from other disciplines provide interdisciplinary exposure to the students. The core-subjects, specialized theme areas of SBB, electives from other schools, hands on laboratory training along with the post graduate project component to be undertaken in-house/ other R&D institutes/ industries will enrich students with right skills required in the current Job market both in academia and industries, on completion of the program.

Outline of M.Tech Curriculum

Core Courses:

- Advanced Cell and Molecular Biology (BY530)
- Computational Biology-1 (BY537)
- Cellular Bioprocess Technology (BY513)
- Nano-Biotechnology (BY505)
- Analytical Biotechniques (BY514)
- Quantitative Biology and Data Analytics (BY531)
- Immunotechnology (BY532)

[Credits: 22]

Core Lab Courses:

- Advanced Cell and Molecular Biology Lab (BY533P)
- Cellular Bioprocess Technology Lab (BY534P)
- Analytical Biotechniques Lab (BY535P)
- Immunotechnology Lab (BY536P)

[Credit: 4]

Elective Courses:

[Total: 9 – 10 Credits]

Specialization Electives:

Systems Biology Basket:

- Introduction to Omics and Systems Analysis (BY516)
- Metabolic Systems Biology (BY504)
- Metagenomics, and Next Generation Sequencing Technologies (BY613)
- Proteomics (BY517)
- Biological Modelling and Simulation (BE506)
- Bioalgorithms (BE502)

Other courses to be declared at the start of the semester

Medical Biotechnology Basket:

- Cellular Fuel and cellular communication (BY503)
- Disease Biology (BY518)
- Protein Science in Therapeutics (BY519)
- Gene silencing and genome editing: principles and applications (BY527)
- Sensory Biology (BY528)
- Mechanobiology of the cell (BY529)
- Anatomy and Physiology (BE501)
- Tissue engineering (BE507)

Other courses to be declared at the start of the semester

Other Electives: Any other elective courses being offered in the SBB

Project:

- Post Graduate Project-1 (BY698P)
- Post Graduate Project-2 (BY699P)

PGP work can be undertaken in any industry or academic institute with recommendation from the competent authority. It is mandatory to have a guide from IIT Mandi and the student should undergo the evaluation process as laid down in the ordinances.

[Credit: 17+16]

Free elective: From any discipline [Total: 3 Credits]

Other Mandatory Courses:

- Seminar (BY525)
- Research Methodology (BY600) [Credit: 2]

Total 72 credits

Credit Structure: A student, to be awarded M.Tech degree, must need to earn 70 - 72 credits.

Program Specialization: The program offers an option to the student to obtain a specialization in the area of "Systems Biology" or "Medical Biotechnology". Towards this the student needs to mandatorily credit at least three electives from the specialization basket. If specialization is to be done then the PGP work should preferably be from the similar area.

Although obtaining a specialization is not mandatory and the program offers the flexibility to the students to opt for any of the specialization electives or other electives as per their choice from among those offered in SBB or related areas by the school.

Degree structure **Total credit requirement: 70-72 credits**

		Credits
a)	Core courses	22
b)	Specialization elective baskets from SBB	9
c)	Core laboratory	4
d)	Research Methodology	1
e)	Free elective from any discipline	3
f)	Thesis	33

M.Tech Biotechnology course structure outline (Total credits required 70-72)

Semester-1	Credits L-T-P-C	**Semester-2**	Credits L-T-P-C
Core 1: Advanced Cell and Molecular Biology (BY530)	3-0-0-3	**Core 5:** Analytical Biotechniques (BY514)	3-0-0-3
Core 2: Computational Biology-1 (BY537)	3-0-2-4	**Core 6:** Quantitative Biology and Data analytics (BY531)	2-0-2-3
Core 3: Cellular Bioprocess Technology (BY513)	3-0-0-3	**Core 7:** Immuno-Technology (BY532)	3-0-0-3
Core 4: Nano-Biotechnology (BY505)	3-0-0-3		
Free elective 1: from other disciplines	Total 3-credits	**Specialization electives*** from Systems Biology theme **or** Medical Biotechnology theme **or** Any 3 courses from the above baskets **or** Other electives offered by SBB	Total: 9 credits
Mandatory: Research Methodology (BY600)	1-0-0-1		
Core Lab 1: Advanced Cell and Molecular Biology Lab (BY533P)	1-0-2-1	**Core Lab 3:** Analytical Biotechniques Lab (BY535P)	0-0-2-1
Core Lab 2: Cellular Bioprocess Technology Lab (BY534P)	1-0-2-1	**Core Lab 4:** Immunotechnology Lab (BY536P)	0-0-2-1
Total credits Semester-1	**19**	**Total credits Semester-2**	**20**
Semester-3	Credits L-T-P-C	**Semester-4**	Credits L-T-P-C
Seminar (BY525)	0-0-0-1	Post Graduate Project-2 (BY699P)	0-0-34-17
Post Graduate Project-1 (BY698P)	0-0-32-16		
Total credits Semester-3	**17**	**Total credits Semester-4**	**16**

* Students qualify for specialization (Systems Biology or Medical Biotechnology), provided the PGP work (BY698P and BY699P) is done in those areas. PGP work can also be undertaken in any industry or academic institute with recommendation from the competent authority. It is mandatory to have a guide from IIT Mandi and the student should undergo the evaluation process as laid down in the ordinances.

Opting for a specialization is not mandatory and the program offers the flexibility to the students to opt for any of the specialization electives or other electives as per their choice from among those offered in SBB or related areas by the schoo

Specialization electives

Theme 1: Systems Biology (Any 3 courses offered in the semester)		
Course		Credits (L-T-P-C)
Special elective S1	Introduction to omics and Systems Analysis (BY516)	3-0-0-3
Special elective S2	Metabolic Systems Biology (BY504)	3-0-0-3
Special elective S3	Proteomics (BY517)	3-0-0-3
Special elective S4	Metagenomics, and Next Generation Sequencing Technologies (BY613)	3-0-0-3
Special elective S5	Biological Modelling and Simulation (BE506)	3-0-0-3
Special elective S6	Bioalgorithms (BE502)	3-0-0-3
Special electives	Other courses to be declared at the start of the semester	

Theme 2: Medical Biotechnology (Any 3 courses offered in the semester)		
Course		Credits (L-T-P-C)
Special elective M1	Cellular Fuel and Cellular Communication (BY503)	3-0-0-3
Special elective M2	Disease Biology (BY518)	3-0-0-3
Special elective M3	Protein Sciences in therapeutics (BY519)	3-0-0-3
Special elective M4	Gene silencing and genome editing:principles and applications (BY527)	3-0-0-3
Special elective M5	Sensory Biology (BY528)	3-0-0-3
Special elective M6	Mechanobiology of the Cell (BY529)	3-0-0-3
Special elective M7	Anatomy and Physiology (BE501)	3-0-0-3
Special elective M8	Tissue engineering (BE507)	3-0-0-3
Special electives	Other courses to be declared at the start of the semester	

IIT Mandi
Proposal for a New Course

Course number : MB555
Course Name : Deep Learning for Business Applications
Credit : 2-0-0-2
Distribution : ***L-T-P-C***
Intended for : MBA
Prerequisite : None
Mutual Exclusion :

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1. Preamble:

Recent advancements in artificial intelligence mostly involve deep learning that influences many aspects of human lives including business. It is becoming more important for the industry to understand this complex field of deep learning to manage business processes subjected to big data processing for major decision-making. This course covers deep learning concepts to equip the students with the requisite background to deal with complex real-world problems. The students will strengthen their understanding through demonstrations, how deep learning is used to handle various use cases. The beauty of deep learning lies in its mere dependency on simple mathematical operators that help in solving overly complex problems.

Objective:

The major learning outcomes and take away from this course are:

- To understand what deep learning is and how it works.
- To understand the basic building blocks used in deep learning-driven problem-solving and decision-making.
- To identify the project that can be implemented using deep learning methods.
- To select and use tools and techniques to handle deep learning-based problems.
- To gain confidence to formulate a deep learning strategy

2. Course Modules with quantitative lecture hours:

Module 1	**Deep Learning Basics**	**(4)**
History of Deep learning, Mathematics behind deep learning, activation functions, and their derivatives, Loss functions, Deep networks, and fully connected networks, variations of gradient descent, Regularization in Networks		
Module 2	**Autoencoders**	**(4)**
Encoding, layer-wise pretraining, types of auto-encoders, Autoencoders for finance applications		

Module 3	**Convolutional Neural Networks**	**(6)**
Convolution basics, filters, padding, multidimensional convolution, and convolution layers, pooling, striding, and transposed convolution, Applying filters for image-identification-related applications.		
Module 4	**Recurrent Neural Networks**	**(4)**
Recurrent neural network basics, dealing with language, training recurrent neural networks, long short-term memory, RNN for forecasting.		
Module 5	**Reinforcement Learning**	**(6)**
Basics of reinforcement learning and its structure, the multi-arm bandit problem, the game of Nim, Temporal difference learning, and Q-learning.		
Module 6	**GAN**	**(4)**
Introducing GAN, forging concepts, forging with neural networks.		
Module 7	**Presentation**	**(2)**

Laboratory/practical/tutorial Modules: None

3. Text books:

***(Latest, Only 2*)**

1. **Author(s), Title, Vol., Publisher, Country, Year**
2. **Author(s), Title, Vol., Publisher, Country, Year**

4. References:

1	J. Krohn, G. Beyleveld and A. Bassens, Deep Learning Illustrated, Pearson India Education Services Ltd, 2020.
2	Nikhil Buduma and Nicholas Locascio, Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, Shroff Publishers, 2017.
3	Ian Goodfellow, Yoshua Benagio and Aaron Courville, Deep Learning, MIT Press, October 2016.
4	Armando Vieira and Bernardete Ribeiro, Introduction to Deep Learning Business Applications for Developers: From Conversational Bots in Customer Service to Medical Image Processing, Apress, 2018.
5	Eugene Charniak, Introduction to Deep Learning, MIT Press, 2019
6	Terrence J. Sejnowski, The Deep Learning Revolution, MIT Press, 2019
7	M Gopal, Deep Learning, Pearson India Education Services Ltd, 2022

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Anjan K Swain **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB556
Course Name : Natural Language Processing for Business
Credit : 2-0-0-2
Distribution : ***L-T-P-C***
Intended for : MBA
Prerequisite : None
Mutual Exclusion :

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1. Preamble:

In the era of digital business to get the maximum benefit from the business it's become increasingly important for computers to make sense of various languages. Natural language processing (NLP) addresses this encompassing knowledge from the disciplines of computer science, machine learning, statistics, linguistics etc. The NLP deals with the processes running on computers to understand human language. This course starts with a mild introduction to linguistics which is at the core of many of the NLP tasks. Then, it covers how to make machines learn these tasks that humans are good at by understanding the challenges in NLP and the reasons thereof. This course deals with various popular tools used in NLP to preprocess collected data to build the required model to handle various real-world applications.

Objective:

The major learning outcomes and take away from this course are:

- To understand the concepts necessary to build NLP solutions to business problems
- To learn how to prepare the textual data to address NLP problems
- To learn various popular NLP tools in use in the industry
- To acquaint themselves with the industrial problems and how they are handling these using NLP

2. Course Modules with quantitative lecture hours:

Module 1	**Fundamentals of Natural Language Processing**	**(4)**
Defining NLP and its tasks, history of NLP, Approaches to NLP, Understanding language, its syntax, structure and semantics, Language as data, Popular NLP applications.		
Module 2	**Text Representation, Preprocessing, and Transforming Models**	**(6)**
Information extraction and Text summarization, preprocessing: tokenization, Stemming, lemmatization, model building and evaluation, TF-IDF: Vectorizing, Bag of words, n-grams,		

Zipf's Law.		
Module 3	**Machines Understanding Words**	**(6)**
Embeddings: Text understanding, Representational Embeddings, Procedural Embeddings: Words to Vectors and Documents to Vectors, Textual Similarity.		
Module 4	**Deep Learning for NLP**	**(4)**
Sequential NLP and Episodic memory for NLP, Transformer Architecture, Transformer Encoder and Decoder, Attention mechanism, Transfer learning in NLP		
Module 5	**Conversational AI**	**(4)**
Conversational AI Basics, Chatbots and Utterances, Taxonomy of chatbots, dialog and response generation		
Module 6	**NLP Applications**	**(4)**
Sentiment analysis, Content recommendations, NLP in healthcare, Supply chain, Law, Telecommunication, Education and Research.		

Laboratory/practical/tutorial Modules: None

3. Text books:

***(Latest, Only 2*)**

1. **Author(s), Title, Vol., Publisher, Country, Year**
2. **Author(s), Title, Vol., Publisher, Country, Year**

4. References:

1	Jyotika Singh, Natural Language Processing in the Real-World: Text Processing, Analytics, and Classification, CRC Press, Chapman & Hall, 2023.
2	Ankur A. Patel and Ajay Uppili Arasanipalai, Applied Natural Language Processing in the Enterprise: Teaching Machines to Read, Write & Understand, O'Reilly Media, Inc., 2021.
3	Vajjala, S., Majumder, B., Gupta, A. & Surana, H., Practical Natural Language Processing, O'Reilly Media, Inc. 2020.
4	Masato Hagiwara, Real-World Natural Language Processing: Practical applications with deep learning, Manning Publications Co., 2022.
5	Dipanjan Sarkar, Text Analytics with Python: A Practitioner's Guide to Natural Language Processing, Apress, 2019.
6	Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 2018.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Anjan K Swain **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB559
Course Name : Fuzzy Logic for Business Decision Making
Credit : 2-0-0-2
Distribution : ***L-T-P-C***
Intended for : MBA
Prerequisite : None
Mutual Exclusion :

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1. Preamble:

Fuzzy logic is a modern scientific tool, capable of solving problems in Information Technology and Management. The aim of this course is to give an introduction to Fuzzy sets and their various applications to IT and Management. Apart from the topics in the area of fuzzy sets, this course will also cover the concepts of rough sets in general and the fuzzily defined rough sets in particular. The aim of the course is to give an exposure to the use of fuzzy sets in IT and Management. The areas of applications include the following.

Objective:

After completion of the course, a student should be able to:

- Understand the reality behind the uncertainty due to impreciseness and fuzziness.
- Compute with words and day-to-day language of human beings and take the decision accordingly.
- Model the problems in functional areas of management and develop the logic/algorithm to solve the problems in the computer.
- Solve IT-related problems in detail by using qualitative/linguistic data in real terms.

2. Course Modules with quantitative lecture hours:

Module 1	**Fuzzy Logic Concepts**	**(2)**
Chapter-1, Text Book.		
Module 2	**Operations on Fuzzy Sets**	**(2)**
Chapter-1&2, Reference Book 1		
Module 3	**Fuzzy aggregation Operators**	**(4)**
Fuzzy Sets & Systems (FSS) Article		
Module 4	**OWA & IOWA Operator in Decision Making**	**(2)**
Fuzzy Sets & Systems (FSS)		

Module 5	**IOWA and Other Weighted Operators**	**(1)**
Journal Articles		
Module 6	**Fuzzy Goal Programming**	**(2)**
Journal Articles		
Module 7	**Fuzzy MCDM**	**(2)**
EJOR Article		
Module 8	**Fuzzy Concepts in Finance, Marketing and Managerial Decision Making**	**(5)**
EJOR, DSS & FSS Articles		
Module 9	**Fuzzy applications in Software Risk Management**	**(4)**
DSS & FSS Articles		
Module 10	**Linguistic quantifiers and its applications to Decision Making**	**(2)**
EJOR, IEEE Fuzzy Systems Articles		
Module 11	**Linguistic quantifiers in Recommender systems and its applications to business**	**(2)**
EJOR, IEEE Fuzzy Systems Articles		

Laboratory/practical/tutorial Modules: None

3. Text books:

1.	First course on Fuzzy theory and applications (K.H. Lee)

4. References:

1	Fuzzy Logic with applications, (H. Bandmer & S. Gottwald)
2	Intelligent techniques in e-commerce (Z. Sun & G.R. Finnie)
Journals	
1	Fuzzy Sets and Systems
2	Decision Support Systems
3	European Journal of Operational Research
4	IEEE Fuzzy Systems

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. B K Mohanty **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : **MB560**
Course Name : Evolutionary computation for business solutions
Credit : **2-0-0-2**
Distribution : ***L-T-P-C***
Intended for : **MBA DS&AI**
Prerequisite :
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

In today's dynamic business environment, effective decision-making is crucial for organizational success. Businesses encounter a plethora of complex problems ranging from resource allocation to strategic planning, all of which require optimization to achieve desired outcomes. This course provides a comprehensive overview of decision-making processes in business and explores various optimization techniques to tackle these challenges.

Objective
Upon completion of this course, students will be able to: - Understand fundamentals evolutionary computation approaches and their significance in business decision-making. - Apply various traditional and non-traditional techniques to solve complex business problems. - Evaluate hybrid approaches combining evolutionary and machine learning techniques for enhanced problem-solving capabilities. - Analyse real-world applications of evolutionary computation in diverse business domains.

2. Course Modules with quantitative lecture hours:

Module 1	**Introduction to business decision making and Optimization**	**(3)**
Overview of business decision making, Optimization Models for business problems, Traditional approaches: Linear and Non-Linear Methods.		
Module 2	**Overview of probability and sampling**	**(3)**
Overview of probability distribution, sampling, and random number simulation.		
Module 3	**Non-Traditional Methods**	**(8)**
Introduction to Evolutionary, Swarm and Nature inspired optimization techniques, Optimization approaches for single objective decision making problem, decision making under constraints: inequality and inequality constraint handling.		

Module 4	**Optimization under conflicting goals**	**(6)**
Introduction to Multi-objective optimization, Evolutionary Approaches for Multi-objective optimization: dominance, decomposition and preference based methods.		
Module 5	**Hybrid Approaches**	**(2)**
Hybrid approaches for solving problems, evolutionary and machine learning based wrapper approaches.		
Module 6	**Evolutionary Computation application to business decision making**	**(6)**
Evolutionary Computation applications in: Project Management, Planning, Scheduling, Transportation, production and operations management, finance.		

Laboratory/practical/tutorial Modules:

There is no exclusive lab for this course. However, the students would be given weekly assignments to simulate the techniques studied in each module.

3. Text books:

Biethahn, Jörg, and Volker Nissen, eds. Evolutionary algorithms in management applications. Springer Science & Business Media, 2012.
Burke, Edmund K., Edmund K. Burke, Graham Kendall, and Graham Kendall. Search methodologies: introductory tutorials in optimization and decision support techniques. Springer, 2014.
Relevant research articles and business cases

4. References:

(*No limit on numbers, relevant*)
Standard format can be followed

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Manoj Thakur **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB572
Course Name : Social Analytics
Credit : 2-0-0-2
Distribution : ***L-T-P-C***
Intended for : MBA
Prerequisite : None
Mutual Exclusion :

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1. Preamble:

In this era of networks, social media pervades every aspect of human society. The last decade has witnessed the overwhelming use of social network data to create new strategies to run the business in unthinkable ways. This requires revisiting and rethinking the way today's businesses operate and compete across industries. Social media is essentially a collection of complex and complicated social network platforms and applications, designed to cater to the needs of individual customers and users. Current social networks generate an enormous amount of data that can be studied to better leverage it to benefit businesses. This course deals with the nuances of collecting and analysing social media data to get a competitive advantage over competitors.

Objective:

The major learning outcomes and take away from this course are to learn:

- To collect, visualize, and analyze data from different social networks to extract useful business insights
- To analyze the impact of social media in various industries using analytics
- how social media affects our thinking about business
- to master the social network concepts, various techniques, and tools to extract business insights
- the importance of the current social media landscape to shape the business

2. Course Modules with quantitative lecture hours:

Module 1	**Web and Social Media Analytics**	**(6)**
World Wide Web, Social media and social networks, The Foundations of Web Analytics and Social Media Analytics, Types of social media and social media analytics, The Roles of Web Analytics and Social Media Analytics, The KPIs for Web Analytics and Social Media Analytics, Social media analytics tools, Web and Social media data gathering process, KPIs for web and social media analytics.		
Module 2	**Social Media Text Analytics**	**(4)**
Types of Social media text, Social media text analytics, and tools.		

Module 3	**Social Media Network Analytics**	**(4)**
Network Types and Terminologies, Social media network types, and Network analytics tools.		
Module 4	**Social Media Action and Hyperlink Analytics**	**(4)**
Social media actions and action analytics tools, Types of Hyperlinks, and hyperlink analytics.		
Module 5	**Social Media Location and Search Analytics**	**(4)**
Types of location analytics, Location analytics tools; Search engine types, analytics, and tools.		
Module 6	**Mobile Analytics**	**(2)**
Apps analytics and its types, mobile analytics tools.		
Module 7	**Social Media Analytics Strategy**	**(2)**
Social media strategy, aligning social media and business, managing social media risks.		
Module 8	**Applications**	**(2)**
Fake news and Reviews, detection of fake reviews in social media, Social media in Healthcare.		

Laboratory/practical/tutorial Modules: None

3. Text books:

4. References:

1	Gohar F. Khan, Seven Layers of Social Media Analytics: Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks Apps, Search Engine, and Location Data, Amazon Digital Services, 2015.
2	Bernard J. Jansen, Kholoud K. Aldous, Joni Salminen, Hind Almerekhi, Soon-gyo Jung - Understanding Audiences, Customers, and Users via Analytics: An Introduction to the Employment of Web, Social, and Other Types of Digital People Data, Springer Nature Switzerland AG, 2024.
3	Gohar F. Khan, Creating Value With Social Media Analytics: Managing, Aligning, and Mining Social Media Text, Networks, Actions, Location, Apps, Hyperlinks, Multimedia, & Search Engines Data, Createspace Independent Pub, 2018.
4	Subodha Kumar, Liangfei Qiu - Social Media Analytics and Practical Applications: The Change to the Competition Landscape, CRC Press, Taylor & Francis Group, LLC, 2022.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Anjan K Swain School: School of Management

Signature: Date:

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

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Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : Cloud Computing for Business
Course Name : MB573
Credit : 2
Distribution : 2-0-0-2 (*L-T-P-C)*
Intended for : MBA
Prerequisite : None
Mutual Exclusion : None

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1. Preamble:

Cloud computing as an advent technology is playing a crucial role in the mainstream business applications. Because cloud computing has the potential to drive the re-imagination of processes and business models, it can be a transformational technology for many businesses. Many business and technology leaders, however, might overlook its potential usage and value for their business and industry. The objective of this course is to learn basics of cloud computing, different Cloud Computing services and security services, and their applications in business.

2. Course Modules with quantitative lecture hours:

Unit 1-Intorduction to Cloud Computing: Understanding what Computing is, Trends in Computing, Centralized vs Distributed Computing, Soft introduction to Grid, Cluster and Utility Computing, Why Cloud Computing, Introduction to Cloud Computing, Definition of Cloud, Component and Implementation of Cloud, Evolution of Cloud Computing, Cloud Characteristics, Advantages and Disadvantages of Cloud computing, Essentials, Benefits, Business and IT perspective **(5 Hours)**

Unit 2- Cloud Architecture and Models: Cloud Architecture, Layered, NIST Cloud Computing Reference Architecture, Cloud Models- Service and Deployment, Cloud Service Models- laaS, PaaS and SaaS, Cloud Service Models- Public Clouds, Private Cloud, Hybrid Cloud, Community Cloud. Architectural Design Challenges, Business applications (appropriate case studies, use cases and situation analysis). **(6 Hours)**

Unit 3- Cloud Storage: Storage as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers, Business applications and use cases - AWS, Google App Engine, Microsoft Azure **(6 Hours)**

Unit 4- Security in Cloud Environment: Cloud Secuiry Causes- Loss, Lack and Multi-tenancy, Taxonomy and Cloud Threat Models, Cloud Infrastructure Security, Security Boundaries in Cloud, Cloud Security Management Frameworks, Security -as-a-Service, Cloud Security Controls (**4 Hours)**

Unit 5- Cloud Virtualization and Adoption: Cloud and Virtualization, Basics of Virtualization, Types of Virtualizations, Virtualization Defined, Virtualization Benefits, Cloud Pricing Models; Pay-as-you-go, Reserved Instances, Spot pricing, Use Cases, Cloud computing transition and adoption in Business applications (appropriate case studies and use cases). **(7 Hours)**

Laboratory/practical/tutorial Modules:

3. Text books:

1. Erl, Thomas, Ricardo Puttini, and Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, 1/e, Pearson, 2013
2. Bahga, Arshdeep, and Vijay Madisetti, Cloud Computing: A Hands-on Approach, CreateSpace Independent Publishing Platform, 2013

4. References:

1. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill.

5. Similarity with the existing courses: None

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

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

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

Approvals:

Faculty interested in teaching this course: – Dr. Daya Sagar Gupta

Proposed by: Dr. Daya Sagar Gupta **School: Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1.	Prof. Manoj Thakur	
2.	Prof. Anjan Kumar Swain	
3.	Dr. Daya Sagar Gupta	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : Cyber Securities, Ethics and Privacy
Course Name : MB574
Credit : 2
Distribution : 2-0-0-2 (*L-T-P-C)*
Intended for : MBA
Prerequisite : None
Mutual Exclusion : None

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1. Preamble:

The development of Information and Communication Technology (ICT) and rising security concerns necessitate a flexible and comprehensive approach to cyber security. The rapid progress of ICT has resulted in a variety of significant challenges that must be addressed. There is a need to discuss cyber security in a broad and in-depth manner so that students from non-technical fields can gain a more thorough understanding of the issues. The curriculum was created with the goal of increasing digital citizens' awareness, responsiveness, and accountability, hence contributing to a healthy cybersecurity posture and ecosystem.

2. Course Modules with quantitative lecture hours:

Unit 1-Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security. Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies. **(5 Hours)**

Unit 2- Cyber crime and Cyber law: Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime

and Cyber security in India, Case studies. **(6 Hours)**

Unit 3- Social Media Overview and Security: Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies. **(6 Hours)**

Unit 4- Data Privacy and Data Security: Defining data, meta-data, big data, nonpersonal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues. (**6 Hours)**

Unit 5- Cyber security Management, Compliance and Governance: Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy. **(5 Hours)**

Laboratory/practical/tutorial Modules:

3. Text books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.

4. References:

1. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.

5. Similarity with the existing courses: None

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

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

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

Approvals:

Faculty interested in teaching this course: – Dr. Daya Sagar Gupta

Proposed by: Dr. Daya Sagar Gupta **School: Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1.	Prof. Manoj Thakur	
2.	Prof. Anjan Kumar Swain	
3.	Dr. Daya Sagar Gupta	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

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Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB579
Course Name : Marketing Analytics
Credit : 2-0-0-2
Distribution : ***L-T-P-C***
Intended for : MBA
Prerequisite : None
Mutual Exclusion :

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1. Preamble:

This course intends to impart knowledge, skills, and confidence to understand marketing data for improved decision-making. Students can think like data scientists, build their problem-solving skills, and discover how to look at data in new ways to deliver business insights and make intelligent data-driven decisions. They will also learn how to clean, explore, and visualize data, implement machine learning algorithms, and build models to make predictions. In this course, students will work with relevant datasets that simulate real-world market analysis projects.

Objective:

The primary learning outcomes and take away from this course are:

- To understand the concepts of Marketing Analytics to make effective data-driven decisions.
- To learn how marketing manages its performance.
- To learn how marketing performance is judged.
- To acquaint themselves with the tools and techniques to generate evidence-based insights.

2. Course Modules with quantitative lecture hours:

Module 1	**Introduction**	**(4)**
Sessions 1&2: Marketing analytics and its evolution, an overview of consumer behavior and marketing strategy, Why and what of marketing analytics, effective marketing decisions	Fundamentals/theory of marketing analytics, using class study materials. **Readings:** • Keep Up with Your Quants (HBR: R1307L) • Why Marketing Analytics Hasn't Lived Up to Its Promise (HBR, H04BYL)	
Sessions 3&4: Tools and Technologies for enabling marketing analytics and marketing analytics challenges	Overview of various tools and techniques with examples, using class study materials.	
Module 2	**Understanding Customers**	**(6)**
Sessions 5: Introduction to understanding varying needs and preferences of customers: static and	Overview of the Marketing fundamentals using class study materials.	

dynamic customers' needs variations; Analysing Static need Variations: Segmentation, Targeting, and Positioning	**Reading:** Gupta, S. (2014). Segmentation and Targeting (HBSP 8219)	
Sessions 6: Cluster analysis for segmentation	**Activity:** Data-based exercise using SPSS. **Reading:** Cluster Analysis for Segmentation (Darden Business Publishing: UV0745)	
Sessions 7&8: Discriminant analysis	**Activity:** Data-based exercise using SPSS.	
Sessions 9&10: Competitive positioning through perceptual and preference mapping	**Activity:** Data-based exercise using SPSS. **Reading:** Mapping your competitive positioning (HBR: R0711G)	
Module 3	**Customer Selection: RFM Analysis and Customer Lifetime Value**	**(5)**
Sessions 11&12: Analysing Dynamic needs of customers: RFM Analysis: Introducing RFM analysis, RFM analysis for marketing, RFM analysis for customer selection	Fundamentals of RFM Analysis, using class study materials. **Reading:** The Dark Side of Customer Analytics (HBR: R0705X) **Activity:** Data-based exercise using SPSS.	
Sessions 13: Introducing customer lifetime value, The Present Value of the Future Cash Flows Attributed to the Customer Relationship, Retention, and Customer Lifetime	Fundamentals of CLV, with examples, using class study materials. **Reading:** Marketing analysis toolkit: Customer Lifetime Value Analysis (HBS: 9-511-029) by Thomas Steenburgh and Jill Avery	
Sessions 14&15: Customer lifetime value for selecting and managing customers.	**Case:** Rosewood Hotels & Resorts: Branding to Increase Customer Profitability and Lifetime Value (HBS2087)	
Module 4	**Customer Insights: Sustainable Competitive Advantage**	**(4)**
Sessions 16&17: Basics of sustainable competitive advantage: what and why of sustainable competitive	Fundamentals of Marketing Research, using class study materials.	

Laboratory/practical/tutorial Modules: None

3. Text books:

1. Essentials of Marketing Analytics by Hair, Harrison and Ajjan. 1st edition. McGraw Hill Publication. (eBook/Connect version only).
2. Multivariate Data Analysis by Hair, Black, Babin and Anderson.8th Edition. ISBN: 9789353501358.

4. References:

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Anjan K Swain **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Proposal for a new course

AI for Finance

Course number : **MB580**
Course Name : **AI for Finance**
Credit Distribution : ***2-0-0-2***
Intended for : **PG and PhD students**
Prerequisite : **None**
Mutual Exclusion : **None**

Preamble

Artificial intelligence is redefining the finance industry, bringing unprecedented capabilities in data analysis, predictive modeling, and automation. This course introduces students to the principles and applications of AI in finance, covering a range of topics from algorithmic trading to credit risk assessment. Students will learn how machine learning models can predict market trends, detect financial fraud, and optimize investment portfolios. They will also explore the ethical implications and regulatory challenges of AI adoption in financial services. By the end of this course, students will understand the transformative potential of AI and be able to design innovative, data-driven financial solutions.

Unit 1 Introduction to AI in Finance (4 Hours)

Overview of AI and Machine Learning Applications in Finance; Big Data and Cloud Computing in Financial Analysis; Fundamental Machine Learning Techniques: Regression, Classification; Ethical Implications of AI in Financial Services

Unit 2 Data Collection and Preparation (6 Hours)

Financial Data Sources: Market, Transactional, and Alternative Data; Preprocessing Financial Data: Cleaning and Normalization; Feature Engineering and Dimensionality Reduction Techniques; Time-Series Data Management

Unit 3 Predictive Modeling and Algorithmic Trading (6 hours)

Building Predictive Models for Market Forecasting; Supervised and Unsupervised Learning Applications; Trading Algorithms and High-Frequency Trading; Sentiment Analysis of Financial News and Social Media

Unit 4 Risk Management and Fraud Detection (6 hours)

AI Techniques in Credit Risk Modeling; Fraud Detection Algorithms: Outlier Detection and Anomaly Detection; Portfolio Risk Management with Machine Learning; Stress Testing and Scenario Analysis

Unit 5 Advanced Topics and Emerging Trends (6 hours)

Deep Learning Models: Neural Networks, LSTM; Reinforcement Learning for Portfolio Optimization; Natural Language Processing in Financial Document Analysis; Regulatory Compliance with AI: Regtech and Explainability

IIT Mandi
Proposal for a New Course

Course number : MB581
Course Name : Leadership lessons from Indian Knowledge Systems
Credit : 2
Distribution : *2-0-0-2*
Intended for : MBA DS&AI and IMBA
Prerequisite : NA
Mutual Exclusion: No similar course is offered in the institute.

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1. Preamble:

The course aims to impart the students with the timeless life-lessons and leadership lessons from the Indian knowledge system contained in scriptural texts such as Bhagavad Gita, Ramayana, and Mahabharata. Common people tend to follow the leaders. Therefore, it is pertinent to build the character of leader based on spiritual values, so that they can have positive impact on their followers and the society at large. Indian knowledge system aimed to create value-based leadership for a sustainable society. By imparting these value based principles, the course aims to shape the MBA graduates of IIT Mandi into ideal leaders.

2. Course Modules with quantitative lecture hours:

Unit 1: Leadership Insights from Bhagavad Gita (14 hours)

Dealing with Dilemmas of life (Chapter 1 of Bhagavad Gita)

Desiphering the problem of Identity (Chapter 2 of Bhagavad Gita)

Principles governing our Action and focusing on excellence: lessons from Karma Yoga (Chapter 3 and 5 of Bhagavad Gita)

Understanding the human mind and art of controlling the mind: Lessons from Dhyana Yoga (Chapter 6 of Bhagavad Gita)

Understanding the Psycho-physical constitution, developing qualities to be a good leader and building leadership character (Chapter 7, 14 and 17 of Bhagavad Gita)

Transformational Leadership (Chapter 9, 16 and 18 of Bhagavad Gita)

Unit 2: Leadership Insights from Ramayan (8 Hours)

Increasing happiness quotient through detachment (Inspiration from Lord Rama'a action while being exiled)

Enhancing Emotional quotient and intricacies of relationship (Inspiration from

relationship among Ram, Laxman, Bharat, Satrughna, Sita, Hanuman)

Servant Leadership (The life of Hanuman in Sundarkand)

Attributes of a king maker (The life of Jambavan)

Overcoming challenges with exemplary qualities and character (Hunuman's Journey to Lanka)

Dharma above everything else (Actions of Lord Ram)

Unit 3: Leadership Insights from Mahabharat (6 Hours)

Sacrifice as a way of life (Lessons from the life of Kunti Maharani)

Justice and fairness: Fearless Leadership (Lessons from the life of Vidura/Vidura Niti)

Motivated blindness and the consequences (Lessons from the life of Dhritarashtra)

Principle vs Rules (Lessons from the Activities of Lord Krishna)

The double-edged sword of Darma (Lessons from life of Karna)

Endeavour and Mercy: The formula for success (The life of Pandavas)

Service vs Enjoyment (Lessons from Pandavas and Kauravas)

3. Text books:

(Latest, Only 2)

1. Prabhupada, ACBS, Bhagavad Gita as it is, Bhakti Vedanta Book Trust, India, 1973.
2. Vilas, Shubha, OPEN EYED MEDITATIONS,Finger Print Publications, India, 2016
3. Vyasa, Krishna Dwipayana, Vidura Niti, Gorakhpur Geeta Press. 2025

4. References:

1. Vilas, Shubha, Ramayana: The game of life (Book1, 2, 3, 4, 5, and 6), Jaico Publishing House, India, 2017, 2029, & 2021.
2. Dharma, Krishna, Ramayana, Mandala Publishing, India, 2020.
3. Dharma, Krishna, Mahabharata: The Greatest Spiritual Epic of All Time, Mandala Publishing, India, 2020.
4. Valmiki, Shrimad Valmikiya Ramayan (Part 1 & 2), India, GITA PRESS GORAKHPUR, 2022
5. Ganguli, K. M. The Complete Mahabharata in English. India. 2017. file:///C:/Users/aknayak/AppData/Local/Temp/Rar$EXa23708.14774/m01/m01000.htm.

5. Similarity with the existing courses:

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

No similarity with existing courses

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

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Akhaya Kumar Nayak **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1	Prof. Laxmidhar Behera	
2	Dr. Ashsish Bolimbala	
3	Dr. Amit Shukla	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB582
Course Name : Consumer Behavior
Credit : 2
Distribution : *2-0-0-2*
Intended for : MBA DS & AI
Prerequisite : Marketing Management
Mutual Exclusion : Consumer Behavior HS461 offered by SHSS

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1. Preamble:

In today's dynamic and highly competitive marketplace every company endeavours to understand the current and future needs of the consumer. Understanding how, when, and why consumers behave in certain ways enables marketers to design and implement better marketing strategies. The conceptual knowledge gained in this course about the factors affecting pre-purchase decisions, consumption, and post-consumption behavior will also help marketers develop stronger analytical models to predict consumer behavior. Drawing from disciplines like psychology, sociology, and anthropology, the course covers individual factors such as perception, learning, motivation, personality, and attitudes, as well as external socio-cultural factors such as family dynamics, social groups, and group processes in the context of consumption. By the end of the course, participants should be able to apply different theories and models to explain consumer behavior in various purchase decision-making contexts.

2. Course Modules with quantitative lecture hours:

S No	Main Topic	Description	No of Hours
1	Introduction to Consumer Behavior	Consumer behavior and Technology, Consumer Value, Satisfaction and Retention, Market Segmentation, targeting and Real-Time Bidding.	2
2	The Consumer as an Individual	Consumer Motivation and Personality, Consumer Perception and Positioning, Consumer learning, Consumer Attitude formation and Change.	8
3	Communication and Consumer	Persuading Consumers, Print, Broadcast, and Social Media, Reference Groups, Communities,	7

	Behavior	Opinion Leaders, and Word of Mouth	
4	Social and Cultural Settings	Family and Consumer Socialization, Family-Decision-Making and Member's Roles, Culture's Role and Dynamics, Measuring Cultural Values, and Core cultural Values, Cross-Cultural Consumer Behavior	7
5	Consumer Decision Making and Ethics	Consumer Decision Making and Diffusion of Innovation, Consumer Gifting Behavior, Marketer' ethics and Social Responsibility.	4

Laboratory/practical/tutorial Modules: NA

3. Text books:

Schiffman, Wisenblit, and Kumar, Consumer Behavior, 12e, Pearson, India, 2018

4. References:

Petty, R. E., & Cacioppo, J. T. (1986), "The Elaboration Likelihood Model of Persuasion," in Communication and Persuasion (pp. 1-24). Springer, New York, NY

Mayyasi, Alex and Priceonomics (2016), "How Subarus Came to be Seen as Cars for Lesbians,"*TheAtlantic,*https://www.theatlantic.com/business/archive/2016/06/howsubaruscame-to-be-seen-as-cars-for-lesbians/488042/

Cialdini, R. B. (2001). The science of persuasion. *Scientific American*, *284*(2), 76-81.

Friestad, Marian, and Peter Wright (1994), The Persuasion Knowledge Model: How People Cope with Persuasion Attempts," *Journal of Consumer Research,* 21(1), 1-31.

McCracken, G. (1989). Who is the celebrity endorser? Cultural foundations of the endorsement process. *Journal of consumer research*, *16*(3), 310-321.

Dinnin Huff, A., Humphreys, A., & Wilner, S. J. (2021). The Politicization of Objects: Meaning and Materiality in the US Cannabis Market. *Journal of Consumer Research*.

Hsee, C. K. (1996). The evaluability hypothesis: An explanation for preference reversals between joint and separate evaluations of alternatives. *OBHDP, 67*(3), 247-257

Hsee, C. K., & Hastie, R. (2006). Decision and experience: why don't we choose what makes us happy?. *Trends in cognitive sciences*, *10*(1), 31-37.

Belk, R. W. (1988). Possessions and the extended self. *JCR*, *15*(2), 139-168.

Savary, J., & Dhar, R. (2020). The uncertain self: How self-concept structure affects subscription choice. *Journal of Consumer Research*, *46*(5), 887-903.

Escalas, J. E., & Bettman, J. R. (2005). Self-construal, reference groups, and brand meaning. *Journal of consumer research*, *32*(3), 378-389.

Gourville, J., & Soman, D. (2002). Pricing and the psychology of consumption. *HBR.*

Gourville, J. T. (1998). Pennies-a-day: The effect of temporal reframing on transaction evaluation. *Journal of Consumer Research*, *24*(4), 395-408.

Hamilton, R. W., & Srivastava, J. (2008). When 2+ 2 is not the same as 1+ 3: Variations in price sensitivity across components of partitioned prices. *JMR*, *45*(4), 450-461.

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.	Marketing Management	MB517	Overview of Consumer Behavior, Segmentation, Targeting,	10%
2	Consumer Behavior	HS461	Consumer as an individual, communication, social and cultural settings, consumer decision making	50%

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

This is an advanced course meant for IMBA and MBA DS&AI. The prerequisite for this course is marketing management. This course is important for those who want to develop specialization in the marketing domain and students can opt for more courses after taking this course. The proposed course is designed for MBA students, whereas HS461 caters to B-Tech students.

Approvals:

Faculty interested in teaching this course: Dr Ashish Bollimbala

Proposed by: Dr Ashish Bollimbala **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1	Dr Saumya Dixit	
2.	Dr Akhaya Nayak	
3.	Prof Anjan Kumar Swain	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB583
Course Name : Digital Marketing
Credit : 2
Distribution : *2-0-0-2*
Intended for : MBA DS & AI
Prerequisite : Marketing Management
Mutual Exclusion: NA

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1. Preamble:

In today's dynamic digital landscape, the power of the internet is revolutionizing the way businesses connect with their audiences. With increasing internet access and its speeds, individuals across the world are not only consuming content but also shaping their purchasing decisions online like never before. In this era, digital marketing emerges as an essential tool for businesses to thrive, evolve, and dominate in their respective industries.

Digital marketing isn't just about reaching audiences; it's about crafting meaningful connections, influencing decisions, and ultimately driving shareholder value. Leveraging the opportunities offered by the internet, marketers can customize communication strategies to engage their target demographics, shaping their behaviors with greater effectiveness.

This course is designed to equip students with strategies, tools, and techniques for meaningfully engaging consumers in the digital space. Through in-depth exploration of various digital marketing, and advertising channels, students will gain invaluable insights into successful planning, execution, and analysis.

COURSE CONTENT

- Strategy and models of the virtual (i.e., digital) world
- Online consumer behaviour
- Online marketing research
- Search engine optimization
- Search advertising
- Display advertising
- Social media marketing
- Web analytics

- Mobile and email marketing

2. Course Modules with quantitative lecture hours:

S No	Main Topic	Description	No of Hours
1	Introduction to Digital Marketing	The Online Market Space, Strategies and Models of virtual world. Online Consumer Behavior, user experiences, Online B2B & B2C behavior.	3
2	Search Engine Optimization	How Search Engine works, SEM components, PPC advertising with Google ad words, SEO success factors (On-Page and Off-Page Techniques), Google analytics, Content Marketing, Developing valuable content, Content strategy, Search Engine Marketing.	4
3	Display Advertising	Real time bidding, Executing display advertising, Video and other rich media,	3
4	E- Mail Marketing	Types of E- Mail Marketing, Email Automation, Lead Generation, Integrating Email with Social Media and Mobile, Measuring and maximising email campaign effectiveness	3
5	Online Reputation Management	Social Reviews and Ratings, Word of Mouth, User-Generated Content, Influencer Marketing, Meme Marketing, User's privacy and Security.	3
6	Social Media Marketing	Social Media Channels, Facebook, Twitter, Linkedin, Instagram, other Social Media channels, Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns, Virtual Brand Communities, and Gamification.	3
7	Mobile Marketing	Mobile Inventory/channels, Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns. Profiling and targeting.	3
8	Web Analytics and Channel Attribution Strategies	Data Collection, Key Metrics, Outcome Analysis, Experience Analysis, Multi-channel attribution, last interaction; firsts interaction; linear; Time-Decay; Position Based Attribution Models, and Types of tracking Codes.	3

9	Emerging Technologies in Digital Marketing	AI in Advertising, Chatbots, Micro-Moment Marketing, Virtual Reality, Augmented Reality, and Marketing Automation.	3

Laboratory/practical/tutorial Modules: NA

3. Text books:

Gupta, Seema (2018), Digital Marketing McGraw Hill Education

4. References:

The consumer decision journey, McKinsey Quarterly (2009). https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/the-consumer-decision-journey

American's Internet Access: 2000-2015, Pew Research Center (2015). https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/the-consumer-decision-journey

Social Media Usage: 2005-2015, Pew Research Center (2015). https://www.pewresearch.org/internet/2015/10/08/social-networking-usage-2005-2015/

Search Engine Optimization Starter Guide, Google. https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/the-consumer-decision-journey

Google analytics tutorial. https://support.google.com/analytics/answer/4553001

Did eBay just prove that paid search ads don't work? Harvard Business Review (2013). https://hbr.org/2013/03/did-ebay-just-prove-that-paid/

Multi-Channel Attribution Modeling: The Good, Bad and Ugly Models, Avinash Kausik (2013). http://www.kaushik.net/avinash/multi-channel-attribution-modeling-good-bad-ugly-models/

How Google Edged Out Rivals and Built the World's Dominant Ad Machine: A Visual Guide, WSJ (2019). https://www.wsj.com/articles/how-google-edged-out-rivals-and-built-the-worlds-dominant-ad-machine-a-visual-guide-11573142071

A Step-by-Step Guide to Smart Business Experiments, Harvard Business Review (2011). https://hbr.org/2011/03/a-step-by-step-guide-to-smart-business-experiments

Whose and what chatter matters? The effect of tweets on movie sales, Huaxia Rui, Yizao Liu, and Andrew Whinston (2013). http://www.sciencedirect.com/science/article/pii/S0167923612003880

How Often Should You Post on Social Media? Benchmarks for 9 Different Industries, HubSpot Blogs (2015). http://blog.hubspot.com/marketing/social-media-frequency-industry-benchmarks

Mobile Targeting, Xueming Luo et al. (2014). https://pubsonline.informs.org/doi/abs/10.1287/mnsc.2013.1836

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.	Marketing	MB517	Marketing Strategies, Advertising	10%

	Management		Communication	

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

The course is unique and doesn't significantly (>30%) overlap with any other course offered in the school and institute.

Approvals:

Faculty interested in teaching this course: Dr Ashish Bollimbala

Proposed by: Dr Ashish Bollimbala **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1	Dr Saumya Dixit	
2.	Dr Akhaya Nayak	
3.	Prof Anjan Kumar Swain	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB201
Course Name : Foundations of Business Management
Credit : 4
Distribution : *3-0-1-4*
Intended for : IMBA
Prerequisite : NA
Mutual Exclusion : Organizational Management HS304 offered by SHSS

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1. Preamble:

This is an introductory course developed to help you gain an understanding and awareness of management principles, practices and functions. The course will provide insights into how the four pillars of management: Planning, organizing, leading, and controlling help organizations achieve their goals in a volatile, uncertain, complex, and ambiguous (VUCA) This course also orients the students towards the management philosophy and pedagogies. At the end of this course, students will gain a deeper understanding of management principles and functions.

2. Course Modules with quantitative lecture hours:

S No	Main Topic	Description	No of Hours
1	Introduction to Management	Defining work, workplace, managers, management, corporation, firm, organization, etc. Theories of management, history of management, and Managerial Decision Making.	8
1	Pedagogies of Management	Case-studies, Simulations, Role plays, Projects etc.	8
2	Contemporary Management	Influence of external environment, Managing in global environment, Managing Diversity, Managing Change and Disruptive innovation, Managing Social responsibility and Ethics.	5
3	Functions of Management: Planning	Foundations of Planning, Managing Strategy, Entrepreneurial Ventures.	5
4	Functions of	Designing Organizational Structure, Managing Human	5

	Management: Organizing	Resources, Managing Groups and Teams	
5	Functions of Management: Leading	Managing Communication, Understanding and Managing Individual Behavior, Motivating Employees, Being effective leaders	5
6	Functions of Management: Controlling	Significance of Controlling, Contemporary Issues in Controlling, Tools for Measuring Organizational Performance, Forecasting, Techniques for resource allocation; Budgeting, Scheduling, Breakeven Analysis, Linear Programming. Project Management and Operations Management.	6

Laboratory/practical/tutorial Modules: 12 Hours.

Practical: Project work on Company Analysis. The students groups will identify a company in a given industry and analyze their environment, planning, organizing, leading, and controlling functions. At the end of the course they have to submit a report and present their findings and recommendations.

Book Reviews:

Ken Blanchard: One Minute Manager book series.

3. Text books:

- Stephens P. Robbins, Mary Coulter., 'Management', Latest Edition, Pearson Education, New Delhi.

4. References:

- Koontz H. Weihrich H., "Essentials of Management", McGraw Hill int. ed., Latest edition.
- Daft Richard L. 'Management' Thomson South Western, Latest edition.

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.	Organizational Management	HS304	Introduction to Management, Planning, Organizing, Leading, & Controlling	50%

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

This course is designed for IMBA students with a focus on introducing management pedagogies, philosophies and theories to them, whereas HS304 caters to B-Tech students and

focuses more on the functions of management. The proposed course is a disciplinary core course for the IMBA students in their first year. The course pedagogy also differs significantly with use of case studies, class activities, project work, and tutorials.

Approvals:

Faculty interested in teaching this course: Dr Ashish Bollimbala

Proposed by: Dr Ashish Bollimbala **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1	Prof Anjan Kumar Swain	
2.	Dr Puran Singh	
3.	Dr Akhaya Nayak	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB202
Course Name : Microeconomics
Credit :
Distribution : 3-0-0-3 (*L-T-P-C)*
Intended for :
Prerequisite :
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

The main objective of the course is to make students understand the way firms and industry works at micro level and how does an economic agent take an optimal decision. The course will help students understand the microeconomic theories and their application in a day-to-day life.

2. Course Modules with quantitative lecture hours:

Unit 1: (8 Hours)

Nature and scope of Economics || Demand and supply schedule || Law of demand and supply || Elasticity of demand and supply- price, income and cross price elasticity || Market forces-price determination and effect of change of market conditions

Unit 2: (8 Hours)

Theory of consumer behaviour: Utility; cardinal and ordinal utility analysis || Consumer's equilibrium-single and multiple commodity case || Indifference curve: types and properties || Price effect: Hicks and Slutsky methods || Derivation of the demand curve.

Unit 3: (10 Hours)

Production function || Law of variable proportions || Returns to scale || Isoquants || Factor substitution || Ridge lines || Internal and external economies and diseconomies || General notes on cost function || Theory of cost: Short-run cost analysis, long-run cost analysis Iso cost || Least cost combination || Concept of revenue: total, average, and marginal revenue || Revenue and elasticity || Break-even analysis

Unit 4: (8 Hours)

Introduction to market || Perfect and pure competition: assumption || Short-run equilibrium: firm equilibrium in the short-run, supply curve of the firm and industry, short-run industry equilibrium || Long-run equilibrium: firm equilibrium in the long-run, industry equilibrium in the long-run, optimal resource allocation

Unit 5: (8 Hours)

Monopoly: definition, demand, cost and revenue || Equilibrium of the monopolist: short-run equilibrium and long-run equilibrium || Comparison of pure competition and monopoly || Price discrimination || Monopolistic competition || Oligopoly: non-collusive oligopoly and collusive oligopoly

Laboratory/practical/tutorial Modules:

3. Text books:

***(Latest, Only 2*)**

1. **Pindyck, Microeconomics, Pearson Publisher.**
2. **Koutsoyiannis A., Modern Microeconomics, Macmillan Publishers.**

4. References:

(*No limit on numbers, relevant*)
Standard format can be followed

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: **School:**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB550
Course Name : Artificial Intelligence for Marketing
Credit : 2-0-0-2
Distribution : *L-T-P-C*
Intended for : MBA DS&AI
Prerequisite : None
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

Preamble
Artificial Intelligence (AI) is understood and implemented through inputs, processes, and outputs. This course is focused on the processes of implementing marketing functional services through programmatic marketing systems. Marketing processes has been changing drastically in the last decade with digital business. Decision making in the online and mobile space with numerous new metrics is truly beyond the conventional marketing wisdom. The massive behavioral data necessitates algorithmic marketing to process these data automatically to arrive at appropriate decisions. This course is based on the AI-based methods used for automating and augmenting major marketing functional services of business-to-consumer verticals.

Objective
The major learning outcomes and take away from this course are: • Understanding the nuances of marketing decisions in the presence of massive behaviorial data. • Learning how algorithmic marketing helps in automating and .augmenting marketing decisions. • Experiencing how AI tools and techniques can be used for marketing decision-making. • Applying AI methods for customer acquisition, retention, and growing relationships.

2. Course Modules with quantitative lecture hours:

Module 1	**Foundations of AI**	**(4)**
Refreshing Concepts of Machine Learning (ML) Methods- Supervised, Unsupervised, and Reinforcement Learning; Maximum Likelihood Estimation, Principal Component Analysis and Clustering, Logistic Regression and Multinomial Classification, and Naive Bayes Classifiers; AI Types, AI and Algorithmic Marketing, Defining AI and Algorithmic Marketing, Marketing functions Automation and Augmentation, Why AI for Marketing?		

Module 2	**AI for Predictive Modelling**	**(4)**
Business Objectives, Consumer Choice Theory- Multinomial Logit Model, Survival Analysis.		
Module 3	**AI for Finding Optimal Match Between Customers and Offerings**	**(5)**
Fundamentals of Product Discovery Problem and identifying right customers for a given offering, Promotions and Advertisements- Business Objectives, Targeting Pipeline, Response Modelling and Measurement, Targeting and LTV Models- Propensity Modelling, Segmentation and Persona-based Modelling, Targeting by using Survival Analysis, Lifetime Value Modelling, Markov Chain Models, Designing and Running Campaigns, Online Advertisements, Measuring the Effectiveness.		
Module 4	**AI Helps Finding Products for the Customers- Search**	**(3)**
Business Objectives, Matching and Ranking- Token Matching, Normalization and Stemming, Ranking and the Vector Space Model; Semantic Analysis, Latent Semantic Analysis, Word2Vector Model, Search Methods for Merchandising.		
Module 5	**Recommending Products for the Customers**	**(4)**
Business Objectives, Quality Evaluation, Recommendation Methods- Content-based, Collaborative Filtering, and Model-based Collaborative Filtering, Contextual Recommendations, Non-Personalized Recommendations.		
Module 6	**Pricing and Assortment**	**(4)**
Business Objectives, The Impact of Pricing, Price and Value, Price and Demand, Basic Price Structures, Demand Prediction, Price Optimization, Dynamic Pricing, Store-Layout Optimization and Category Management.		
Module 7	**ChatBots and Large Language Models (LLMs) for Marketing**	**(4)**
Business Objectives, Bots as a New Customer Interface and Operating System, Harnessing the Power of LLMs (like, ChatGPT) for Your Business, LLMs for Lead Generation, social media marketing, Optimizing Conversion Rates, Market Research and Analysis.		

Laboratory/practical/tutorial Modules:

Nil

3. Text books:

***(Latest, Only 2*)**

1. **Author(s), Title, Vol., Publisher, Country, Year**
2. **Author(s), Title, Vol., Publisher, Country, Year**

4. References:

1	Jim Sterne, Artificial Intelligence for Marketing: Practical Applications, John Wiley & Sons, 2017.
2	Mike Kaput, and Paul Roetzer, Marketing Artificial Intelligence: AI, Marketing, and the Future of Business, BenBella Books, 2022.
3	Ilya Katsov, Introduction to Algorithmic Marketing: Artificial Intelligence for Marketing Operations, Ilia Katcov, 2017.
4	Raj Venkatesan, and Jim Lecinski, The AI Marketing Canvas: A Five-Stage Road Map to Implementing Artificial Intelligence in Marketing, Stanford Business Books, 2021.
5	Peter Gentsch, AI in Marketing, Sales and Service: How Marketers without a Data Science Degree can use AI, Big Data and Bots, Springer Nature Switzerland AG, 2019.
6	Mike Kapu, Paul Roetzer, Marketing Artificial Intelligence: AI, Marketing, and the Future of Business, BenBella Books, 2022.
7	Katie King, Using Artificial Intelligence in Marketing: How to Harness AI and Maintain the Competitive Edge, Kogan Page, 2019.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: **School:**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..the Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : MB551
Course Name : Causal Analytics for Business decision making
Credit : 2-0-0-2
Distribution : *L-T-P-C*
Intended for : MBA DS&AI
Prerequisite :
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

Preamble
Traditional business analytics and machine learning approaches are heavily based on simple correlation in the data. However, most business decisions involve understanding the underlying causal relationship between the input and output variables. This knowledge is important because humans use causal reasoning to understand, explain, and make decisions about the real world. The natural use of machine learning methods is to establish regularities in the underlying data, but the causal approach assumes a stronger underlying structure, which is normally difficult to learn. However, the causal analysis makes the process more explainable. A proper causal AI system involves automating causal reasoning with machine learning. This course is focused on providing a basic understanding of causal inferencing in machine learning and AI.

Objective
The major learning outcomes and take away from this course are: • Describing how causal Data Science and AI become more explainable. • Understanding causal knowledge and its role in data-driven decision-making. • Experiencing the limitations of correlation-driven machine learning and AI systems for business decisions. • Learning and practicing causal data science tools and algorithms. • Making machine learning and AI more usable with causal analysis. • Applying causal data analysis methods for business decisions.

2. Course Modules with quantitative lecture hours:

Module 1	**Foundations of Causal Analytics**	**(4)**
Why and what of Causal effects and causal inference, Describing variables and relationships, Finding and using Causes, Correlation vs Causation, Causation without Correlation, Probabilities and Causation, Evidence and Causes.		

Module 2	**Causal Diagrams- Drawing Your Assumptions**	**(4)**
Assumptions about data for Causal Inference, Levels of Causation, Interventions and Counterfactuals, Data to Graphs, Drawing Causal diagrams, Moderators in Causal Diagrams, Causal Paths and their use to test the diagram, Confounding and Deconfounding, Measuring Causality, Granger Causality, and Causality Checklist.		
Module 3	**Business Experiments- Data Designing**	**(6)**
Experimental and Non-Experimental Data, Characteristics of Business Data, Data Generating Process, The magic of randomization, Random vs, Non-random data, Randomized Controlled Trials, Randomized Treatment Assignment and Causal Inference, Randomized vs. Observational Studies, Planned Experiments and Quasi-Experiments, Treatment Effects Estimation on Business Data.		
Module 4	**Tools for Experimentation**	**(6)**
Matching, Difference-in-Differences, Regression, , Simulation, Phased Rollouts, and Sensitivity Analysis in Observational Study.		
Module 5	**Opportunistic Data**	**(4)**
Defining and navigating Opportunistic Data, Anticipating and Influencing Business Outcomes, Causality with Opportunistic Data.		
Module 6	**Natural Experiments-Discontinuities and Instrument Variables**	**(4)**
Business and Natural Experiments, Analysing Natural Experiments, Difference-in-Differences in Natural Experiments, Regression Discontinuity.		
Module 7	**Explanation and Action**	**(2)**
What Caused What: Finding Causes, Explanation with Uncertainty, Automating Explanation, Evaluating Causal Claims, to Decisions.		

Laboratory/practical/tutorial Modules:

Nil

3. Text books:

***(Latest, Only 2*)**

1. **Author(s), Title, Vol., Publisher, Country, Year**
2. **Author(s), Title, Vol., Publisher, Country, Year**

4. References:

Judea Pearl and Dana Mackenzie, The Book of Why: The New Science of Cause and Effect,

Penguin Books, 2018.
Paul R. Rosenbaum, Causal Inference, MIT press, 2023.
Samantha Kleinberg, Why-A guide to finding and using Causes, Shroff Publishers and Distributors Pvt. Ltd., 2019
Jefferey, T. Prince and Amarnath Bose, Predictive Analytics for Business Strategy, McGraw Hill Education (India) Private Ltd., 2021
Jonas Peters, Dominik Janzing, and Bernhard Scholkopf, Elements of Causal Inference: Foundations and Learning Algorithms, The MIT Press, 2017.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Anjan K Swain **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Proposal for a new course

Financial Analytics

Course number	**: MB552**
Course Name	**: Financial Analytics**
Credit Distribution	**: *2-0-0-0***
Intended for	**: PG and PhD students**
Prerequisite	**: None**
Mutual Exclusion	**: None**

Preamble

Financial analytics has emerged as a powerful tool for deciphering complex financial data and uncovering actionable insights. This course offers a comprehensive introduction to the fundamental concepts and methodologies of financial analytics, providing students with a solid understanding of data analysis, predictive modeling, and risk management. With practical applications in fraud detection, portfolio optimization, and corporate finance, students will learn how to leverage data to support strategic financial decision-making. By the end of this course, students will be equipped with the analytical tools necessary to navigate financial markets, assess risks, and enhance organizational performance.

Unit 1 Introduction to Financial Analytics (6 Hours)

Overview of Financial Analytics: Importance and Applications; Descriptive, Predictive, and Prescriptive Analytics; Key Financial Data Sources and Data Quality Issues; Role of Statistical Techniques in Financial Analysis

Unit 2: Data Preparation and Exploration (6 Hours)

Data Cleaning and Transformation Techniques; Financial Data Visualization and Reporting Tools; Exploratory Data Analysis (EDA) Techniques; Identifying Patterns and Outliers in Financial Data

Unit 3 Predictive Modeling for Financial Analysis (6 hours)

Regression Models for Forecasting Financial Data; Time-Series Analysis: ARIMA, Seasonal; Decomposition; Machine Learning Techniques: Classification and Clustering; Measuring Model Performance and Avoiding Overfitting

Unit 4 Risk Management and Portfolio Optimization (6 hours)

Credit Risk Analysis: Credit Scoring Models; Value at Risk (VaR) and Stress Testing; Portfolio Theory and Optimization: Markowitz Model; Hedging and Risk Mitigation Strategies

Unit 5 Applications of Financial Analytics (4 hours)

Fraud Detection and Prevention Techniques; Algorithmic Trading and High-Frequency Trading; Customer Analytics in Banking and Financial Services; Financial Analytics in Corporate Strategy

Proposal for a new course

Fintech

Course number : MB553
Course Name : Fintech
Credit Distribution : *2-0-0-2*
Intended for : PG and PhD students
Prerequisite : None
Mutual Exclusion : None

Preamble

The rapid rise of fintech is revolutionizing the financial services industry, transforming traditional business models with cutting-edge technologies like blockchain, artificial intelligence, and digital payments. This course provides a deep dive into the world of fintech, exploring the key players, disruptive technologies, and regulatory challenges shaping this dynamic sector. Students will gain insights into how fintech startups are reshaping banking, insurance, and wealth management while understanding the cybersecurity risks and compliance demands of this evolving landscape. By the end of the course, students will be prepared to identify opportunities, adapt to emerging trends, and create innovative business models that align with the future of finance.

Unit 1 Introduction to Fintech (4 Hours)

Understanding Fintech: History and Evolution; Key Players in the Fintech Ecosystem; Disruptive Technologies in Financial Services; Impact of Fintech on Traditional Banking Models

Unit 2 Digital Payments and Lending (6 Hours)

Digital Wallets, Mobile Banking, and Cryptocurrency; Peer-to-Peer Lending and Crowdfunding Platforms; Smart Contracts and Blockchain Technology; Regulatory and Compliance Challenges

Unit 3 Insurtech and Wealthtech (6 hours)

Insurtech: Innovations in Insurance Industry; Robo-Advisors and Automated Investment Services; Digital Wealth Management Platforms; Ethical and Legal Implications of Automation

Unit 4 Risk Management and Cybersecurity (6 hours)

Cybersecurity Risks in Fintech; Anti-Money Laundering (AML) and KYC Compliance; Digital Identity and Authentication Technologies; Strategies to Mitigate Risks in Digital Finance

Unit 5 Fintech Business Models and Trends (6 hours)

Innovative Business Models in Fintech; Partnerships Between Banks and Fintech Startups; Emerging Trends: Regtech, DeFi, Open Banking; Global Regulatory Frameworks and Fintech Sandboxes

IIT Mandi
Proposal for a New Course

Course number : MB584
Course Name : Supply Chain Management
Credit : 2-0-0-2
Distribution : *L-T-P-C*
Intended for : MBA DS&AI
Prerequisite :
Mutual Exclusion : (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

Preamble
This course provides a comprehensive exploration of Supply Chain Management (SCM) principles, focusing on the intricate interplay between inventory management, demand forecasting, network design, and real-world applications. Students will delve into the core concepts and quantitative techniques essential for optimizing supply chains in diverse industries. Through a blend of theoretical frameworks and practical examples, participants will develop a robust understanding of SCM strategies to address contemporary challenges and capitalize on emerging opportunities in the global marketplace.

Objective
Upon completion of this course, students will be able to: • Understand the fundamental principles of supply chain management, including inventory control systems and demand forecasting methodologies. • Evaluate inventory planning strategies and their role in mitigating supply chain risks, such as cycle inventory and safety inventory. • Design efficient supply chain networks by considering strategic frameworks, distribution planning methodologies, and trade-offs between cost, performance, and pricing. • Apply supply chain management principles to real-world scenarios, analyzing applications like Lean Supply Chain Management and its impact on industries such as automotive and agriculture.

2. Course Modules with quantitative lecture hours:

Module 1	**Introduction to Supply Chain and Inventory Management**	**(6)**

Introduction: Supply chain management objectives and requirements, Supply Chain Management Cycle, Inventory and logistics management and their importance in supply chain management, Different types of inventory control systems.		
Module 2	**Demand Forecasting**	**(4)**
Introduction to demand forecasting and its role, qualitative and quantitative forecasting methods, components of a demand forecast, demand in a supply chain using time-series data, estimation of forecasting error.		
Module 3	**Inventory planning and Issues in Supply Chain Management**	**(8)**
Cycle Inventory, Economies of Scale, Inventory cost estimation, Safety Inventory, its levels and Risk, Pooling Echelons in SCM, Manufacturing Resource Planning, Just-in-time, Replenishment Policies, Pull and Push Systems, Levels of Product availability.		
Module 4	**Designing of Supply Chain Network**	**(4)**
Strategic framework for design of a distribution network, Importance of distribution network and factors influencing the distribution networks, Methodologies for network design and distribution planning and their Performance, Trade-Offs, pricing issues, and alternatives.		
Module 5	**Supply Chain Management Applications**	**(6)**
Lean Supply Chain Management, Supply Chain Management in Automobile Industry, Agricultural Supply Chain Management.		

Laboratory/practical/tutorial Modules:

No

3. Text books:

1	Sunil, Chopra. Supply Chain Management: Strategy, Planning, And Operation, 5/e. Pearson India, 2013.
2	Jacobs, F. Robert, and Richard B. Chase. Operations and supply chain management. McGraw-Hill, 2018.
3	Relevant research articles and business cases

4. References:

1	Bowersox, Donald J., David J. Closs, M. Bixby Cooper, and John C. Bowersox. Supply chain logistics management. Mcgraw-hill, 2020.
2	Heizer, Jay, Barry Render, and Chuck Munson. Operations management: sustainability and supply chain management. Pearson, 2020.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Manoj Thakur **School: School of Management**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..the Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Annexure F

Credit Distribution for Internships and Application Process

Action Items

- ✓ Review and finalize the credit distribution policy for internships.
- ✓ Discuss and implement the policy for the 8th semester internship discouragement.
- ✓ Establish clear procedures for internship permissions and notifications.
- ✓ Set up a framework for handling negative feedback and stress calls from companies and students.
- ✓ Ensure communication of policies to all stakeholders, including students, faculty, and companies.

1. Credit Distribution

a) Summer/Winter Break Internships (IC010)

Completion requirement: Minimum 6 weeks.

Credit allocation: 2 credits.

Mode: Both online and offline options are available as per Company/Institute policy.

Valid Semesters: Vacations following 5th, 6th and 7th semesters. To be completed before commencement of 8th semester.

b) Semester-Long Internships (Only during the regular semesters)

Offline/Onsite: Minimum 14 weeks 9 credits; can be done during 6th and 7th semesters only

Online/Remote: Minimum 14 weeks 6 credits; can be done during 6th, 7th and 8th Semesters.

Limitations:

- Maximum of 9 credits from courses can be done during online/remote internships, based on recommendation of FA.
- Student is supposed to complete all Institute Core and Discipline Courses, before undergoing semester-long internships.
- NOC should be obtained from Academic Section for semester-long internships.

Exceptional Circumstances

A committee comprising the FA, Advisor CnP/TnI will determine appropriate credits in exceptional cases.

2. 8th (Final) Semester Internship Policy

- Students must remain on campus during 8th semester to prevent academic issues and facilitate knowledge transfer to the subsequent batches.

- A Student is permitted to do/undergo **Online/Remote Internship** during the 8th semester.

3. Internship Process and Permissions

a) **Semester Internship (DP399P)**: Notification and permission required from FA—Advisor TnI and CnP Cell (cc)—AD Courses within 5 working days for industrial internships.
    a. Student should register for relevant course (DP-399_.....).
    b. FA will submit the grades for the specified semester at the time of grade submission/correction.

b) **Internship (IC010)**: Notification and permission required from FA—Advisor TnI and CnP Cell (cc) within 5 working days for industrial internships.
    a. Grades for Internships will be submitted by FA along with the 8th semester grades.

c) **Off-campus offers**: Permissions managed by FA – AD Courses without CnP office involvement.

4. Handling Negative Feedback

a) From Companies

- Consideration of company and student feedback forms before validating remarks.
- Formation of a committee (FA, Advisor CnP/TnI, student internship members) to investigate.
- Decision on awarding partial/no credits if the student's work is sufficient.

b) From Students

- Similar process for investigating stress calls or unmet company commitments.
- Internship drop allowed before midsemester based on negative feedback or stress calls from students.

5. Adding/Dropping of the Semester-long Internship:

- Permission/NOC should be obtained before add/drop courses deadline.
- No permission will be given to add Internship, after add/drop dates.
- Maximum permissible deadline to drop the semester-long internship, based on the negative feedback, is the commencement of Midsem Exams for that semester.

Annexure G

Inward No. 3884
06 MAY 2024
Academics Section

IIT Mandi
Proposal for a New Course

Course number : CS212

Course name : Design and Analysis of Algorithms

Credits : 3-0-2-4

Prerequisites : IC253: Programming and Data Structures, or equivalent for UG students

Intended for : BTech (Semester 3 or 4)

Distribution : Discipline Core for BTech CSE/DSE

Semester : Odd/Even

1. Preamble

The proposed core course, building on top of the course on Programming and Data Structures (IC253), offers formal introduction to various common algorithm design techniques, methods for analyzing the performance of corresponding algorithms and improving their efficiency, and to provide performance guarantees.
The theoretical aspects of this course are going to be supplemented by comprehensive practice exercises and weekly programming labs worth one lab credit.

2. Course modules

1. Review of Data Structures from IC course: Asymptotic Notations and recurrence relations, Insertion Sort, Merge Sort, QuickSort and Randomization (5 H)
2. Sorting Lower Bounds and Non-Comparison Sorting algorithms like Counting Sort and Radix Sort (2 H)
3. Order Statistics: Minima and Maxima, Quickselect, Median of Medians (3 H)
4. Applying sorting techniques to Computational Geometry : Closest pair problem, Convex Hull of points in a plane (3 H)
5. Advanced topics in Sorting and Searching:- Binary Search Trees, Red-Black Trees, Augmentation of Binary Search Trees (8 H)
6. Graph Algorithms: Basics of Graphs, BFS and DFS, Topological Sorting, MST(using Kruskal and Prim's), Union-Find Data structure, Single-Source Shortest Path Dijkstra's Algorithm and Bellman-Ford /Maximum Flow (Ford Fulkerson) (8 H)
7. Dynamic Programming: Longest Common Subsequence, Matrix Multiplication (2 H)
8. Amortized analysis: aggregate analysis, accounting, potential method (3 H)
9. Advanced Data Structures: B-Trees, Binomial and Fibonacci/Quake Heaps (3 H)
10. Computational complexity: Problem classes: P, NP, NP-complete, NP-hard. Reductions and Examples of NP-complete problems. (3 H)
11. Dealing with NP-hard problems:- Approx/Randomized Algorithms, Parameterized Complexity (2 H)
12. Coding Lab which covers topics discussed in this course (28 H)

3. Textbook

1) T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press, 3/e, 2009.
2) J. Kleinberg and E. Tardos, Algorithm Design, Pearson, 2006.

4. Reference books

1) S. Dasgupta, C. H. Papadimitriou, U. V. Vazirani, Algorithms, McGraw-Hill, 2006.
2) S. S. Skiena, The Algorithm Design Manual, Springer, 2/e, 2008

5. Similarity content declaration with existing courses:

	Course Name	Common Topic(s)	Overlap (%)
CS514	Advanced Data Structures and Algorithms	Several topics	> 30%

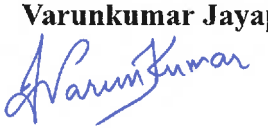
6. Justification of new course proposal if cumulative similarity content is >30%:

CS202 was previously an introductory second year course for undergrad students who enrolled for CS514 in third year. Now CS202 has been replaced by an IC course and the students need an intermediate level Algorithms core course in second year. Second year students cannot credit a CS5xx course, so as a replacement a similar course suited for 2nd year students is being offered. CS514 Course, will be modified/upgraded appropriately after CS212 is approved.

Approvals:

Faculty interested in teaching this course: – Varunkumar Jayapaul, Prateek Vishnoi, Gaurav Sood.

Proposed by: Varunkumar Jayapaul **School: SCEE**

Signature:  **Date: 06/05/2024**

The following faculty (at least 3 faculty) discussed on…03/05/2024……and approved the proposal on …06/05/2024……..

Sl. No	Faculty Name	Signature
1	Varunkumar Jayapaul	
2	Dinesh Singh	
3	Prateek Vishnoi	

School Chair : 06 MAY 2024

School : SCEE

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. The Academic Office provides the IC Course Code.

IIT Mandi
Proposal for an Updated Course

Course number: CS 305
Course Name: Artificial Intelligence
Credit Distribution: 3-0-0-3
Intended for: 3rd and 4th year B.Tech. students
Prerequisite: CS 212 Design of Algorithms or an equivalent course
Mutual Exclusion: None

1. Preamble:
The Artificial Intelligence (AI) course is designed to introduce students to the foundational concepts and techniques that form the basis of intelligent computer systems. This course aims to build a strong foundational understanding of AI by covering a range of topics from heuristic search and game playing to knowledge representation and robotics. It is essential for students interested in advanced fields like machine learning, cognitive modelling, natural language processing, and computer vision.

2. Course Modules with quantitative lecture hours:

Unit 1: Introduction to AI (3 Hours)
Overview, historical perspective, Turing test, agents.

Unit 2: Search Methods and Optimization (8 Hours)
Problem representation, State Space Search, A* Algorithm, AO* search, Minimax and alpha-beta pruning, AI in games.

Unit 3: Logic and Automated Reasoning (7 Hours)
Propositional Logic, Predicate Calculus, Resolution Refutation, Formal Systems, Soundness, Consistency, Completeness.

Unit 4: Planning and Constraint Satisfaction (6 Hours)
Blocks World, STRIPS, Constraint Satisfaction Problems, Basics of Probabilistic Planning, Waltz Algorithm.

Unit 5: Knowledge Representation and Reasoning (7 Hours)
Semantic Net, Frames, Scripts, Conceptual Dependency, Ontologies, Basics of Semantic Web, Intelligent Question Answering.

Unit 6: Learning and Uncertainty (6 Hours)
Learning from Examples, Decision Trees, Neural Nets, Bayesian Theory, Fuzzy Logic, Non-monotonic Logic, Default Reasoning, Case-based Reasoning.

Unit 7: Advanced Topics in AI (5 Hours)
Introduction to Computer Vision, Expert Systems, Natural Language Processing, Robotics, Hidden Markov Models, Reinforcement Learning.

Laboratory/practical/tutorial Modules: None.

3. Textbooks:
Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach. 4th Edition, Pearson Education, USA.
Poole, D., & Mackworth, A. (2017). Artificial Intelligence: Foundations of Computational Agents. 2nd Edition, Cambridge University Press, UK.

4. References:
Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press, USA.
Luger, G. F. (2008). Artificial Intelligence: Structures and Strategies for Complex Problem Solving. 6th Edition, Pearson Education, USA.

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

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

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

The course CS 305, approved in the 3rd Senate meeting of IIT Mandi, has been updated with less than 20% change in the course contents.

Approvals:

Other Faculty interested in teaching this course: Prof. Padmanabhan Rajan

Proposed by: Prof. Varun Dutt **School:** SCEE

Signature: **Date:** 10th November 2023

Recommended/Not Recommended, with Comments:

_____ **Date:**_____
Chairperson, CPC

Approved / Not Approved

_____ **Date:**_____
Chairperson, BoA

Responses to Referee Comments

Referee #1:

Partha Pratim Roy, PhD, FIETE,
Associate Professor, Dept. of Computer Science & Engineering,
Indian Institute of Technology Roorkee, India
Email: partha@cs.iitr.ac.in

Dear Prof. Agarwal,

The curriculum was designed to cover all key areas of AI.
I find this structure to be quite standard and endorse it.

Best Regards,
Partha

Response: Thank you for your kind encouragement.

Referee #2:

Shashi Shekhar Jha, PhD
Assistant Professor
Department of Computer Science and Engineering,
Indian Institute of Technology Ropar (IIT Ropar), Main campus,
Near Rupnagar Bypass Road, Birla Farms,
Rupnagar, Punjab, 140001
Email: shashi@iitrpr.ac.in

I went through the AI course curriculum.
First of all, I am delighted to note that AI is being considered as a core course for CSE 3rd year students. As otherwise, an AI course is usually floated as an elective.

Response: Thank you for your kind encouragement. As AI and machine learning are highly demanded, having a core course on the BTech CSE student's transcript would help build the student's foundations in AI.

The course contents look good to me. However, I would like to point out one aspect with regards to the Labs/Practicals. I am not sure if there is a separate AI lab course under consideration. If not, then there should be labs included with the AI course for the students to try hands-on on the different topics.

Response: Thank you for your kind encouragement. As it is a core course and the number of core credits is tight in the BTech CSE program, we plan to manage the hands-on component as

part of the assignments given in the course. Students will take home these assignments, but these assignments will be discussed in and out of class via the institute's learning management system. Furthermore, several other machine learning courses in the BTech CSE curriculum have a lab component, where the hands-on component gets covered.

Also, the course doesn't specify any prerequisites, however, I feel that Data Structures and Algorithms (DSA) should be prerequisites in order to follow the initial material on search methods in this course.

Response: Yes, we agree that DSA is a good prerequisite course. This DSA course (CS212 Design of Algorithms) is also a core course in the curriculum of the BTech CSE program that students will do either before or in parallel to the AI course. This course has now been added as a prerequisite to the syllabus.

Inward No. 3-892-2
07 MAY 2024
Academics Section

IIT Mandi
Proposal for a New Course

Course number	: CS 312
Course Name	: Operating System
Credit	: 4
Distribution	: 3-0-2-4
Intended for	: B.tech (CSE) 3rd Year, Electives for others
Prerequisite	: None
Mutual Exclusion	: None

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1. Preamble:

This course aims to teach the students the basics of Operating Systems design and implementation as it provides users with a usable and programmable interface while managing computing resources efficiently. This imparts knowledge essential for any programmer to understand how any program element/feature works and can be expected to behave. The focus is on teaching the base theory and concepts while keeping in perspective the history of how concepts developed and their relevance/importance in current computing. Concepts are illustrated with detailed case studies from existing OS kernels.

2. Course Modules with quantitative lecture hours:

Unit 1: Introduction to Operating Systems (OS): What OS do, OS Structure, OS Operations, OS Services, User and OS Interface, System Calls, Types of System Calls, System Programs, OS Design and Implementation, OS Debugging and OS Generations. **(5 Hours)**

Unit 2: Process Management: Process Concept, Scheduling, Interprocess Communication, Multi-core and Multithreading Programming Models, Thread Libraries, Threading Issues, The Critical-Section Problem, Mutex Locks, Semaphores, CPU Scheduling, Scheduling Algorithms, Thread Scheduling, Deadlocks Characterization, Detection, Prevention and Avoidance. **(9 Hours)**

Unit 3: Memory Management: Main Memory Background, Swapping, Contiguous Memory Allocation, Segmentation, Virtual Memory Concept, Demand Paging, Page Table Structure, Page Replacement, Copy-on-Write, Thrashing. **(8 Hours)**

Unit 4: Storage Management: Storage Structure Overview, Disk Management and Scheduling, RAID Structure, File System Interface, Directory and Disk Structure, File Sharing, File-System Structure and Allocation Methods, Directory Implementation, I/O Hardware, I/O Interface, Kernel I/O Subsystem. **(8 Hours)**

Unit 5: Protection and Security: Goals, Principle and Domain of Protection, Access Matrix. Access Control, Access Rights Revocation, Security Problem, Program Threats,

User Authentication, Implementing Security Defenses, Firewalls. **(7 Hours)**

Unit 6: Advance Topics: Virtual Machines, Virtualization and OS Component, Distributed System, Network-based OS, Communication Protocols, Case Studies related to different OS like XV6, Linux, Windows, etc. **(5 Hours)**

Laboratory/practical/tutorial Modules: Lab(s)/Assignment(s) related to process management, shells, memory, threads, virtualization, concurrency, persistency, and security etc.

3. Textbooks:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, 8th Ed., John Wiley, 2008.
2. AS Tanenbaum, Modern Operating Systems, 3rd Ed., Pearson, 2009.

4. References:

1. William Stallings, Operating Systems: Internals and Design Principles. Prentice-Hall, 6th Ed., 2008.
2. AS Tanenbaum, AS Woodhull, Operating Systems Design and Implementation, 3rd Ed., Prentice Hall, 2006.
3. M. J. Bach. Design of the Unix Operating System, Prentice Hall of India, 1986
4. Remzi Arpaci-Dusseau, Andrea Arpaci-Dusseau, Operating Systems: Three Easy Pieces, Version 1.10.

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.	None			

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

Not Applicable

Approvals:

Other Faculty interested in teaching this course: – Dr. Indu Joshi

Proposed by: Dr. Sukarn Agarwal **School:** SCEE

Signature: Sukarn . **Date:** 07/5/24

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1.	Dr. ~~Aditya Nigam~~ Indu Joshi	Indu Joshi
2.	Dr. Padmanabhan Rajan	
3.	Dr. ~~Indu Joshi~~ Aditya Nigam	

School Chair: 07 MAY 2024

School:

Date:

This proposal is reported in ……th Board of Academics on……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

IIT Mandi
Proposal for a New Course

Course number	: CS 313
Course Name	: Computer Networks
Credit	: 4
Distribution	: 3-0-2-4
Intended for	: BTech CSE (Third year)
Prerequisite	: None
Mutual Exclusion	: None

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1. Preamble:

Intended to serve as a first course in computer networks, this course introduces students to the history and conceptualization of the Internet, its layered architecture and the fundamental concepts on which the protocols in each layer are based. It is intended as a platform for students to explore and understand the underlying principles of computer networks. The course covers the underlying principles of protocols in each layer of the protocol stack, and builds concepts required to design protocols for networks of today and the future.

2. Course Modules with quantitative lecture hours:

1. **Introduction (4 lecture hours):**
   [a] What is the Internet? Services and protocols.
   [b] Core and Edge Network, Packet-switched and circuit-switched networks
   [c] Layered architecture, Data Encapsulation, the end-to-end argument, history of the Internet.
   [Lab] Networking tools in Linux: ping, traceroute, etc. Introduction packet analyzers such as tcpdump, Wireshark.

2. **Application layer (4 lecture hours):**
   [a] Services of the application layer, network applications, where is the application layer?
   [b] Application layer protocols, Hypertext Transfer Protocol, Email and Simple Mail Transfer Protocol (SMTP), Secure Shell (SSH), Domain Name System (DNS), File Transfer Protocol (FTP).
   [Lab] Socket programming.

3. **Transport layer (7 lecture hours):**
   [a] Transport layer services and overview, Principles of reliable data transfer, UDP and TCP, Flow control and congestion control.
   [b] TCP congestion control, TCP implementation: Slow start, congestion avoidance, fast retransmit and fast recovery, Evolution of TCP, legacy TCP and latest variants.
   [Lab] Introduction to network simulators: ns2/ns3. Simulation-based study of TCP and UDP.

4. **Network layer (9 lecture hours):**
   [a] Network layer services and overview, architecture of a router, Switching and Forwarding, Datagram Approach (connectionless Service), Virtual Circuit Approach (connection- oriented Service).
   [b] The Internet Protocol, Addressing and NAT, IPv4, IPv6 and Dynamic Host Configuration Protocol (DHCP).
   [c] Unicast and multicast routing, Routing algorithms: Link-state routing and Distance-vector routing.
   [d] Interaction of transport and network layer. Role of network layer in congestion control.
   [e] Software-Defined Networking (SDN) and its evolution, Network management and associated protocols.
   [Lab] Study of routing algorithms using ns2/ns3 or network emulation using Mininet.

5. **Link layer (8 lecture hours):**
   [a] Link layer services, overview, link layer addressing, Address Resolution Protocol (ARP).
   [b] Error detection and correction, Cyclic Redundancy Check (CRC) and Checksum.
   [c] Multiple access protocols: channel partitioning, random access (ALOHA, CSMA and its variants), taking turns. Link-layer addressing, Ethernet and its evolution, Switches and VLANS.
   [Lab] Virtual networking in Linux.

6. **Wireless and next-gen networks (4 lecture hours):**
   [a] WiFi and 802.11 standard.
   [b] Cellular Internet Access, Routing and handoffs in mobile networks.
   [c] Edge computing, architecture for cloud networking and IoT.
   [Lab] Simulation-/measurement-based study of wireless networks.

7. **Advanced topics (6 lecture hours):**
   Firewalls, Proxy, VoIP, protocols for video streaming, network economics, Content Delivery Networks.

3. Text books:

1. JF. Kurose and KW. Ross, Computer Networking: A top-down approach, 8th Edition, Pearson, 2022.

4. References:

1. L. Peterson and B. Davie, Computer Networks: A Systems Approach, 6th Edition, Morgan Kaufmann Publishers.
2. BA. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill.
3. MJ. Donahoo and KL. Calvert, TCP/IP Sockets in C: Practical Guide for Programmers, Morgan Kaufmann Publishers.

5. Similarity with the existing courses: None
(Similarity content is declared as per the number of lecture hours on similar topics)

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

			Content	
1.				

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

Not Applicable

Approvals:

Other Faculty interested in teaching this course: – Dr. Siddhartha Sarma

Proposed by: Dr. Sreelakshmi Manjunath and Dr. Samar **School:** SCEE

Signature: **Date: 6/5/24**

The following faculty (at least 3 faculty) discussed on…4/5/24……and approved the proposal on…6/5/24……..

Sl. No	Faculty Name	Signature
1.	Dr. Siddhartha Sarma	
2.	Dr. Padmanabhan Rajan	
3.	Dr. Adarsh Patel.	

School Chair:

School: School of Computing and Electrical Engineering

Date: 06 MAY 2024

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

Reviewer Comments:

Dr. Padmanabhan Rajan:

Wireshark must be included in the lab component. Otherwise the theory components are fine and standard.

Dr. Siddhartha Sarma:

The content looks fine to me. Even the lab exercises corresponding to each module are clearly indicated. However, the lecture hours do not add up to 42. It must be altered accordingly.

Indian Institute of Technology Mandi

Inward No. 3884
06 MAY 2024
Academics Section

IIT Mandi
Proposal for a New Course

Course number : CS 362
Course Name : Artificial Intelligence
Credit Distribution : 3-0-0-3
Intended for : 3rd and 4th year B.Tech. students
Prerequisite : CS 212 or an equivalent course
Mutual Exclusion : None')

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1. Preamble:

The Artificial Intelligence (AI) course is designed to introduce students to the foundational concepts and techniques that form the basis of intelligent computer systems. This course aims to build a strong foundational understanding of AI by covering a range of topics from heuristic search and game playing to knowledge representation and robotics. It is essential for students interested in advanced fields like machine learning, cognitive modelling, natural language processing, and computer vision.

2. Course Modules with quantitative lecture hours:

Unit 1: Introduction to AI (3 Hours)

Overview, historical perspective, Turing test, agents.

Unit 2: Search Methods and Optimization (8 Hours)

Problem representation, State Space Search, A* Algorithm, AO* search, Minimax and alpha-beta pruning, AI in games.

Unit 3: Logic and Automated Reasoning (7 Hours)

Propositional Logic, Predicate Calculus, Resolution Refutation, Formal Systems, Soundness, Consistency, Completeness.

Unit 4: Planning and Constraint Satisfaction (6 Hours)

Blocks World, STRIPS, Constraint Satisfaction Problems, Basics of Probabilistic Planning, Waltz Algorithm.

Unit 5: Knowledge Representation and Reasoning (7 Hours)

Semantic Net, Frames, Scripts, Conceptual Dependency, Ontologies, Basics of Semantic Web, Intelligent Question Answering.

Unit 6: Learning and Uncertainty (6 Hours)

Learning from Examples, Decision Trees, Neural Nets, Bayesian Theory, Fuzzy Logic, Non-monotonic Logic, Default Reasoning, Case-based Reasoning.

Unit 7: Advanced Topics in AI (5 Hours)

Introduction to Computer Vision, Expert Systems, Natural Language Processing, Robotics, Hidden Markov Models, Reinforcement Learning.

Laboratory/practical/tutorial Modules: None

3. Text books:

1. Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach. 4th Edition, Pearson Education, USA.
2. Poole, D., & Mackworth, A. (2017). Artificial Intelligence: Foundations of Computational Agents. 2nd Edition, Cambridge University Press, UK.

4. References:

1. Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press, USA.
2. Luger, G. F. (2008). Artificial Intelligence: Structures and Strategies for Complex Problem Solving. 6th Edition, Pearson Education, USA.

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.	NA			

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

The course CS 305, approved in the 3rd Senate meeting of IIT Mandi, has been updated with less than 20% change in the course contents.

Approvals:

Other Faculty interested in teaching this course: – Dr. Padmanabhan Rajan 11/5/24

Proposed by: Dr. Varun Dutt **School:** SCEE

Signature: Varun Dutt **Date:**

Recommended

Recommended/Not Recommended, with Comments:

Chairperson, CPC 03 MAY 2024 **Date:**_____

Approved / Not Approved

Chairperson, BoA **Date:**_____

Responses to Referee Comments

Referee #1:

Partha Pratim Roy, PhD, FIETE,
Associate Professor, Dept. of Computer Science & Engineering,
Indian Institute of Technology Roorkee, India
Email: partha@cs.iitr.ac.in

Dear Prof. Agarwal,

The curriculum was designed to cover all key areas of AI.
I find this structure to be quite standard and endorse it.

Best Regards,
Partha

Response: Thank you for your kind encouragement.

Referee #2:

Shashi Shekhar Jha, PhD
Assistant Professor
Department of Computer Science and Engineering,
Indian Institute of Technology Ropar (IIT Ropar), Main campus,
Near Rupnagar Bypass Road, Birla Farms,
Rupnagar, Punjab, 140001
Email: shashi@iitrpr.ac.in

I went through the AI course curriculum.
First of all, I am delighted to note that AI is being considered as a core course for CSE 3rd year students. As otherwise, an AI course is usually floated as an elective.

Indian Institute of Technology Mandi

Response: Thank you for your kind encouragement. As AI and machine learning are highly demanded, having a core course on the BTech CSE student's transcript would help build the student's foundations in AI.

The course contents look good to me. However, I would like to point out one aspect with regards to the Labs/Practicals. I am not sure if there is a separate AI lab course under consideration. If not, then there should be labs included with the AI course for the students to try hands-on on the different topics.

Response: Thank you for your kind encouragement. As it is a core course and the number of core credits is tight in the BTech CSE program, we plan to manage the hands-on component as part of the assignments given in the course. Students will take home these assignments, but these assignments will be discussed in and out of class via the institute's learning management system. Furthermore, several other machine learning courses in the BTech CSE curriculum have a lab component, where the hands-on component gets covered.

Also, the course doesn't specify any prerequisites, however, I feel that Data Structures and Algorithms (DSA) should be prerequisites in order to follow the initial material on search methods in this course.

Response: Yes, we agree that DSA is a good prerequisite course. This DSA course (CS212 Design of Algorithms) is also a core course in the curriculum of the BTech CSE program that students will do either before or in parallel to the AI course. This course has now been added as a prerequisite to the syllabus.

Indian Institute of Technology Mandi

IIT Mandi
Proposal for a New Course

Course number	: CS673
Course Name	: Advanced Computer Vision
Credit Distribution	: 3-0-2-4
Intended for	: B.tech (3rd and 4th Year), CSE, DSE and EE Students
Prerequisite	: EE511 Computer Vision or CS671 Deep Learning or EE608 Digital Image Processing or CS669 Pattern Recognition, or similar
Mutual Exclusion	: None

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1. **Preamble:** Recent revolutions in artificial intelligence (AI) are attributed to the advances in computer vision. Computer vision enables the computing machines to understand and extract information from digital images and videos like humans or better than humans in some of the domains. This course will provide a high-level in-dept understanding of the recent advancements in the computer vision to enable senior undergraduates and graduate students aspiring to pursue the advanced research including representation, recognition, detection, tracking, segmentation, generation, summarization of the visual data. This course will use deep learning extensively but largely focus on the learning aspect of computer vision unlike Deep Learning.

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

Unit 1: Introduction to Computer Vision: Get a conceptual overview of image classification, object localization, object detection, and image segmentation. Also be able to describe multi-label classification and distinguish between semantic segmentation and instance segmentation. In the rest of this course, you will apply PyTorch to build object detection and image segmentation models. **(6 Hours)**

Unit 2: Vision Models Classification: Convolutional Neural Networks: Architectures, Convolution / Pooling Layers, spatial arrangement, layer patterns, layer sizing patterns, AlexNet/ZFNet/VGGNet/EfficentNet case studies, computational considerations, Transfer learning for Representation, domain adaptation, domain Generalization, open set, open world, curriculum learning **(6 Hours)**

Unit 3: Vision Models Object Detection and Tracking: Overview of some popular object detection models, such as regional-CNN and ResNet-50. Use of object detection

models in PyTorch, Transfer Learning for object detection: download your own models and configure them for training and build your own models for object detection. Using transfer learning, you will train a model to detect and localize. Model compression and real-time inference on Edge-devices. **(9 Hours)**

Unit 4: Vision Models Segmentation: Types of semantic segmentation, instance-based models, Disadvantages of search window methods, RCNN-family models, Unet, DeepLab, Transformer based segmentation. **(6 Hours)**

Unit 5: Graphs and XAI for Vision: Graph Representation/formulation for visual tasks, Deep Learning Models for Graphs, GradCam, GradCam++, Graph Model Explanation, LIME, GraphLIME **(6 Hours)**

Unit 6: Vision & Language Models: Visual to Text: Recent methods for Text embeddings, Scene/Video Captioning, OCR, VQA, Video Description using RNNs, LSTMs, Transformers. Text to Visual: Text to image/video generation using VAEs, GANs, Transformers. **(9 Hours)**

Laboratory/practical/tutorial Modules: Based on the course modules

3. Text books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Computer Vision: A Modern Approach (Second Edition) by David Forsyth and Jean Ponce.

4. References:

1. Deep Learning by Ian Goodfellow
2. Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, and Jerome Friedman.
3. Multiple View Geometry in Computer Vision (Second Edition) by Richard Hartley and Andrew Zisserman

Indian Institute of Technology Mandi

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Course Name	Similarity Content
1.	EE 511	Computer Vision	< 30%
2.	CS 671	Deep Learning and Applications	< 30%

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

EE 511: This course focusses on introduction to computer vision and its basic task using image prepossessing techniques and shallow learning techniques. While the proposed course will cover advanced topics beyond the scope of the EE511 which is one of the prerequisites for the proposed course.

CS 671: This deep learning and advanced deep learning course are focusing on the recent advances in the neural networks such as CNNs, LSTMs, etc. However, the objective is the neural networks-based model design and their training. The knowledge of these methods is going to be used in advanced computer vision however the focus will be on the understanding and to solve the vision problems and redesign and retraining based on the challenges and need of the vision tasks. These courses are also in the list of prerequisites for the proposed course.

Approvals:

Other Faculty interested in teaching this course: – Dr. Rohit Saluja

Proposed by: Dr. Dinesh Singh **School:** SCEE

Signature: **Date:** 01/5/2024

Indian Institute of Technology Mandi

Responses to Referee Comments

Review #1
Prof. Makoto Yamada
Associate Professor, Machine Learning and Data Science Unit
Okinawa Institute of Science and Technology (OIST), Japan
Email: makoto.yamada@oist.jp

I've examined the course, and it appears to be an excellent advanced computer vision program. Given its advanced nature, incorporating a final project utilizing the acquired knowledge for potential research could be beneficial.

Response: Thank you for your kind encouragement. Indeed, the project is a major part of the evaluation in this course.

Review #2
Prof. C Krishna Mohan
Professor, Department of Computer Science and Engineering
Indian Institute of Technology Hyderabad
Email: ckm@cse.iith.ac.in

The course contents look good to me. The course includes advanced topics and laboratory components to provide hands-on practice on the different methods of advanced computer vision. However, I would like to point out one aspect with regards to the Labs/Practicals is that it requires a suitable laboratory equipped with GPU enabled PCs and Centralized GPU-enabled HPC Node(s).

Response: Thank you for your kind encouragement. Indeed, we also proposed a suitable laboratory separately for AI-related courses.

Review #3
Prof Chetan Arora,
Professor, Department of Computer Science and Engineering
Joint Faculty, Yardi School of Artificial Intelligence,
Indian Institute of Technology Delhi
Email: chetan@cse.iitd.ac.in

It's good to see you taking initiative for designing advanced courses. Some of my suggestions are as follows: 1) Vision is undergoing changes at very fast pace. Some of the topics that you listed in Unit 1-4 are already becoming part of first computer vision course. 2) If you give lecture-wise topic list at 60- or 90-mins level it will help to discern what can be reduced and pushed to introductory vision course, and what can remain in advanced. 3) You may also wish to give some reference material with each lecture. This will help you plan the course at a finer level. You will have to do this anyways when you teach, as students will need reference besides your slides/lectures. Doing it at this stage will understand what depth you can afford to go in each lecture, given overall time constraints. 4) Any advanced course without discussion about foundational and multimodal models will look incomplete.

Response: Thank you for your kind encouragement. Indeed, we also have lecture-wise plan and reference material during the class execution. Unit 1-4 are kept for foundations. Multimodal (Text + Visual) models are added into Unit 5-6.

Indian Institute of Technology Mandi

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/center faculty on

Sl. No	Faculty Name	Signature
1	Rohit Saluja	
2	Indu Joshi	Indu Joshi
3	Parimala Kanchrala	K. Parimala.

Recommended/Not Recommended, with Comments:

Date:_____

Chairperson, CPC

08 MAY 2024

Approved / Not Approved

Date:_____

Chairperson, BoA

Indian Institute of Technology Mandi

शैक्षणिक अनुभाग
Inward No...3884
06 MAY 2024
Academics Section

IIT Mandi
Proposal for a New Course

Course number : CS683
Course Name : **Generative AI**
Credit : **4**
Distribution : ***3-0-1-4 (L-T-P-C)***
Intended for : **UG/PG/PhD**
Elective for B. Tech. Data Science and Engineering, Discipline elective for B. Tech. Computer Science and Engineering, Electrical Engineering, Free elective for other B. Tech. disciplines, Elective for M.Tech (CSP/Intelligent Systems/CSE) and PhD
Prerequisite : **CS671-Deep Learning and It's Applications**
Mutual Exclusion : (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

Preamble: Recent advancements in generative AI have equipped machine learning algorithms with the ability to learn from and accurately replicate observed data, creating new, similar data instances. This course provides an in-depth exploration of the key algorithmic developments in generative models, together with their underlying mathematical principles. We will cover a range of topics such as normalizing flows, variational autoencoders, generative adversarial networks, diffusion models, and sequence generation models, etc.

Objective:

- Understanding Generative Models: Develop a comprehensive understanding of generative models in artificial intelligence, including their applications, strengths, and limitations.
- Generative Adversarial Networks & Variational AutoEncoders & Flow based models: Understanding the math behind each algorithm and discussing all the variants of GANs and VAEs.
- Diffusion Models: Dive deep into diffusion models, understanding their mathematical foundations, training methodologies, and applications in generating high-quality images, text, and other types of data.
- Understanding Sequential Generative Models : Transformers and text to video/image generative models.

- Deep Generative Graph Models: Understand the principles and architectures of Graph Neural Networks (GNNs) and Graph Generation using Graph Generative Models.
- Hands-on Experience: Gain practical experience through hands-on projects and exercises, implementing GANs and diffusion models using popular deep learning frameworks such as TensorFlow or PyTorch.

- **Course Modules with quantitative lecture hours:**

Introduction : (4 Hours)

Introduction to Generative Models- GenAI , Basics of Deep Learning ,Convolutional Neural Networks, Convolutional Neural Networks -II, Recurrent Neural Networks & LSTM

Variational Autoencoders (3 Hours)

Deep Dive Into Variational AutoEncoder, Variants of Variational AutoEncoders

Generative Adversarial Networks (7 Hours)

Theory of GAN, Variants of GAN, GAN architectures, Various GAN losses and Convergence analysis of GAN, Conditional GANS:pix2pix, cycleGAN, Domain adaptation frameworks.

Flow Based Generative Models (2 Hours)

Normalizing Flow Basics, Variational Normalizing Flow and Sampling Basics

Diffusion Models (7 Hours)

Introduction to Diffusion Models, Deepdive into Diffusion Models -I, Score Based Diffusion Models, Discrete Latent Variable Models, Diffusion Models for Discrete Data

Hybrid Generative Models (2 Hours)

VAE-GAN, Diffusion guided Style GAN

Evaluation of Generative Models (1 Hour)

Discussion of the scores like FID, Inception Score

Transformer Based Generative Models (8 Hours)

Introduction to Transformers, Variants of Transformers, BERT Models, GPT Models, Chat GPT , Video and Image generation via. Transformers: VIT, VVIT, CLIP, GLIDE, DALE, Text Generation, Text to Text and Text to Image, Text to Video

Deep Graph Generative Models (8 Hours)

Graph Neural Networks - Model , Design , Deep Generative Models for Graph Generation and Graph Transformers

Laboratory/practical/tutorial Modules:

- Lab to be conducted on a 2-hour slot every week. It will be conducted in tandem with the theory course so the topics for problems given in the lab are already initiated in the theory class.
- Programming Assignments to Implementing state of art Diffusion Models, GANs,Transformers and Graph Neural Networks.
- Tools - Pytorch or Tensorflow

- **Text books:**
  - The Artificial Intelligence and Generative AI Bible: [5 in 1] The Most Updated and Complete Guide | From Understanding the Basics to Delving into GANs, NLP, Prompts, Deep Learning, and Ethics of AI, Alger fraley, 2024
  - Generative Deep Learning, 2nd Edition by David Foster Released April 2023 Publisher(s): O'Reilly Media, Inc
- **References:**
  - Deep Generative Modeling by Jakub M. Tomczak
  - Graph Neural Networks in Action by Keita Broadwater and Namid Stillman.
- **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.	Deep Learning and Applications	CS671	Module-1	8%
2.	Advanced Deep Learning and Applications	CS672	GAN Introduction to transformers	15%

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

None

Approvals:

Faculty interested in teaching this course: –
Dr. Aditya Nigam
Dr. Arnav Bhavsar
Dr. Indu Joshi
Dr. Parimala Kancharla

Proposed by: Dr. Parimala Kancharla **School: SCEE**

Signature: K. Parimala **Date: 03-05-2024**

The following faculty (at least 3 faculty) discussed on…03-05-2024…and approved the proposal on…03-05-2024……..

Sl. No	Faculty Name	Signature
1	Dr. Aditya Nigam	
2	Dr. Arnav Bhavsar	
3	Dr. Indu Joshi	Indu Joshi
4	Dr. Parimala Kancharla	K. Parimala

School Chair:

School: SCEE

Date: 03.05.2024

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

IIT Mandi
Proposal for a New Course

Course number : CS 685
Course Name : Natural Language Processing
Credit Distribution : 3-0-0-3
Intended for : BTech 3rd/4th year; MTech; MSc; Ph.D.
Prerequisite : Introductory course in machine-learning/AI; Programming in Python;
Mutual Exclusion : None

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1. Preamble:

This course aims to equip students with an in-depth understanding of Natural Language Processing (NLP), emphasizing the development, functionality, and the impact NLP models have across various sectors. By exploring the theoretical underpinnings, ethical considerations, and practical applications of NLP, students will gain the expertise needed to innovate in the field.

2. Course Modules with quantitative lecture hours:

Unit/Topic 1: Introduction to NLP and FSTs (6 Hours)

- History of NLP and its Evolution
- Challenges and Applications of NLP
- Text Preprocessing: Tokenization, Stop words removal, Stemming, Lemmatization, and Normalization
- Parsing Algorithms
- Regular Languages and Finite State Transducers

Unit/Topic 2: Language Modeling (6 Hours)

- Language modeling with Markov chains
- Introduction to probability and information theory in NLP
- Concept of Perplexity
- Supervised learning: Feature extraction, Naive Bayes and Support Vector Machines for text classification

Unit/Topic 3: Word Embeddings and HMM (6 Hours)

- Word2Vec, CBOW and Skip-gram
- FastText
- GloVe: Global Vectors for Word Representation
- HMM and Viterbi

Unit/Topic 4: Named Entity Recognition (NER) and Part-of-Speech Tagging (POS) (9 Hours)

- Introduction to NER
- Sequence labeling for NER
- CRF-based NER models
- Deep learning approaches to NER
- Introduction to POS tagging
- Rule-based POS tagging
- Hidden Markov Models for POS tagging
- Neural network-based POS tagging

Unit/Topic 5: Text Post Processing and Sentiment Analysis (8 Hours)

- Adaptive Text Post Processing using plugin classifiers
- Understanding sentiment analysis and Lexicon-based approaches
- Machine learning-based sentiment analysis

Unit/Topic 6: Text Generation (10 Hours)

- Using pre-trained word embeddings for specific applications
- Sentence Embeddings
- Introduction to text generation
- Sequence-to-Sequence Models, Attention Mechanism and Transformers
- Recurrent Neural Networks (RNNs) for text generation
- Large Language Models
- BERT for NER
- Language generation with GPT-3 and similar models
- Ethical considerations, future trends and research directions in NLP

Laboratory/practical/tutorial Modules:

In addition to the lecture modules, this course will include a take home assignment where students will apply their knowledge to develop and fine-tune LLM applications using Python and platforms such as Hugging Face Transformers.

3. Text books:

1. Yoav Goldberg Neural Network Methods for Natural Language Processing, Morgan and Claypool (2017).

2. Dan Jurafsky and James Martin Speech and Language Processing, 3nd Edition.

4. References:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.

4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

5. 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.	Advanced Computer Vision	CS 6XY	10%	Some foundational topics in ANN and DNNs with vision + text modalities may be common. This course is distinct in its focus on basics of Natural Language Processing, combining advanced theoretical insights with practical, hands-on experience, thus filling a unique niche in the curriculum.
2.	Large Language Models: Core Concepts to Custom Applications	CS 6XY	10%	Some foundational topics in ANN and DNNs may be common. This course is distinct in its focus on basics of Natural Language Processing, combining advanced theoretical insights with practical, hands-on experience, thus filling a unique niche in the curriculum.

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

NA

Approvals:

Faculty interested in teaching this course: –

Proposed by: Dr. Rohit Saluja
Electrical Engineering

School: School of Computing and

Signature: 

Date: 13/5/24

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Inward No. 3929
14 MAY 2024
Academics Section

Sl. No	Faculty Name	Signature
1	Rohit Saluja	
2	Dinesh Singh	13/5/2024
3	Arnav Bhavsar Vinayak	

School Chair:

School:

Date: 14 MAY 2024

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

Indian Institute of Technology Mandi

IIT Mandi
Proposal for a New Course

Course number	: CS 686
Course Name	: Large Language Models: Core Concepts to Custom Applications
Credit Distribution	: 3-0-2-4
Intended for	: BTech 3rd/4th year; MTech; MSc; Ph.D.
Prerequisite	: Introductory course in machine-learning/AI; Programming in Python
Mutual Exclusion	: None

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1. Preamble:

This course aims to equip students with an in-depth understanding of Large Language Models (LLMs), emphasizing their development, functionality, and the impact they have across various sectors. By exploring the theoretical underpinnings, ethical considerations, and practical applications of LLMs, students will gain the expertise needed to innovate in the field of AI and NLP.

2. Course Modules with quantitative lecture hours:

Unit/Topic 1: Introduction to NLP and LLMs (9 Hours)

- Fundamentals of NLP and its Evolution
- Language Model Basics: n-grams to Neural Networks
- Word embeddings
- Introduction to Transformer Architectures and Attention Mechanisms
- Introduction to Generative AI
- Overview of Prominent LLMs (GPT, BERT, Llama, Mistral, etc.) and their Impact

Unit/Topic 2: Deep Dive into LLM Architectures (12 Hours)

- Selecting the right model and Generative AI responsibility
- Comprehensive Study of Transformer Mechanism
- Scaling Challenges: Computational Demands, Data Efficiency
- Hallucinations and Citations
- Architectural Variants and Innovations in LLMs

Unit/Topic 3: Practical Applications and Customization of LLMs (15 Hours)

- Text data cleaning, normalization, and **tokenization**
- LLMs in Text Generation, Translation, and Summarization
- Best Prompt Engineering Techniques
- Fine-Tuning Strategies for Task-Specific Applications
- Overview of Instruction Fine Tuning and Reinforcement Learning from Human Feedback (RLHF)
- Retrieval-Augmented Generation (RAG)
- Practical Session: Building LLM-based Applications

- Building Chat Applications
- Embeddings based Search Applications
- Speech based LLMs

Unit/Topic 4: Ethical Considerations and Societal Impacts (4.5 Hours)

- Addressing Bias and Fairness in LLM Outputs
- Ethical Use and Misuse of Generative AI
- Future Societal Challenges and Opportunities

Unit/Topic 5: Advanced Topics and Research Directions in LLMs (4.5 Hours)

- Emerging Trends in LLM Research
- Novel Applications and Future Technologies
- Open Problems and Discussion

Laboratory/practical/tutorial Modules:

In addition to the lecture modules, this course will include take home assignment where students will apply their knowledge to develop and fine-tune LLM applications using Python and platforms such as Hugging Face Transformers.

3. Text books:

1. Auffarth, B. (2023). Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT and other LLMs. Packt Publishing.
2. Jacob Eisenstein, *Introduction to Natural Language Processing*, MIT Press, USA, 2019.

4. References:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press, USA, 2016.
2. A collection of the latest research papers, technical blogs, and articles from top journals and conferences to stay updated with the advancements and debates in the domain of LLMs.
3. *Title: Large Language Models in Practice* - This is a placeholder for a current and comprehensive resource focused on the practical and theoretical aspects of LLMs. Due to the rapidly evolving nature of this field, the latest resource available at the time of course launch should be selected.
4. Generative AI for beginners by Microsoft https://learn.microsoft.com/en-gb/collections/zpv7c8zmq6kv0z?WT.mc_id=academic-105485-korevst

5. 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.	Deep Learning and Applications	CS 671	10%	Some foundational topics in ANN and

				DNNs may be common. This course is distinct in its focus on Large Language Models, combining advanced theoretical insights with practical, hands-on experience, thus filling a unique niche in the curriculum.
2	Natural Language Processing	CS 685	10%	Some foundational topics with text modalities may be common. This course is distinct in its focus on Large Language Models, combining advanced theoretical insights with practical, hands-on experience, thus filling a unique niche in the curriculum.

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

NA

Approvals:

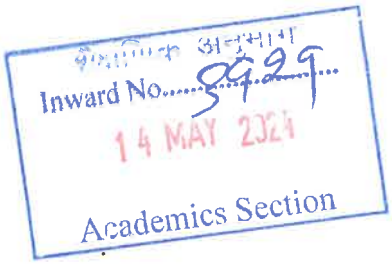
Faculty interested in teaching this course: –

Proposed by: Dr. Varun Dutt and Dr. Rohit Saluja **School:**School of Computing and Electrical Engineering

Signature:  **Date:** 13/5/24

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1	Varun Dutt	
2	Rohit Saluja	
3	Aditya Nigam	



School Chair:

School: 14 MAY 2024

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

Indian Institute of Technology Mandi

IIT Mandi
Proposal for the revision of an existing Course

Course number : DS313
Course Name : Statistical Foundations of Data Science
Credit : 4
Distribution : *3-1-0-4*
Intended for : Discipline core for B. Tech. Data Science and Engineering, Discipline elective for B. Tech. Computer Science and Engineering, Electrical Engineering, Free elective for other B. Tech. disciplines
Prerequisite : IC110-Engineering Mathematics, IC252-Data Science 2
Mutual Exclusion : Applied Probability (CS511), Probability and Random Processes (EE532/EE534), Probability & statistics (MA524)**,** Probability and Statistics for Data Science and AI (MB-510)

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1. Preamble:

In the context of data science, probability theory is the one of most crucial tool for predictive modelling. It assists in the study of data and helps in making inferential decisions about it. Most of the commercial and open-source software/packages available currently for the purpose of data analysis and prediction rely upon fundamental concepts of probability theory and statistics. A practitioner typically uses these concepts as a black box, but a data scientist capable of analyzing and designing new algorithms must have a clear understanding of the underlying notions. This helps in choosing/designing better tools for problem solving and analyzing the data. This course is intended to impart a strong background in probability theory to the students so that they are in a position to grasp notions involving probability in advanced topics such as statistical analysis, machine learning etc.
On completion of this course, students should be able to exhibit their understanding of various concepts of probability and statistics that are required in DSE for subsequent courses such as Statistical Learning and Pattern Recognition.

In particular, students should be able to
- understand the notion of random variables, their distribution properties and certain key results related to convergence and limit theorems.
- acquire adequate knowledge of various random processes and their properties.
- have a thorough understanding of various sampling techniques of practical importance and graphical models for machine learning and data science

2. Course Modules with quantitative lecture hours:

Unit 1: Sample space, Sigma field, axiomatic definition of probability, conditional probability and independence, Bayes Rule. **(2 Hours)**

Unit 2: Review: Random variables – discrete and continuous, probability mass function, probability density function, some standard (important) pdfs, independence, expectation,

variance, conditional distribution, conditional expectation, covariance and correlation, Functions of random variables. **(7 Hours)**

Unit 3: Probability generating function, moment generating function and characteristic functions – properties and applications. **(3 Hours)**

Unit 4: Convergence of random variables – basic results, inequalities (Markov and Chebyshev), law of large numbers (weak and strong), central limit theorem**. (5 Hours)**

Unit 5: Random vectors and covariance and correlation matrix, Random processes – stationarity, WSS, Autocorrelation, cross correlation, power spectral density, Ergodicity. Wiener processes, Markov processes, Poisson Process. **(8 Hours)**

Unit 6: Sampling methods: Inverse transforms sampling, Rejection sampling, adaptive rejection sampling, importance sampling, Markov chains and MCMC. **(8 Hours)**

Unit 7: Graphical models: ML and MAP estimation, directed and undirected models, Bayesian networks, CRF, Learning and Inference method (ML, MAP, Sampling) **(9 Hours)**

Tutorial Modules: Same as the course modules. Selected practice problems will be discussed in tutorial sessions.

3. Text books:

1. Papoulis, Athanasios, and S. Unnikrishna Pillai.Probability, random variables, and stochastic processes. Tata McGraw-Hill Education, 2002.
2. Grimmett, Geoffrey, and David Stirzaker.*Probability and random processes*. Oxford university press, 2001.

4. References:

1. Bishop, Christopher M.Pattern recognition and machine learning. Springer, 2006.
2. Ross, Sheldon.A first course in probability. Pearson, 2014.
3. Hajek, B., Random Processes for Engineers. Cambridge: Cambridge University Press (2015).

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

This is a core course for Data Science UG program. There are no data science courses that has similarity with to this one.

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

Approvals:

Faculty interested in teaching this course: – Siddhartha Sarma, Arnav Bhavsar

Proposed by: Siddhartha Sarma **School: SCEE**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on 7 May 24 and approved the proposal on 7 May 24.

Sl. No	Faculty Name	Signature
1	Arnav Bhavsar	
2	Padmanabhan Rajan	
3	Siddhartha Sarma	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : DS411
Course Name : Optimization for Data Science
Credit : 4
Distribution : 3-*1-0-4*
Intended for : UG
Prerequisite : IC111-Linear Algebra, IC110-Engineering Mathematics, DS301-Mathematical Foundations for Data Science
Mutual Exclusion : NA

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1. Preamble:

Optimization lies at the heart of data science. Most of the problems in data science and machine learning are formulated as optimization problems. Techniques such as regression, estimation, learning etc. used in data science when applied to large scale data sets need efficient optimization techniques to find the solution. This course is meant as a first course in optimization for the undergraduate data science and engineering program. The first part of this course gives a strong foundation on convex optimization. An exposure to typical algorithms and acceleration methods used in data science as well as machine learning are provided in the second part. A good background in these topics will prepare the student for dealing with advanced optimization methods used in data science and machine learning.

2. Course Modules with quantitative lecture hours:

Unit 1: Affine sets, convex sets, cone, examples – hyperplanes, half-spaces, polyhedra, simplexes, positive semidefinite cones. Operations that preserve convexity. Separating and supporting hyperplanes. Dual cones. **(6 Hours)**

Unit 2: Convex function, first and second order conditions, epigraph, operations that preserve convexity, conjugate function. **(6 Hours)**

Unit 3: Convex optimization – linear, quadratic, geometric, conic, semidefinite programming. Formulation of - unconstrained, equality constrained, inequality constrained and both – problems. **(7 Hours)**

Unit 4: Duality – Lagrange dual function, bounds on the optimal value. Lagrange dual problem, weak and strong duality, optimality conditions. **(8 lectures)**

Unit 5: Gradient methods – gradient descent, Lipschitz functions, smooth functions, projected gradient descent, Frank-Wolfe algorithm, Chebyhsev iterations, conjugate gradient, Nesterov's accelerated gradient descent. Dual gradient ascent, ADAM. **(10 lectures)**

Unit 6: Nonconvex optimization – alternating minimization and expectation maximization algorithms, convex relaxations. **(5 lectures)**

Laboratory/practical/tutorial Modules: 1-credit tutorial

3. Text books:

1. Boyd, Stephen, and Lieven Vandenberghe. *Convex optimization*. Cambridge university press, 2004.

4. References:

1. Yurii, Nesterov, *Introductory lectures on convex optimization: a basic course*. Kluwer Academic Publishers, 2004.
2. Luenberger, D. G., and Y. Ye. *Linear and nonlinear programming*, Springer New York, 2008.
3. Nocedal, Jorge, and Stephen Wright. *Numerical optimization*. Springer Science & Business Media, 2006.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Parimala Kancharla **School: SCEE**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on May 5, 2024 approved the proposal May 5, 2024

Sl. No	Faculty Name	Signature
1.	Arnav Bhavsar	
2.	Padmanabhan Rajan	
3.	Siddhartha Sarma	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : DS412
Course Name : Matrix Computations for Data Science
Credit : 4
Distribution : 3-*0-2-4*
Intended for : UG
Prerequisite : IC111-Linear Algebra, IC110-Engineering Mathematics
Mutual Exclusion : NA

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1. Preamble:

Many of the machine learning algorithms when applied to some practical problems often requires dealing with massive systems of linear equations or matrices. Due to increasing complexity in the real world scenarios and recent advances in the area of data science, understanding of numerical linear algebra and large scale matrix computations has become essential for data science practitioners.

After doing courses on engineering mathematics and linear algebra, students get conversant with various concepts related to multivariable calculus, vector spaces, linear transformations and basic matrix properties. To further enhance their expertise to cater the requirements to deal with large scale applications, this course introduces matrix factorization methods and their implementations. Also, direct and iterative methods for solving system of linear equations and eigenvalue problems of large dimensions are discussed.

This course tries to answer the fundamental question of choice of suitable matrix computation method with objective of having adequate speed and suitable accuracy in the computations. Hands-on experience with all the methods covered is the most crucial part of this course. All the topics discussed in this course would be accompanied with parallel practical session to reinforce the learning outcome of the course.

2. Course Modules with quantitative lecture hours:

Basics:
Errors in numerical computations. Review matrices and Block matrix, Linear Transformations: matrices, Projection Transformations, Reflection Transformations, and Rotational Transformations, compositions of Linear Transformations, Matrix and Vector Norms. **(10 lectures)**

Matrix factorizations:
Cholesky factorization, QR factorization, Householder reflectors and Givens rotations. LU factorization and Gaussian elimination. Numerical stability Pivoting strategies and solution of triangular and full systems by factorization. **(6 lectures)**

Eigenvalue problem:
Basic theory, Power method, bisection method, QR algorithm. Similarity reduction. **(5 lectures)**

Linear least squares problem:
Jordan decomposition: Uniqueness and similarities, Existence and computation, Matrix functions, Singular value decomposition, Moore-Penrose Pseudoinverse. Perturbation theory. Least square and normal equations. SVD and rank deficiency, Principal Component Analysis, Linear Discriminant Analysis. **(8 lectures)**

Iterative methods for linear systems:
Iterative methods for linear systems Iterative methods: Jacobi, Gauss-Seidel and SOR iterations. Kronecker product. Krylov subspace methods, conjugate gradient method, preconditioning. **(7 lectures)**

Sparse and banded linear systems:
Storage schemes for banded and sparse matrices, Sparse matrices and sparse solutions: approximate inverses, eigenvalues, incomplete factorization. Matrix regularization: matrix completion. **(6 lectures)**

Laboratory/practical/tutorial Modules: Lab would be conducted on a 2-hour weekly slot. Lab sessions would be conducted in tandem with the theory course so the topics for problems given in the lab are already initiated in the theory class.

3. Text books:

1. Trefethen, Lloyd N., and David Bau III. Numerical linear algebra. Vol. 50. SIAM, 1997.
2. Eldén, Lars. Matrix methods in data mining and pattern recognition. Vol. 4. SIAM, 2007.

4. References:

1. Watkins, David S. *Fundamentals of matrix computations*. Vol. 64. John Wiley & Sons, 2004.
2. Demmel, James W. *Applied numerical linear algebra*. Vol. 56. SIAM, 1997.
3. Golub, Gene H., and Charles F. Van Loan. *Matrix computations*. Vol. 3. JHU press, 2012.
4. Cullen, Charles G. *An introduction to numerical linear algebra*. PWS Publishing Company, 1994.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Dr. Preeti **School: SMSS**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on May 5, 2024 approved the proposal May 5, 2024

Sl. No	Faculty Name	Signature
1.	Arnav Bhavsar	
2.	Padmanabhan Rajan	
3.	Parimala Kancharla	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number **:** DS413
Course Name **:** Introduction to Statistical Learning
Credit **: 3-1-0-4**
Distribution **:** Discipline core for B. Tech. Data Science and Engineering, Discipline elective for B. Tech. Computer Science and Engineering, Electrical Engineering, Free elective for other B. Tech. disciplines
Intended for **:** UG
Prerequisite **:** IC272 – Data Science-3, IC111 – Linear Algebra, IC152 – Computing and Data Science, IC252 - Probability and Statistics (Data Science 2)
Mutual Exclusion **:** (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

Data science involves using the scientific methods to process the data to extract knowledge and insights from data in various forms, both structured and unstructured. Vast amounts of data are being generated in many fields, and the data analyst's job is to make sense of it all: to extract important patterns and trends. This involves learning from data. This course intends to provide fundamental ideas and techniques in learning from data in the statistical framework.

2. Course Modules with quantitative lecture hours:

Introduction to learning from data: (4 lectures)

- Introduction to supervised learning and unsupervised learning.
- Introduction to statistical learning
- Statistical Models, Supervised Learning and Function Approximation

Supervised learning: Regression (7 lectures)

- Linear regression models and least squares
- Shrinkage methods: ridge regression
- The LASSO
- Logistic regression.

Supervised learning: Classification (12 lectures)

- Bayes Decision Theory (Taken from PR)
    - Minimum-error-rate classification
    - Classifiers, Discriminant functions, Decision surfaces

- Normal density and discriminant functions
- Discrete features

- Bayes classifier with unimodal and multimodal density - maximum likelihood estimation and MAP (class density estimation), Expectation-Maximization (EM) algorithm
- Decision trees: Classification and Regression Trees (CART) (Random Forest)
- K - nearest neighbour
- Perceptron
- Support vector machine (SVM)

Model Assessment and Selection: (9 lectures)

- Bias, variance and model complexity
- The Bayesian approach, AIC and BIC,cross-validation
- Bootstrap methods, hypothesis testing, confidence intervals, significance testing,Ensemble learning

Unsupervised learning: (10 lectures)

- Introduction to association rules, clustering, and dimension reduction.
- Principal component analysis (PCA) – Optimization formulation and kernel PCA
- Linear discriminant analysis (LDA)

3. Text books:

Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition, Springer, 12th Reprint, 2017

References:

Duda, R. O., Hart, P. E. and Stork, D. G., Pattern Classification, John Wiley, 2001.

Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006.

Theodoridis, S. and Koutroumbas, K., Pattern Recognition, Academic Press, 2009.

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.	None	none	None	-

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

None

Approvals:

Faculty interested in teaching this course: –

Dr. Parimala Kancharla

Proposed by: Dr. Parimala Kancharla **School: SCEE**

Signature: **Date: 02-05-2024**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1	Dr. Arnav Bhavsar	
2.	Dr. Padmanabhan	
3.	Dr. Aditya Nigam	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : EE500
Course Name : Network Control System
Credit Distribution : *3-0-0-3*
Intended for : B.Tech. EE (3rd and 4th year), M.Tech., M.Tech. (R), PhD
Prerequisite : For B.Tech. – Control System or equivalent course
Mutual Exclusion : None

1. Preamble:

With the advent of the internet and increasingly more powerful and inexpensive computing resources, network control systems have become a focus in the research community. Providing advantages with respect to robustness, complimentary capabilities, and task parallelization, network control systems have found applications in various domains including distributed sensing, power grids, and robotics.

By the end of the course, one should be able to do the following:

- Model multi-agent networks as graphs
- Use linear algebra to assess algebraic and spectral graph properties
- Analyse the stability of network control systems
- Design local interaction protocols that give rise to desired global behaviours
- Apply graph-theoretic principles to problems in sensing and estimation
- Relate engineered systems to the natural world through the lens of network science

2. Course Modules with quantitative lecture hours:

Introduction: Introduction to Network Control Systems, The Rendezvous Problem, Algebraic Graph Theory, Graph Connectivity and Robustness (Cheeger's inequality, proximity graphs)

(10 Hours)

Consensus: The Consensus Protocol, Discrete-Time Consensus, Directed Consensus, Switching Consensus, Lyapunov Stability with Switching Networks, The Synchronization Problem and Kuramoto Model

(10 Hours)

Multi-Agent Robotics: Formation, Graph rigidity and Persistence, Formation Control and Design Choices, Leader-Follower Networks, Network controllability and network feedback, Distributed optimal control

(10 Hours)

Mobile Sensor & Communication Networks: Sensor networks, Gabriel and Voronoi graph, Coverage Control, Communication models, random graphs, random consensus

(10 Hours)

Laboratory/practical/tutorial Modules: None

3. Text books:

***(Latest, Only 2*)**

1. Graph Theoretic Methods in Multiagent Networks, by M. Mesbahi and M. Egerstedt, Princeton University Press, 2010.
2. F. Bullo, J. Cortes, and S. Martinez, Distributed Control of Robotic Networks, Princeton University Press, 2009.

4. References:

1. Passivity-Based-Control and Estimation in Networked Robotics, by T. Hatanaka, N. Chopra, M. Fujita, and M.W. Spong, Springer, 2015.
2. Algebraic Graph Theory, by C. Godsil and G. Royle, Springer, 2001.
3. Networked Embedded Sensing and Control, edited by P. J. Antsaklis and P. Tabuada, Springer 2006.

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.	NA	NA	NA	NA

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

None

Approvals:

Faculty interested in teaching this course: –
Narendra Kumar Dhar

Proposed by: Narendra Kumar Dhar **School:** SCEE

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on 02-05-2024 and approved the proposal on course “Network Control System”.

Sl. No	Faculty Name	Signature
1	Dr. A.P. Tiwari	
2	Dr. Tushar Jain	
3	Dr. Kaushik Halder	

School Chair:

School:

Date:

This proposal is reported in ……..the Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : EE-557

Course Name : Adaptive Control

Credit Distribution : 3-0-0-3 ***(L-T-P-C)***

Intended for : Engineering graduates (pursuing M. Tech, PhD)

Prerequisite : Basic (Level 1) course in Automatic Control, e.g., EE301 – Control Systems Engineering. Familiarity to some extent with Standard state-space description of dynamical systems and Digital Control is desirable.

Mutual Exclusion : None

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1. Preamble:

The objective of the proposed course is to impart advanced theoretical knowledge in the area of adaptive control which has numerous industrial applications. Methods of automatic tuning, gain scheduling, continuous adaptation, model reference adaptive control, parameter estimation, etc. which will be covered in the course are of great relevance today. It is also intended to provide insight into techniques and algorithms for recursive and online fitting of dynamic models based on data generated by real systems. These are useful in understanding neural networks and fuzzy systems too.

2. Course Modules with quantitative lecture hours:

Introduction (3h)**:** Feedback control system design steps, effect of process variations, adaptive schemes and applications.

Models of dynamic systems (recapitulation only): State space and Input-output models, plant parametric models,

Stability (4h)**:** Norms, Quadratic forms, Positive definiteness of matrices; BIBO stability, Stability in the sense of Lyapunov, Stability of linear systems.

Parameter Estimation (6h)**:** Least squares and Regression models, Recursive estimation,

Deterministic and Stochastic Self-tuning Regulators (6h): Pole placement design, Continuous-time self-tuners, Direct self-tuning regulators;
Minimum-variance and moving average controllers, stochastics self-tuning regulators, Linear quadratic self-tuning regulator, Adaptative predictive control.

Model Reference Adaptive Control (8h): Simple direct model reference adaptive control (MRAC) schemes, MRAC for SISO plants, Direct MRAC with unnormalized and normalized adaptive laws, Indirect MRAC with unnormalized and normalized adaptive laws, Adaptive laws with projection.

Auto Tuning and Gain Scheduling (4 h): Auto tuning of PID controllers, Design of gain scheduling controllers

Robust Adaptive Laws (5h): Plant uncertainties and robust control, Instability phenomena in Adaptive systems, Robust adaptive laws.

Robust Adaptive Control Schemes (4h)**:** Robust identifiers and adaptive observers, Robust MRAC, Robust adaptive pole placement control schemes

Perspectives on Adaptive Control (2h): Expert control systems, Learning systems, Future trends, Conclusion

Laboratory/practical/tutorial Modules: Not envisaged

3. Text books:

1. K. J. Astrom and B. Wittenmark, "Adaptive Control," Addison Wesley, 1995 (2e), Dover Publications, 2008 (2e rev.)

2. Petros A. Ioannou and Jing Sun, "Robust Adaptive Control," Dover Publications, NY, 2012

3. S. Sastry and M. Bodson, "Adaptive Control: Stability, Convergence and Robustness," Dover Publications, 2011

4. R. Isermann and M. Munchhof, "Identification of Dynamic Systems: An introduction with applications," Springer 2011

4. References: --

5. Similarity with the existing courses: No similarity

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

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

Not Applicable

Approvals:

Faculty interested in teaching this course: Dr. Akhilanand Pati Tiwari

Proposed by: Dr. Akhilanand Pati Tiwari **School:** SCEE

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on…**May 2, 2024**…and approved the proposal on… **May 3, 2024**.

Sl. No	Faculty Name	Signature
1.	Dr. Kaushik Halder	
2.	Dr. Narendra Kumar Dhar	
3.	Dr. Tushar Jain	

School Chair:

School: SCEE

Date:

This proposal is reported in ……..th Board of Academics on ……

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Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

EE 552 Power and Energy Systems

Credit **:** 3-1-0-4 **Approval**: Approved in 6th Senate

Prerequisites **:** EE 201 Electromechanics or Instructors consent

Students intended for **:** UG **Semester** **:** Even

Elective or Compulsory: Compulsory for EE, Elective for CSE/ME

Preamble:

The basic objective of this course is to provide a comprehensive introduction on Power Systems, incorporating issues on supply, generation, transmission, distribution, reliability and stability, economics, demand management and renewable energy in the grid & "Smart Grids".

Course Outline:

The objective of the course is to provide the first detailed treatment of fundamental understanding and operation of the power systems. Beginning with the basic terms, concepts and power system components representations, the course will present power generation technologies and power delivery systems. Students will be introduced about fault analysis, integrated economic operation of power systems with reliability and stability. Introduction to new developments in power system operation and control by restructuring of power systems and smart grid will be discussed.

Course Modules:

Introduction to power systems and its structure: Generation, transmission and distribution, substation arrangements. (2 lectures)

Representation of power system components: Generator, Transformers, Transmission lines, line parameters, transmission line design, interference of power lines with communication circuits, line insulators, power cables, per unit system. (10 lectures)

Network Analysis – Concepts of PV, PQ and Slack Bus, Load flow using NR Method, DC load flow, Economic load dispatch, unit commitment (12 Lectures)

Fault Analysis: Symmetrical components, symmetrical and unsymmetrical fault calculations, transient analysis (7 lectures)

Network Protection: relaying strategies, circuit breakers, numerical relays (5 lectures)

Power System Dynamics: stability, swing equation, equal area criterion, voltage and frequency control (10 lectures)

Energy systems: Solar photovoltaic, solar thermal, wind energy, energy storage (8 lectures)

Smart grid components: SCADA, Smart sensors, communication (2 lectures)

Text Books:

1. J. J. Grainger and W. D. Stevenson, “Power System Analysis”, Tata McGraw Hill.
2. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, Tata McGraw Hill.
3. A. J. Wood and B. F. Wollenberg, “Power Generation, Operation and Control,” 2nd Edition, Wiley-Blackwell.
4. S. Jha, S. Sen, R. Kumar and D. P. Kothari, “Smart Grid- Fundamental and Applications,” New Age International.

IIT Mandi
Proposal for a New Course

Course number : EE553
Course Name : Foundations of Intelligent Communication Systems-I
Credit : 4
Distribution : 3-*0-2-4*
Intended for : MTech/MTech (R)/ PhD students of the SCEE.
Prerequisite : IC 111 Linear Algebra, IC 260 or equivalent
Mutual Exclusion: (EE522, CS512, MA512, MA525, MA551, or equivalent.)

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1. Preamble:

Signal representation, time invariant systems along with the fundamentals of matrix theory and linear optimization has found application in several disciplines of engineering, such as, electrical, electronics, computer science, mechanical, structural engineering, etc. As various branches of engineering deal with linear systems, whose signals can be expressed using vectors and matrices, hence knowledge of such a course is must for modern engineers. Though due to advances in computation technology large linear systems can be solved within reasonable time limit, but some insights from the course, in many cases, can reduce the computational task significantly.

2. Course Modules with quantitative lecture hours:

- *Module-I* *(9 hours)*
  Signal Space Representation: Lowpass representation of bandpass signals, vector spaces, signal space concepts, subspaces, linear dependence/ independence, basis and dimension, sampling and reconstruction, inner product, orthogonal expansion of signals, orthogonal matrices, four fundamental subspaces.

- *Module-II* *(9 hours)*
  Linear Time-Invariant Systems: Response, properties, eigenfunctions of a continuous-time and discrete-time linear time-invariant systems. Systems described by the differential equations and the difference equations. State-space analysis. Applications: Principle of Orthogonality, least squares problem, state space representation of continuous-time and discrete-time LTI systems.

- *Module-III* *(12 hours)*
  Inner product spaces: Determinants, Eigenvalues and Eigenvectors, Positive definite and semidefinite matrices, Inner product and Lp - norms; Singular Value Decomposition/ QR/ Schur & Principal Component Analysis, Pseudo-inverse of a full row/column-rank matrix, generalized inverse for a matrix which is non-singular and not a full full row/ column-rank. Applications: Best k-Rank approximation and matrix compression, fitting and linear regression problem; solving underdetermined/ overdetermined systems of linear equations.

- *Module-IV* *(12 hours)*
  Optimization Methods: Optimization framework description, linear and quadratic optimization problems, Lagrange dual function, geometric interpretation, and its

applications; solving underdetermined/ overdetermined systems of linear equations with additional constraints like sparsity and regularization, etc.

Laboratory/practical/tutorial Modules:
The two-hours of lab session per week will enhance the understanding of the concepts taught in the class. The lab will cover the concepts including principle of orthogonality, least Squares, SVD, low-rank matrix decompositions and its applications in the modern systems.

3. Text books:

- Deisenroth, M. P., Faisal, A. A., Ong, C. S., *Mathematics for Machine Learning*. Cambridge University Press (2020).
- Strang, G., *Linear Algebra and Learning from Data*, Wellesley-Cambridge Press (2019)
- J. G. Proakis and M. Salehi, *Fundamentals of Communication Systems*, Prentice Hall, December 2004.

4. References:

- Friedberg, S.H., A Insel, A.J.,A Spence, L.E., Linear Algebra, Pearson Education (2014)
- Boyd, S., & Vandenberghe, L., Convex optimization, Cambridge university press (2004).
- Alan V. Oppenheim, Ronald W. Schafer., Discrete-time signal processing, Pearson Education (2010).

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.	EE522, CS512	Vector spaces, Subspaces, EVD/ SVD.	<20%
2.	MA512	Parts of modules II & III	<25%
3.	MA525	Parts of module IV	<20%
4.	MA551	Parts of module II	<15%
5.	EE304	Parts of module I	<10%

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

The course is an advanced-level course for SCEE PG students in communications, signal processing, networks, photonics and related streams. The PG students must be thorough with their UG courses like linear algebra, statistics, signals & systems, digital signal processing, etc., and understand their interlinkage. Moreover, learning advanced courses like matrix theory, applied optimization, advanced communication theory, advanced wireless and computer networks, etc., requires more credits/courses. Given the time-bound nature of the PG programs, doing many credits/courses is invaluable, often not needed, for the PG students. Considering the importance and breadth of the topics that need to be covered to provide such a comprehensive view, it is understandable that one course cannot accommodate all these topics. Therefore, we propose two courses, Foundations of Intelligent Communication Systems-I and II, by grouping the syllabus based on their prerequisites, difficulty level and coherency. The course will provide a seamless transition for the admitted SCEE PG students.

Approvals: Strongly recommended and approved by the committee members.

Faculty interested in teaching this course: –
Dr. Adarsh Patel, Dr. Satyajit Thakor, Dr. Siddhartha Sarma, & Dr. Sreelakshmi PM.

Proposed by: DCC chair, Dr. Adarsh Patel **School:** SCEE

Signature: **Date:** 06/05/24

The following faculty (at least 3 faculty) discussed on__03/05/24__and approved the proposal on__06/05/24.

Sl. No	Faculty Name	Signature
1	Dr. Adarsh Patel	
2	Dr. Satyajit Thakor	
3	Dr. Siddhartha Sarma	
4	Dr. Sreelakshmi PM	

School Chair:

School: SCEE

Date:

This proposal is reported in ……..th Board of Academics on ……

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Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : **EE-554**
Course Name : **Low Power VLSI Design**
Credit Distribution : *(format: 3-0-0-3, replace with relevant numbers)*
Intended for : B. Tech in Engineering (EE), Microelectronics and VLSI, M. Tech in Microelectronics and VLSI Design, MS, M. Tech. & PhD
Prerequisite : **Digital System Design (EE210)**
Mutual Exclusion : **None** (*courses with high similarity not allowed to credit by the students after or along with this course, if not relevant courses write* 'None')

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1. **Preamble:** The everlasting demand for delivering low-power circuits and systems has motivated the need for a focused study on low-power VLSI design. With the proliferating growth in terms of the complexity of integrated circuits, power consumption has emerged as a prerogative and vital metric in the design of integrated circuits and systems. The course aims at design and development of low power integrated circuits, with the challenge of power reduction being aimed at various levels including algorithmic, architectural, logic, and transistor levels.

(Maximum of 100-120 words) All the text will be in Times New Roman, 12 pt, single spacing, and emphasis can be made through bold/Italics, No different fonts or sizes allowed)

2. **Course Modules with quantitative lecture hours:**
    1. **Introduction to low power design**: Components of power dissipation of VLSI circuits. **(2 Hours)**
    2. **Circuit techniques for Low Power Design**: Standby leakage control using transistor stacks, multi-threshold and dynamic threshold techniques, supply voltage scaling technique. (**4 Hours)**
    3. **Low power low voltage arithmetic circuits:** Low power adder architectures – ripple carry adder, carry look-ahead adder, carry select adder, carry save adder, carry skip adder, current mode adder using multi-valued logic, residue adders, low power multiplier architectures- serial multiplier, parallel multiplier, serial-parallel multiplier, Braun multiplier, Baugh Wooley multiplier, Booth multiplier, Wallace tree multiplier. (**10 Hours)**
    4. **Low power low voltage memories**: Read only and random access memories. Power reduction of read only and random access memories at architectural, logic, and transistor levels. (**8 Hours)**
    5. **Transforms for low power VLSI circuits:** Behavioral level transform, algorithm and architecture level transform, negative differences, sorted recursive differences, shared multiplier based voltage scaling operation, architecture driven voltage scaling,

power reduction using operation reduction and operation substitution. **(9 Hours)**

6. **Multiple and Dynamic supply voltage design:** Multiple supply voltage design, dynamic supply voltage design, rate of change of supply voltages, power supply network, variation of the clock speed. **(6 Hours)**

7. **Low power multi-core architectures**: Notion of multi-cores, hardware and software techniques for power reduction in multi-core architectures**.** **(3 Hours)**

Laboratory/practical/tutorial Modules: None

3. Text books:

***(Relevant and Latest, Only 2*)**

1. K.S. Yeo, K. Roy, "Low Voltage Low Power VLSI Systems", McGraw Hill, 2013.
2. A. Pal, "Low power VLSI design", McGraw Hill, 2014.

4. References:

1. J. M. Rabaey and M. Pedram, Eds., *Low Power Design Methodologies*, Boston: Kluwer Academic Publishers, 1996.
2. B. Parhami, Computer Arithmetic: Algorithms and Hardware Designs (2e). USA: Oxford University Press, Inc., 2010
3. I. Koren, Computer Arithmetic Algorithms, CRC Press, 2001.

(*No limit on numbers, relevant standard format can be followed, the formats should be similar)*

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.	Digital MOS LSI Circuits	EE524	RAM, Memory, RCA	< 10%

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

Approvals:

Faculty interested in teaching this course: – Dr. B. Srinivasu, Dr. Rahul Shrestha, Dr. Shubhajit Roy Chaudhury, Dr. Hitesh Shrimali.

Proposed by: Dr. B. Srinivasu **School: SCEE**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature
1.	Dr. Hitesh Shrimali	
	Dr. Gopi Shrikanth Reddy	
	Dr. Shubhajit Roy Chaudhury	
	Dr. Rahul Shrestha	
	Dr. Kunal Ghosh	

School Chair:

School:

Date:

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Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : **EE-555**
Course Name : Intelligent Control System
Credit Distribution : ***3-0-0-3***
Intended for : B.Tech. EE (3rd and 4th year), M.Tech., M.Tech. (R), PhD
Prerequisite : For B.Tech. – Control System or equivalent course; For all – Linear Algebra
Mutual Exclusion : None

1. Preamble:

Control systems are decision-making systems that are designed to provide autonomy to dynamic systems, such as power plants, chemical processes, aerospace, and robotic systems. With technological advancement, there is an urgent need to design control systems that are able to maintain acceptable performance levels under significant unanticipated uncertainties. Recent advances in intelligent control methodologies have enabled us to address this issue better. Different intelligent control paradigms have been developed emulating certain characteristics of intelligent biological systems.

This course will provide students an exposure to intelligent control methodologies and applications. It will offer an introduction to computational intelligence techniques, such as neural networks, fuzzy logic, evolutionary computation, and machine learning, and their integration with automatic control design to develop intelligent controllers.

2. Course Modules with quantitative lecture hours:

Nonlinear Control - Primer: Norms, Sign-definiteness, State-space model, Lyapunov stability theory, Discrete-time systems, Nonlinear control strategies.

(4 Hours)

Neural Network: Feed-forward networks, Multi-layered neural networks, Radial-Basis function networks, Feedback networks, System identification using neural network

(6 Hours)

Fuzzy Logic: Classical sets, Fuzzy sets, Approximate reasoning, Fuzzy logic control, System identification using Fuzzy models

(6 Hours)

Indirect Adaptive Control using Neural Networks: Continuous-time affine systems, Discrete-time affine systems, Discrete-time non-affine systems

(6 Hours)

Direct Adaptive Control using Neural Networks: Direct Adaptive control, Single-input single-output affine systems, Multi-input multi-output systems, Backstepping control

(6 Hours)

Reinforcement Learning (Approximate Dynamic Programming): Linear quadratic regulator, HJB formulation, HJB for affine systems, Heuristic and Dual heuristic dynamic programming, Single network adaptive critic, Continuous-time adaptive critic

(8 Hours)

Intelligent Control of Benchmark Systems: Pendulum on cart, Mobile robot, Robot manipulator, HVAC system

(6 Hours)

Laboratory/practical/tutorial Modules: None

3. Text books:

***(Latest, Only 2*)**

1. Ali Zilouchian and Mo Jamshidi, *Intelligent Control Systems using Soft Computing Methodologies*, CRC Press.
2. Dusko Katic and Miomir Vukobratovic, *Intelligent Control of Robotic Systems*, Springer.
3. Laxmidhar Behera and Indrani Kar, *Intelligent Systems and Control: Principles and Applications*, Oxford University Press.

4. References:

1. Thrisantha Nanayakkara, Ferat Sahin, and Mo Jamshidi, *Intelligent Control Systems with an Introduction to System of Systems Engineering*, CRC Press.

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.	NA	NA	NA	NA

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

None

Approvals:

Faculty interested in teaching this course: –
Narendra Kumar Dhar

Proposed by: Narendra Kumar Dhar **School:** SCEE

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on 02-05-2024 and approved the proposal on course “Network Control System”.

Sl. No	Faculty Name	Signature
1	Dr. A.P. Tiwari	
2	Dr. Tushar Jain	
3	Dr. Kaushik Halder	

School Chair:

School:

Date:

This proposal is reported in ……..the Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : EE556

Course Name : Nuclear Reactor Control

Credit Distribution : 1-0-0-1 **(*L-T-P-C*)**

Intended for : UG (3rd year and final year) and PG students

Prerequisite : Differential Equations, Laplace Transform, Elementary Matrix Algebra

Mutual Exclusion : None

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1. Preamble:

Nuclear reactor is a complex nonlinear system used typically in a nuclear power plant (NPP) for production of electricity. There are about 450 nuclear reactors in the world and 23 in India. The different aspects of nuclear reactors, e.g., reactor physics, reactor engineering, reactor thermal hydraulics, reactor instrumentation and control, and reactor safety are fully developed specialized subjects.

Recently there are initiatives at global and national levels to harness energy from renewable/green sources, at a much larger scale. Several Small Modular Reactor (SMR) designs are emerging. India has plans for constructing huge number of reactors in the coming few decades. Therefore, there is a renewed interest in the subject of NPP design, operation and control. The proposed course is fully justified in the present context and may be expanded in future as a one semester course of 42 hours (approx..).

The objective of the proposed course is to impart basic knowledge in the area of nuclear reactor control. It will familiarize the inquisitive minds with nuclear reactors and create interest for higher study in this specialized field.

2. Course Modules with quantitative lecture hours:

Introduction (1h)**:** India's nuclear energy scenario, Nuclear Power Plants (NPP)

Schematic, Components of a NPP, Nuclear Reactor types and applications

Selected Topics from Reactor Physics (3h)**:** Interactions of neutron with nuclei (matter), Nuclear Reaction Cross—sections, Mechanism of nuclear fission, Nuclear fission reactions, Energy released in fission;

Prompt and delayed neutrons, Multiplication factor, Four factor formula, Non-leakage probability;

The one – speed neutron diffusion equation, General solution of one – speed neutron diffusion equation; Reactor criticality condition for parallelopiped and cylindrical geometries, Effect of reflector.

Nuclear Reactor Kinetics (2h)**:** Derivation of point kinetics model from one speed neutron diffusion equation;

Solution of point kinetics model for step change in reactivity, reactor period, In-hour equation, Interpretation of reactor shut-down and trip.

Reactor as a Control Element (2h)**:** Linearization of point kinetics model and representation into standard state-space form, transfer function, Reactor stability, Controllability and Observability.

Reactor Dynamics Studies (3h)**:** Modeling of Internal feedback effects due to changes in fuel, coolant and Moderator temperatures**;**

Modeling of Internal feedback effect due to fission product xenon; xenon spatial instability**;**

Modeling of Internal feedback effect due to fission product samarium; Issues in modeling and control of large reactors.

Reactor Instrumentation (1h)**:** Methods of neutron flux measurement; n, log n, dn/dt and d(logn)/dt signals for reactor control, Thermal power measurement; Power correction; Flux mapping.

Miscellaneous Topics (2h)**:** Examples of typical reactor power control systems**;** Reactivity estimation – Inverse point kinetics method, Kalman Filter method.

Laboratory/practical/tutorial Modules: Not envisaged

3. Text books:

1. James J. Duderstadt and Louis J. Hamilton, "Nuclear Reactor Analysis," Wiley, 1976

2. L. E. Weaver, "Reactor Dynamics and Control: State Space Techniques," American Elsevier Publishing Company, 1968

4. References:

1. A. P. Tiwari, et. al. “Modelling and Spatial Control of 540 MWe Pressurized Heavy Water Reactor,”Trans. INAE, Vol. 6, pp. 731–753, Sept. 2021.

2. P.V. Surjagade, et. al. “Robust Optimal Integral Sliding Mode Controller for Total Power Control of Large PHWRs,” IEEE Trans. Nucl. Sci., Vol. 65, Issue 7, pp. 1331-1344, 2018.

3. C. S. Subudhi, et. al., “A mathematical model for total power control loop of large PHWRs,” IEEE Trans. Nucl. Sci., vol. 63, no. 3, pp. 1901–1911, June 2016.

4. Patel SB, Mukhopadhyay S, Tiwari A (2018) Estimation of reactivity and delayed neutron precursors’ concentrations using a multiscale extended kalman filter. Ann Nucl Energy 111:666–675

5. Bhatt TU, Patel SB, Tiwari AP (2019) Reactivity and delayed neutron precursors’ concentration estimation based on recursive nonlin- ear dynamic data reconciliation technique. IEEE Trans Nucl Sci 66(2):541–548

6. Mishra AK, Shimjith SR, Bhatt TU, Tiwari AP (2014) Kalman filter- based dynamic compensator for vanadium self powered neutron detectors. IEEE Trans Nucl Sci 61(3):1360–1368

7. M. G. Na, I. J. Hwang, and Y. J. Lee, “Design of a fuzzy model predic- tive power controller for pressurized water reactors,” *IEEE Transactions on Nuclear Science*, vol. 53, no. 3, pp. 1504–1514, June 2006.

8. R. N. Banavar and U. V. Deshpande, “Robust controller design for a nuclear power plant using h-infinity optimization,” *IEEE Transactions on Nuclear Science*, vol. 45, no. 2, pp. 129–140, Apr 1998.

9. H. Eliasi, M. Menhaj, and H. Davilu,“Robust nonlinear model predictive control for a PWR nuclear power plant,” *Progress in Nuclear Energy*, vol. 54, no. 1, pp. 177 – 185, 2012.

5. Similarity with the existing courses: No similarity

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

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

Not Applicable

Approvals:

Faculty interested in teaching this course: Dr. Akhilanand Pati Tiwari

Proposed by: Dr. Akhilanand Pati Tiwari **School:** SCEE

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on…**May 2, 2024**…and approved the proposal on… **May 3, 2024**.

Sl. No	Faculty Name	Signature
1.	Dr. Kaushik Halder	
2.	Dr. Narendra Kumar Dhar	
3.	Dr. Tushar Jain	

School Chair:

School: SCEE

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Proposal to revise an existing course

Course number : EE570

Course Name : Advanced Communication Theory

Credit : 4

Distribution : 3-*0-2-4*

Intended for : BTech/MTech/MTech (R)/ PhD students of the SCEE.

Prerequisite : IC210: Probability, Statistics and Random Processes, EE 304: Communication Theory or the instructor's consent

Mutual Exclusion: none so far

Preamble:

Advance communication theory is an advance level course which builds on top of the core course Communication Theory (EE304). The primary objective of this course is to demonstrate to the students how practical and complex communication concepts/technologies are built on top of their learnings from the communication theory course. The course aims to provide the students an understanding of the advance concepts and techniques used in the design, performance analysis, and implementation of current communication systems. Therefore, the course will serve an important role in the development of the communication systems of the future. Also, this course will aid the Wireless Communications course to provide more in-depth treatment of various advanced concepts (such as fading, MIMO, STBC, etc).

Course modules:

1. *Module I* (12 contact hours)
   Digital modulation schemes: Bandpass and lowpass signal representation, Digital modulation schemes (PAM, PM, QAM, Multidimensional Signals, CPFSK, CPM) and their corresponding optimal receivers and error probabilities for AWGN Channel.
2. Module II (8 contact hours)
   Carrier and Symbol Synchronization: Importance in signal demodulation, carrier frequency and phase estimation – decision directed and power of N methods, timing estimation - spectral-line, MMSE, and ML methods, joint carrier and symbol synchronization.
3. *Module III* (12 contact hours)
   Equalization: Optimal zero-forcing equalization, Linear, Decision-feedback, Adaptive Linear, Adaptive Decision-feedback, and Blind equalization.
4. *Module IV* (8 contact hours)
   Multichannel and Multicarrier Systems: Wireless & AWGN multi-channels, Multicarrier communications: OFDM – modulation and demodulation, spectral characteristics, bit and power allocation, channel.
5. *Module V* (3 contact hours)
   Case Studies: A brief overview of modern communication/broadcast technologies.

Text Books:

1. J. G. Proakis and M. Salehi, Digital Communications, 5/e, McGraw-Hill, Prentice Hall, 2007.
2. R. G. Gallager, Principles of Digital Communication, Cambridge Univ. Press, 2008.

Reference Books:

1. B. Sklar, Digital Communications: Fundamentals and Applications, 2/e, Prentice Hall, 2001.
2. John R. Barry, David G. Messerschmitt, and Edward A. Lee, *Digital Communication: Third Edition*. Kluwer Academic Publishers, 2003.
3. A. Lapidoth, A Foundation in Digital Communication, Cambridge Univ. Press, 2009.
4. Simon Haykin, *Digital Communications*. Wiley Publishing, 2006.

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.	EE641, EE517, EE304	Portions of module I	<10%

Justification of revision for the existing course:

To obtain a comprehensive view of communication theory and its applications, undergraduate students should not only learn the principles of modern digital communications, they should also be aware of the historical development that led to the digital communications, 5G/ 6G era. Considering the breadth of the topics that need to be covered to provide such a comprehensive view, it is understandable that all these topics cannot be accommodated in a UG level course. Therefore, the second course was proposed and now revised, namely Communication theory and Advanced Communication theory by grouping the topics based on their prerequisites, difficulty level and coherency over the topics. Advance communication theory is an advance level course which builds on top of the core course Communication Theory (EE304). The primary objective of this course is to demonstrate to the students how practical and complex communication concepts/technologies are built on top of their learnings from the communication theory course.

Approvals: Strongly recommended and approved by the committee members.

Faculty interested in teaching this course: –

Dr. Samar, Dr. Satyajit Thakor, Dr. Siddhartha Sarma & Dr. Adarsh Patel.

Proposed by: DCC chair, Dr. Adarsh Patel **School:** SCEE

Signature: **Date:** 08/05/24

The following faculty (at least 3 faculty) discussed on__03/05/24__and approved the proposal on__08/05/24.

Sl. No	Faculty Name	Signature
1	Dr. Adarsh Patel	
2	Dr. Satyajit Thakor	
3	Dr. Siddhartha Sarma	

School Chair:

School: SCEE

Date: 08/05/24

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a revision of an existing course

Course Number : EE571

Course Name: Digital Signal Processing

Distribution: 3-0-2-4

Intended for: B.Tech. 2nd, 3rd year students

Prerequisites: EEXXX (Signals & Systems)

Mutual Exclusion: None

Preamble: This is an introductory course in discrete-time signal processing. The primary objective of this course is to introduce the students to time and frequency domain analysis of discrete-time signals and applications of these techniques in designing various linear time-invariant discrete-time systems. This course will also serve as a prerequisite for advanced courses on signal processing, e.g., Image processing, advanced signal processing and speech processing. The theory sessions must be accompanied by the corresponding lab sessions where students will learn how to visualize discrete-time signals in both time and frequency domains as well as the implementations of various DSP algorithms in Python or MATLAB.

Course modules:

Unit 1: Review of discrete-time signals and systems (4 hours)

LTI systems and their properties, impulse response and convolution, Difference equations, Eigen-functions of LTI systems

Unit 2: Fourier and Z-transforms (10 hours)

Discrete-time Fourier transform and its properties; Z-transform and its properties; Discrete Fourier Transform and its properties; Fast Fourier Transform

Unit 3: Sampling (8 hours)

Time domain and frequency domain representation, Nyquist theorem, Signal reconstruction, Discrete-time processing of continuous-time signals, Continuous-time processing of discrete-time signals, Changing the sampling rate, Multi-rate signal processing, Sub-Nyquist sampling and its applications

Unit 4: Filtering (10 hours)

Discrete-time frequency selective filtering, Phase distortion and delay, Characterization with difference equations, Stability and Causality, Frequency response of rational system functions, All pass and minimum phase systems, Basics of filter design, Z-transform

characterization of IIR filters, Window functions for FIR filters, Filter structures for IIR and FIR filters,

Unit 5: Introduction to wavelets and their applications (10 hours)

Haar expansions, Wavelets in continuous time, Discrete Wavelet Transform using Haar basis, Construction of wavelets using Fourier techniques, Multiresolution analysis and construction of the wavelet.

Lab: The exercises/projects should cover various real-world applications of DSP. A few suggested topics: image processing and compression; Speech processing; Compressed sensing; Signal processing in communication systems

Text Books:

1. Alan V. Oppenheim, Ronald W. Schafer, John R. Buck., "Discrete-Time Signal Processing," Second edition, Pearson, 1999.
2. Martin Vetterli, Jelena Kovacevic and Vivek Goyal, "Fourier and Wavelet Signal Processing", Cambridge University Press, 2014

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis., "Digital Signal Processing – Principles, Algorithms, and Applications," Fourth Edition, Pearson 2007.
2. Stephen Mallat, A Wavelet Tour of Signal Processing The Sparse Way, Elsevier, 2009

5. Similarity with the existing courses:

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

This is a core course for undergraduate students in electrical engineering stream and also revision of an existing course.

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

Not applicable

Approvals:

Faculty interested in teaching this course: Siddhartha Sarma, Arnav Bhavsar, Sneha Singh

Proposed by: Siddhartha Sarma, Arnav Bhavsar School: SCEE

Signature: Date: 3 May 24

The following faculty (at least 3 faculty) discussed on **2 May 24** and approved the proposal on **3 May 24**.

Sl. No	Faculty Name	Signature
1	Arnav Bhavsar	
2	Siddhartha Sarma	
3	Sneha Singh	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

IIT Mandi
Proposal for a New Course

Course number	**: EE-574**
Course Name	**: Biomedical Signal and Image Analysis**
Credit Distribution	*: (format: 3-0-0) 3-credits*
Intended for	**: Open Elective for All 3rd/4th year (odd-sem) BTech/MTech/MS/MSc/MA/Ph.D.**
Prerequisite	**: None**
Mutual Exclusion	: None

1. Preamble:

This course aims to motivate students to explore different techniques of analyzing biomedical signals and images, in the time and frequency domain with particular emphasis on problems in biomedical research and clinical medicine. This course will make students understand the fundamental principles of signal and image acquisition, filtering, coding, feature extraction, and modeling. topics related to various types, sources, and characteristics of noise and artifacts present in biosignals and finding the best possible filters designed in time/frequency domains to remove those noises. Also, it will cover the vision-based methodologies for computational analysis of multidisciplinary biomedical images for clinical applications. This would serve as a fundamental but detailed course for students and scholars working in the area of biomedical data processing as well as vision computing.

2. Course Modules with quantitative lecture hours:

i. Unit/Topic 1: Introduction to fundamental concepts **(4 Hours)**

Subtopics: Signal processing overview; Fundamental signals (1-D and 2-D); Classification of systems; Characteristics of linear and non-linear systems, Concepts of convolution and Autocorrelation. Frequency analysis: Fourier Transform, DTFT, FFT, Welch's method; Data Acquisition: Sampling in time, aliasing, interpolation, and quantization. Introduction to random variables and probability density functions (PDFs). Stationary and Nonstationary Processes.

ii. Unit/Topic 2: Electrophysiology and Electrographic modalities **(6 Hours)**

Subtopics: Electric properties of a cell: Ion transport, transmembrane potential, membrane resistance and capacitance, action potential, Hodgkin-Huxley model. Electric data acquisition and biomedical electrodes. ECG: Function and structure of heart, cardiac muscle and excitation process, origin of ECG, ECG electrode placement, noise sources, Modeling and representation of ECG, ECG and cardiovascular diseases. EEG: Neuron, scalp potentials, EEG recording systems, EEG rhythms, Evoked potentials, EEG artifacts, Disease of CNS and EEG. EMG: Muscle, motor unit, muscle contraction, muscle force, noise in EMG, Neuromuscular disease and EMG

iii. Unit/Topic 3: Biosignal processing **(10 Hours)**

Subtopics: Feature extraction methods: Frequency domain (PSD, dominant frequency, spectral entropy), Nonlinear features (Lyapunov exponents, fractal dimensions, complexity and mobility measures), entropy-based measures, cross-correlation and coherence, phase-based features (phase synchronization, phase coherence, phase-amplitude coupling), time-frequency methods (short-time Fourier Transform, Wigner-Ville distribution, Morlet Wavelets), connectivity analysis (graph theoretic measures, synchronization measures, Granger causality). Noise Removal: Removal of linear and nonlinear trends, Filtering techniques active and passive filters; Design of digital filters. Generalized Eigen Decomposition (GED) for denoising, Empirical mode decomposition (EMD), and blind source

separation (PCA, ICA).

iv. Unit/Topic 4: Introduction to Medical Images **(8 Hours)**

Subtopics: Imaging Modalities: introduction of major modalities for medical imaging: ultrasound, X-ray, CT, MRI, PET, and SPECT. Image formation and tissue energy interaction as a basis for different imaging modalities, quantitative medicine, multi-scale and multi-resolution relations in medical diagnostics, Cardiovascular and Neuro Imaging and Analysis. Automated Image Quality Assessment in Medical Images.

v. Unit/Topic 5: Statistical and Structural Analysis **(8 Hours)**

Subtopics: Statistical and structural classification, morphological and topological component analysis. Rigid and non-rigid transformations. Co-registration of images, and motion correction. Extension of filtering and Fourier methods to 2-D signals and systems. Noise reduction methods, optimal and adaptive filters, homomorphic filtering, edge detection, time-frequency, and fractal analysis. Bayesian graphical modeling and inference for image restoration.

vi. Unit/Topic 6: Pattern Analysis **(6 Hours)**

Subtopics: Pattern classification and diagnostic decision–Measures of diagnostic accuracy. Abnormality detection and pattern recognition in cardiac, brain, and abdominal images, image categorization, and computer-aided diagnosis. Image descriptors, Image similarity, rendering surfaces and volumes, 3D neurostructure analysis, hypothesis testing, and prediction modeling. Deep learning for medical images.

Laboratory/practical/tutorial Modules: There shall be practical demonstration of certain fundamental algorithms of data processing and its analysis that shall be explained in computational modeling fashion. This shall be conducted in the form of minor projects and analyzing real problems in clinical practice to aid theoretical concepts.

2. Text books (any one) :

a) John L. Semmlow, "Biosignal and Biomedical Image Processing: MATLAB Based Applications", CRC press.

3. References:

a) Rangayyan R M, "Biomedical Image Analysis", Fifth Edition, CRC Press, 2005

b) Medical Image Analysis, second edition, by Atam Dhawan, WILEYISBN: 978-0-470-62205- 6.

c) Reddy, D.C., 2005. Biomedical signal processing: principles and techniques. McGraw-Hill

d) Gonzalez, R., and R. E. Woods. Digital Image Processing. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 2002. ISBN: 9780201180756.

e) E.N. Bruce, Biomedical Signal Processing and Signal Modelling, John Wiley and Sons, 2001.

a. 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.	Digital Signal Processing	EE-305	2-3 lectures	5-10%
2.	Digital Image Processing	EE-608	2-3 lectures	5-10%
3.	Medical Imaging and Applications	EE-XXX	2-3 lectures	5%
4.	Introduction to Biosignals & Cognitive Markers	IK-502	2-3 lectures	5-10%

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

NA

Approvals:

Faculty interested in teaching this course: – Dr. Siddharth Panwar, Dr. Sneha Singh

Proposed by: Dr. Siddharth Panwar, Dr. Sneha Singh **School:** SCEE

Signature: **Date: 13/05/2024**

The following faculty (at least 3 faculty) discussed on May 6th, 7th, and 13th and approved the proposal on the 13th of May 2024.

Sl. No	Faculty Name	Signature
1.	Dr. Shubhajit Roy Chowdhury	Approval done. Mail attached.
2.	Dr. Arnav Bhavsar	
3.	Dr. Indu Joshi	Indu Joshi
4.	Dr. Dinesh Singh	

School Chair:

School: SCEE

Date: 14 MAY 2024

This proposal is reported to 54th Board of Academics on 14th May 2024

Dean Academics

Date:

Note: The school is responsible for the Course Code. The Academic Office provides the IC Course Code.

IIT Mandi

Proposal for a new course

Course number : **EE-575**
Course Name :**Applied statistics for data and signals**
L-T-P-C : **3-0-2-4**
Prerequisites : **EE304/ EE503/ EE305/ MA524 or equivalent**
Intended for : **B.Tech./M.S./M.Tech./Ph.D.**
Distribution : **Core for M.Tech., Elective for B.Tech. 3rd and 4th year, M.Tech (R), Ph.D.**

1.Preamble:

Estimation theory deals with methods for estimating unknown parameters from observed data and fitting data to models, while detection theory focuses on making decisions about the presence or absence of a signal or phenomenon in noisy data. These concepts are fundamental in fields like statistics, signal processing, communications, and machine learning. This course intends to provide fundamental theoretical ideas and techniques to develop and evaluate common frameworks to address a myriad of inferencing problems along with providing a foundation for building principled algorithms for solving a wide range of practical problems. Students will implement the ideas learnt in this course on real-world data.

2. Course Modules:

- Module 1: Mathematical background: [4 Lectures]
  – Probability measure space, sample space, σ-algebra, measure theory, random variables, CDF, PDF, joint, marginal and conditional PDFs, transformation of random variable, statistical averages, vector space, inner products, norms, metric, stochastic processes, stationarity, Gaussian process, white noise, stochastic processes through LTI systems.

- Module 2: Statistical Detection Theory: [15 Lectures]
  – Binary testing, Decision criteria: Neyman-Pearson Criterion, Bayes Criterion, Min-Max Criterion, receiver operating characteristics (ROC), M-ary decision, erasure decision Bayes risk detectors, sequential detection, Composite hypothesis testing: Bayesian and generalized likelihood ratio test (GLRT), locally most powerful (LMP) detectors, asymptotically equivalent tests.

- Module 3: Estimation for deterministic parameters: [11 Lectures]
  – Principle of estimation and its application, properties of estimators.

– Minimum Variance Unbiased Estimation: existence and search of MVU estimators, extension to vector parameters. Cramer-Rao Lower Bound: signals in white Gaussian noise, parameter transformation, vector parameters, general Gaussian case.
– Linear Models and Unbiased Estimators, scalar and vector Best Linear Unbiased Estimators (BLUE); Maximum Likelihood estimation, Least Squares estimation: linear, order-recursive, sequential , constrained , and nonlinear.

- Module 4: Estimation for random parameters: [6 Lectures]
  – Bayesian Estimation: Bayesian linear model, nuisance parameters. Bayesian estimation for deterministic parameters, risk functions, MMSE and MAP estimators, scalar, vector, and sequential Linear MMSE estimators, Wiener filtering.

- Module 5: Regression analysis [6 lectures]:
  – Simple linear regression, multiple linear regression, estimation and interpretation of regression coefficients, goodness of fit, confidence intervals and hypothesis testing for regression coefficients, generalized linear models.

Laboratory Modules: Data preprocessing, Density Estimation methods, feature vector selection, numerical integration methods, ROC

3. Textbooks:

1. S. M. Kay, Fundamentals of Statistical Signal Processing, Vol I: Estimation Theory, Prentice Hall , 1993.
2. H. L. van Trees, K. L. Bell, and Z. Tian, Detection, Estimation, and Modulation Theory, Part I: Detection, Estimation, and Filtering Theory, Wiley, 2013.

4. Reference books:

1. L. L. Scharf, Statistical Signal Processing: Detection, Estimation, and Time Series Analysis, Addison-Wesley, 1991.
2. H. Y. Poor, An Introduction to Signal Detection and Estimation, Springer-Verlag, 1994.
3. C. W. Helstrom, Elements of Signal Detection and Estimation, Prentice Hall, 1995.
4. G. Casella and R. L. Berger, Statistical Inference, Duxbury Press, 2002.
5. S. M. Kay, Fundamentals of Statistical Signal Processing, Vol 2: Detection
Theory, Prentice Hall, 1998.

5. Similarity with existing courses:

Sr. no	Course	Similarity Content	Approx. % of content
1	EE 304: Communication Theory	MAP and ML detectors	<10%
2	EE 503: Advanced communication theory	ML, MSE, and LS estimation	<10%
3	CS 669 Pattern Recognition	Bayes decision, ML and MAP estimation	<20%
4	CS 531	Bayes decision, ML and MAP estimation	<30%

6. Justification for new course:

The course is aimed at teaching classical statistical techniques that are not only relevant to traditional engineering disciplines but also serve as a theoretical foundation for the more recent machine learning methods. With the addition of a lab component and coding assignments this course aims to make this material present in the course more relevant to the students.

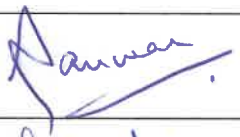
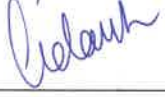
Approvals:

Faculty interested in teaching this course: – Dr.Siddharth Panwar, Dr. Adarsh Patel

Proposed by: Dr.Siddharth Panwar **School:** SCEE

Signature:  Date: 09/05/2024

The following faculty discussed and approved the proposal on 9th May 2024.

Sl. No	Faculty Name	Signature
1.	Dr. Siddharth Panwar	
2.	Dr. Adarsh Patel	

Inward No. 3929
14 MAY 2024
Academics Section

3.	Dr. Siddhartha Sarma	
4.	Dr. Satyajit Thakor	

School Chair:

School: SCEE

14 MAY 2024

Date: 09/05/24

This proposal is reported in_____ Board of Academics on _____

Dean

Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comment of reviewers:

IIT Mandi
Proposal for a New Course

Course number : EE581
Course Name : Foundations of Intelligent Communication Systems-II
Credit : 4
Distribution : 3-*0-2-4*
Intended for : MTech/MTech (R)/ PhD students of the SCEE.
Prerequisite : IC 210/ IC252 Probability, statistics, and random variables or equivalent.
Mutual Exclusion: (EE534, CS511, MA 511, MA521, MA524, MA568, MA 601, or equivalent.)

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1. Preamble:

Real analysis, probability, statistical detection/ estimation and queueing theory are a key to characterize and model system applications in several disciplines of engineering, such as, electrical, electronics, computer science, mechanical, structural engineering, etc. As various branches of engineering deal with probabilistic modelling of the linear systems, which can be expressed using random variable/ vectors/ matrices/ queue etc, knowledge of such a course is must for modern engineers. Though due to advances in computation technology, large linear systems can be solved using a reasonable probabilistic system modelling, but some insights from the course, in many cases, can closely resemble the modelled system and hence can reduce the computational task significantly.

2. Course Modules with quantitative lecture hours:

- *Module-I* (6 lectures)
  Analysis: The Real Number System, Euclidean Spaces, Metric Spaces, Closed and open sets.

- *Module-II* (8 lectures)
  Numerical sequences and series, convergence of sequences of numbers, Limits, Continuity of functions, Derivatives of functions, Integration (Riemann integration, Lebesgue integration, Riemann-Stieltjes, Lebesgue-Stieltjes).

- *Module-III* (11 lectures)
  Probability Theory: The axioms of probability theory, Independence and conditional probability, Random variables and their distribution, Expectation, Conditional distribution, Convergence of sequences of random variables, Laws of large numbers and Central limit theorem. General concepts of stochastic processes.

- *Module-IV* (11 lectures)
  Data driven/ Statistical detection and Estimation: Hypothesis testing, Optimal detectors, minimum variance unbiased estimation, mean squared estimation; filtering, and prediction, and Kalman filtering, parametric/ nonparametric distribution estimation, data driven detection and estimation.

- *Module-V* (6 lectures)
  Basics of Queueing theory: Introduction to Markov chains, Kendall's notation for queueing systems, M/M/1, M/M/m, M/M/infinity, M/M/m/m, M/G/1, G/G/1 queueing systems and applications.

Laboratory/practical/tutorial Modules:
The two-hours of lab session per week will enhance the understanding of the concepts taught in the class. The lab will cover the concepts including sets, sequence convergence, random variables, central limit theorem, detection, and estimation techniques for statistical and data driven scenarios.

3. Text books:

- Hajek, B., *Random Processes for Engineers*. Cambridge: Cambridge University Press (2015).
- S. M. Kay, *Fundamentals of Statistical Signal Processing, Vol - 1 & 2*, Pearson (20210).

4. References:

- Deisenroth, M. P., Faisal, A. A, Ong, C. S., *Mathematics for Machine Learning*, Cambridge University Press (2020).
- J. G. Proakis and M. Salehi, *Fundamentals of Communication Systems*, Prentice Hall, December 2004.
- Harry L. Van Trees, Kristine L. Bell, Zhi Tian, *Detection, Estimation, and Modulation Theory: Detection, Estimation, and Linear Modulation Theory*, Wiley (2013).
- Dimitri P. Bertsekas, and Robert G. Gallager, *Data Networks* (2nd Edition), Pearson Publication

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.	EE534	Parts of module III	<20 %
2.	CS511	Parts of modules I & III	<25%
3.	MA511, MA521, MA524, MA568, MA601	Parts of modules I & II	<20%
4.	CS549	Parts of module IV	<15%

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

The course is an advanced-level course for SCEE PG students in communications, signal processing, networks, photonics and related streams. The PG students must be thorough with their UG courses like linear algebra, statistics, signals & systems, digital signal processing, etc., and understand their interlinkage. Moreover, learning advanced courses like matrix theory, applied optimization, advanced communication theory, advanced wireless and computer networks, etc., requires more credits/courses. Given the time-bound nature of the PG programs, doing many credits/courses is invaluable, often not needed, for the PG

students. Considering the importance and breadth of the topics that need to be covered to provide such a comprehensive view, it is understandable that one course cannot accommodate all these topics. Therefore, we propose two courses, Foundations of Intelligent Communication Systems-I and II, by grouping the syllabus based on their prerequisites, difficulty level and coherency. The course will provide a seamless transition for the admitted SCEE PG students.

Approvals: Strongly recommended and approved by the committee members.

Faculty interested in teaching this course: –
Dr. Adarsh Patel, Dr. Satyajit Thakor, Dr. Siddhartha Sarma, & Dr. Sreelakshmi PM.

Proposed by: DCC chair, Dr. Adarsh Patel **School:** SCEE

Signature: **Date:** 06/05/24

The following faculty (at least 3 faculty) discussed on__03/05/24__and approved the proposal on__06/05/24.

Sl. No	Faculty Name	Signature
1	Dr. Adarsh Patel	
2	Dr. Satyajit Thakor	
3	Dr. Siddhartha Sarma	
4	Dr. Sreelakshmi PM	

School Chair:

School: SCEE

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

शैक्षणिक अनुभाग
Inward No. 3858
01 MAY 2024
Academics Section

Acad

IIT Mandi
Proposal for a New Course

Course number : IC 253
Course Name : Programming and Data Structures
Credit Distribution : 2-0-2-3
Intended for : B.tech (1st Yr)
Prerequisite : None
Mutual Exclusion : None

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1. **Preamble:** The proposed new curriculum for a CSE core course in the IC bucket. The proposed course follows the new CS curriculum design approach that strives to cover the fundamental concepts that a CS and DS undergraduate student must know. The course proposal attempts to include the fundamental topics in programming and data structures. The topics form the essential core of this course that must be covered comprehensively, with lots of examples, and practice exercises. Advanced topics in algorithm design and analysis are going to be covered in discipline electives.

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

Unit 1: Introduction: Review of problem-solving using computers; Importance of data structure and algorithms; Elementary data structures: array, linked lists, stack and queues; Abstract data Operations on elementary data structures; Time and space complexity of algorithms: asymptotic analysis and notation, average, and worst-case analysis. Subtopics **(3 Hours)**

Unit 2: Stack and Queues: Sequential and linked implementations, representative applications such as towers of Hanoi, and parenthesis matching. **(3 Hours)**

Unit 3: Lists: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, doubly linked lists, circular lists, skip lists, applications of lists in sparse tables. **(3 Hours)**

Unit 4: Trees: Abstract data type, sequential and linked implementations, tree traversal methods and algorithms, Binary trees and their properties. **(3 Hours)**

Unit 5: Search Trees: Binary search trees, search efficiency, insertion, and deletion

operations, the importance of balancing, AVL trees, searching, insertion, and deletions in AVL trees. **(4 Hours)**

Unit 6: Heaps: Heaps as priority queues, heap implementation, insertion-deletion operations, and heapsort. **(2 Hours)**

Unit 7: Graphs: Definition, terminology, directed and undirected graphs, properties, implementation – adjacency matrix and linked adjacency chains, connectivity in graphs, graph traversal – breadth first and depth first, spanning trees. **(3 Hours)**

Unit 8: Basic Algorithm Techniques: Greedy algorithms, divide & conquer. Search techniques - backtracking, Sorting algorithms with analysis, integer sorting, selection sort. Graph algorithms: DFS and BFS with applications, MST, and shortest paths. **(7 Hours)**

Laboratory/practical/tutorial Modules: Included with each Unit

3. Textbooks:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press, 3/e, 2009.

4. References:

1. S. Sahni, Data Structures, Algorithms, and Applications in C++, Silicon Press, 2/e, 2005.
2. A. M. Tenenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Prentice Hall, 2/e, 1995.

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Course Name	Similarity Content	Approx. % of Content
1.	CS 212	Design and Analysis of Algorithms	Hashing and Heap Concepts	<= 30%

6. Justification of new course proposal if cumulative similarity content is >30%: None

Indian Institute of Technology Mandi

Approvals:

Other Faculty interested in teaching this course: – Dr. Prateek Vishnoi

01/05/2024

Proposed by: Dr. Dinesh Singh **School:** SCEE

Signature: **Date:** 01/05/2024

Recommended/Not Recommended, with Comments:

Chairperson, CPC **Date:**_____

01 MAY 2024

Approved / Not Approved

Chairperson, BoA **Date:**_____

Indian Institute of Technology Mandi

IIT Mandi
Proposal for a New Course

Course number : HS307
Course Name : Macroeconomics I
Credit : 3 credits
Distribution : 3-0-0-3
Intended for : B. Tech./ Undergraduate students
Prerequisite : None
Mutual Exclusion: None

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1. Preamble:

The main objective of the course is to make students understand the way economy runs and the socio-economic conditions affect their decision making at macro level. The course will focus upon theoretical and empirical understanding of the economic theories and their application in Macroeconomics.

2. Course Modules with quantitative lecture hours:

Unit 1: Introduction (2 Lectures)

Nature and scope of Macroeconomics

Unit 2: National Income Accounting (5 Lectures)

National income: concepts and measurement || Circular flow of national income in two, three, and four-sector economy || National income and economic welfare

Unit 3: Money and Inflation (5 Lectures)

What is money? || The quantity theory of money || Inflation and interest rates || The nominal interest rate and the demand for money || Hyperinflation

Unit 4: Money supply and money demand (5 Lectures)

Money supply: 100-percent and fractional-reserve banking || A model of the money supply || Monetary policy approaches and its frameworks || Money demand: different theories of money demand

Unit 5: Consumption and investment theories (5 Lectures)

Consumption function || Keynes's psychological law of consumption and its implications || Consumption function puzzle: Kuznet's findings || Investment and its type || Investment determination: Classical and Keynesian approach

Unit 6: Economy in the short run (10 Lectures)

Introduction to economic fluctuations || Aggregate demand: the goods market and the IS curve, the money market and the LM curve || The short-run equilibrium

Unit 7: Introduction to the open economy (5 Lectures)

The international flows of capital and goods || Saving and investment in a small open economy || Exchange rates: nominal and real exchange rates || Economic polies and exchange rate

Uni 8: Introduction to macroeconomics datasets (5 Lectures)

This session aims at exploring macroeconomic databases and to empirically testify some of the economic theories in India context.

Laboratory/practical/tutorial Modules: NA

3. Text books:

1. Mankiw N. Gregory. *Macroeconomics"* Worth Publishers, 2023.
2. Froyen, R. T.. *Macroeconomics: theories and policies".* Pearson Publication, 2023.

4. References:

1. Mishkin, F. *"Economics of money, banking and financial market",* Pearson Publication, 2023.

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.	Principles of Economics	HS202	Some parts of National Income Accounting and Keynesian Models	10%

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

Approvals:

Faculty interested in teaching this course: Dr. Masudul Hasan Adil, Dr. Ramna Thakur, Dr. Shyamasree Dasgupta.

Proposed by: Masudul Hasan Adil, SoM.

School: School of Humanities and Social Sciences (Course is being proposed by SHSS)

Signature: **Date: 09/02/2024**

The following faculty (at least 3 faculty) discussed on 09/02/2024 and approved the proposal on 09/02/2024.

Sl. No	Faculty Name	Signature
	Dr. Masudul Hasan Adil	
	Dr. Ramna Thakur	
	Dr. Shyamasree Dasgupta	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi: Proposal for a New Course

Course Number: HS308
Course Name: Introduction to Modern European Literature
Credit: 2
Distribution: 2-0-0-2
Intended for: Undergraduate
Prerequisite: None

Mutual Exclusion: None

1. **Preamble:** This course introduces students to modern European literature by focusing on the analysis of a range of canonical 20th Century literary texts. It will start by presenting a brief outline of the political, social and cultural situation of Europe in the late 19th and early 20th century, as well as an overview of the literary context leading to the emergence of modernism. The overarching aim of the course is to provide students with an overview of 20th century European history, literature and philosophy, through the discussion of various narrative, dramatic and poetic works of literature.

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

Unit 1: Introduction (6 hours)
- Europe in the late 19th and early 20th centuries.
- Overview of preceding literary movements.
- Introduction to Literary theory and criticism

Unit 2: From Realism to Modernism (6 hours)
- Knut Hamsun, *Hunger*
- August Strindberg *The Dance of Death*
- James Joyce, *Dubliners*

Unit 3: High Modernism (6 hours)
- Gertrude Stein, *Tender Buttons*
- Franz Kafka, *The Metamorphosis*
- Virginia Woolf, "The Mark on the Wall"

Unit 4: (Post)Modernism (6 hours)
- Albert Camus, *The Stranger.*
- Jorge Luis Borges, *The Aleph*
- Eugene Ionesco, *The Bald Soprano*

Unit 5: Conclusions (4 hours): Modernism VS Postmodernism: what's at stake?
- The death of the Author
- The Postmodern Condition.

Primary Reference Books:
- *Norton Anthology of Literary Criticism and Theory*

- Modernism, Blackwell Anthology

Similarity with the existing courses:
This course has no similarity with 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
N/A	N/A	N/A	N/A

Justification of new course proposal if cumulative similarity content is >30%: N/A
Approvals:

Faculty interested in teaching this course: – SHSS/Visiting Faculty

Proposed by: Dr. Juan Luis Toribio Vazquez

School: School of Humanities and Social Sciences

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on _____ and approved the proposal on _____.
*The course syllabus was circulated with all faculty members of SHSS and approved thereafter.

Sl. No	Faculty Name	Signature
1	Dr Thirthankar Chakraborty	
2	Dr Neethi V. Alexander	
3		

School Chair
School: SHSS
Date:

Dean Academics
Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi: Proposal for a New Course

Course Number: HS 505
Course Name: Circularity in Modern European Literature
Credit: 3
Distribution: 3-0-0-3
Intended for: B.Tech
Prerequisite:

Mutual Exclusion: None

1. **Preamble:** This course introduces students to modern European literature and philosophy by focusing on the analysis of circularity in a range of canonical modernist and postmodernist works of literature. It begins by presenting a brief overview of the socioeconomic landscape of Europe in the 20th century, as well as an introduction to key concepts in literary theory such as 'narrative', 'story' and 'discourse', which are fundamental in the formal analysis of literary texts. It then discusses the necessary philosophical context to be able to examine the significance of circularity in the dramatic and prose narratives studied. The overarching aim of the course is to provide students with an overview of 20th-century European history, literature and philosophy, through the discussion of the concept of circularity, which has been fundamental in Eastern philosophies, but somewhat obscure in the modern Western world.

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

Unit 1: Introduction: Modern European Literature (8 hours)
- Europe in the late 19th and early 20th centuries.
- Key concepts in literary theory.
- The genealogy of linearity

Unit 2: Ouroboros: On the concept of Circularity (8 hours)
- Introduction to the concept of circularity in Western Philosophy.
- Overview of the philosophy of Friedrich Nietzsche

Unit 3: Circular Drama (10 hours)
- August Strindberg's *The Dance of Death*
- Eugene Ionesco's *The Bald Soprano*
- Samuel Beckett's *Waiting for Godot*
- Daniil Kharm's *Elizabeth Bam*

Unit 4: Circular Prose (10 hours)
- Daniil Kharms' *The Knife*
- Jorge Luis Borges' *The Circular Ruins*
- Cortázar *The Continuity of the Parks*
- Maurice Blanchot *The Madness of the Day.*

Primary Reference Books:

- *Circular Narratives in Modern European Literature*, Juan Luis Toribio Vazquez.
- *Nietzsche and Philosophy*, Arthur Danto

Similarity with the existing courses:
This course has no similarity with 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
N/A	N/A	N/A	N/A

Justification of new course proposal if cumulative similarity content is >30%: N/A
Approvals:

Faculty interested in teaching this course: – SHSS/Visiting Faculty

Proposed by: Juan Luis Toribio Vazquez and Thirthankar Chakraborty

School: School of Humanities and Social Sciences

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on _____ and approved the proposal on _____.
*The course syllabus was circulated with all faculty members of SHSS and approved thereafter.

Sl. No	Faculty Name	Signature
1	Dr Neethi V. Alexander	
2	Dr Suman Sigroha	
3	Dr Neha Kausheek	

School Chair
School: SHSS
Date:

Dean Academics
Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course Number: HS 506
Course Name: Population Studies: Theory and Basic Analysis
Credit: 3
Distribution: *3-0-0-3*
Intended for: M.A. (Development Studies) (Discipline Elective) and B.Tech. 3rd and 4th year
Prerequisite: None
Mutual Exclusion: None

Preamble:

The course is designed to acquaint students with various concepts of population science and demography, it's working and trends in recent years. It undertakes a detailed study of population indicators such as fertility and mortality rates and enables the use of mathematical measures for projection of population statistics including phenomena like migration.

Course Modules with quantitative lecture hours:

Unit 1: Population science/demography (4 hours)

- Evolution of demography as a scientific discipline
- Multidisciplinary nature of demography
- Sources of demographic data
- Basic demographic concepts
- Components of population change and balancing equation
- Theory of Demographic Transition

Unit 2: Population Size, Growth and Characteristics (6 hours)

- Overview of the size and growth of world population by regions
- Overview of the size and growth of India's population
- Demographic profile of Indian states
- Age and sex structure of the population and population pyramids
- Determinants of age and sex structure of the population and their implications
- Sex ratios: total sex ratio, sex ratio at birth, child sex ratio, sex ratio
- Changing patterns of sex ratio in India, North-south divide, 'Missing women'

Unit 3: Fertility and Nuptiality (10 hours)

- Concepts and measurements of fertility: period and cohort measures
- Age patterns of fertility
- Bongaart's proximate determinants of fertility
- Socio-economic determinants of proximate variables
- Rele's Method and Reverse Survival Method in fertility analysis
- Fertility levels and differentials in developed and developing countries and India
- Nuptiality: Concept and analysis of marital status, proportion single, Singulate Mean Age at Marriage (SMAM) and trends in child marriages (marriage <18 years) in India

Unit 4: Morbidity and Mortality (12 hours)

- Basic concepts and analysis of morbidity
- Concepts and measurements of mortality
- Standardization of mortality rates
- Life tables: Concepts, types, uses, and methods of construction
- Differentials and Determinants of Mortality
- Causes of death and epidemiological transition

Unit 5: Migration and urbanization (10 hours)

- Concepts and measurement of migration
- Differentials in migration
- Causes and consequences of internal migration
- Trends and patterns of internal and internal migration
- Migration theories and models: Ravenstein's, Lee's, Wolpert's and Todaro's model
- Spatial distribution and urbanization
- Growth and distribution of rural-urban population in developed and developing countries and India

3. **Laboratory/practical/tutorial Module**s: None

4. **Text books:**

1) Asha Bhende and Tara Kanitkar: Principles of Population Studies; Himalaya Publishing House

2) Henry, S. Shryock, The Methods and Materials of Demography, Vol. 1 and 2, U.S. Department of Commerce, Bureau of Census, Washington D.C.

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.	HS501	Global Health and Demography	Life Tables and measures of morbidity and mortality	~20%

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

Approvals:

Faculty interested in teaching this course: None

Proposed by: Dr. Mayanka Ambade
School: School of Humanities and Social Sciences

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on…and approved the proposal on……..
*The course syllabus was circulated with all faculty members of SHSS and approved thereafter.

Sl. No	Faculty Name	Signature
1		
2		
3		

School Chair:
School: SHSS
Date:

Dean Academics
Date:
Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : HS555
Course Name : Infrastructural Development in Highland South Asia
Credit : 3 credits
Distribution : 3-0-0-3
Intended for : Discipline Elective for MA Development Studies and Outside Discipline/Free Elective for Other Postgraduates and undergraduates (3rd and 4th year)
Prerequisite : None
Mutual Exclusion: None

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1. Preamble:

Infrastructures are embedded in the modernist project and are enchanted by the principles of progress and development. They act as physical forms of networks that transfer and communicate objects, people, and ideas over time and space. Both transport and non-transport infrastructure serve as semiotic vehicles that symbolize and connect identities, experiences, and aspirations of a society. They play a vital role in augmenting the national imaginary, as they act as the harbinger of modernity and progress. Yet, infrastructures often remain as invisible backdrops and become part of the background. Focusing on the growth and development of transport infrastructures such as four lane highways, roads, railway tunnels and hydroelectric projects in highland South Asia this course views infrastructure as 'socio-technical assemblages 'that have social, legal, political and technical aspects that work and allow them to be held in place over time. The course is designed to familiarize the students with the anthropological and ethnographic understanding of transport infrastructural development and its impact on mobility in highland South Asia. The course, inter alia, includes a critical analysis of the development of transport infrastructure in the Himalayan region which have shaped the landscape in recent years. The course discusses the challenges, promises and newer possibilities of such infrastructural development in the region. It exemplifies how infrastructural developments do not merely possess 'technical functions 'but operate at a symbolic level informing ethnic identities, gendering experiences, and mobility patterns and are engulfed in the political contingencies to gain power through technical progress and development.

2. Course Modules with quantitative lecture hours:

Unit 1: Introduction to Anthropology of infrastructure (6 lecture hours)

- The infrastructural turn
- The mobility paradigm in anthropology
- Promises and perils of infrastructural creation in highland South Asia
- Road Ethnographies

Unit 2: Connecting the remote: The poetics and politics (8 lectures)

- From mule tracks to imperial highways
- Remoteness and connectivity channels
- Roads as the harbinger of progress, development and connectivity
- Roads as state conceived spaces
- Land acquisition and other issues.

Unit 3: The Dromocratic revolution (6 lecture hours)

- Speed and flows
- Connection and communication channels
- Corporeal and kinetic connection

Unit 4: Mobility and Mobile connections (8 lecture hours)

- Embodied travel experiences
- Temporal and material conditions of infrastructure
- Roadside contacts: stationary and the non-stationary
- People as infrastructures: Gender experiences of mobility

Unit 5: Tunneling and damming the hills (8 lecture hours)

- The destructive production of infrastructure: railway tunnels and aerial connection
- Dams and the moral ecology of infrastructure
- Debri and debacle along infrastructure channels
- Extraction of Raw-materials

Unit 6: Infrastructure and Sustainability (6 lecture hours)

- Issues of sustainability in infrastructure development
- Loss of forested lands, natural habitats and other environmental concerns
- Environmental Impact Assessment and other issues
- Negotiating the loss.

Laboratory/practical/tutorial Modules:

Field visits, invited lectures, film screening and other activities including evaluation of the Environmental and Social Impact assessment reports submitted before the commencement of the project.

3. Text books:

Anand, Nikhil, Akhil Gupta, and Hannah Appel. 2018. *The Promise of Infrastructure*. United Kingdom: Duke University Press.

Harvey, Penny, Casper Bruun Jensen, and Atsuro Morita. 2016. *Infrastructures and Social Complexity: A Companion.* United Kingdom: Taylor & Francis.

Dalakoglou, D., Harvey, P. (Eds.). 2014. *Roads and Anthropology: Ethnography,*

Infrastructures, (Im)mobility (1st ed.). New York: Routledge.

4. References:

1. Appel, Hannah, Anand, Nikhil and Gupta, Akhil.2015. Introduction: The Infrastructure Toolbox | *Society for Cultural Anthropology* (culanth.org)

2. Adey, P., Bissell, D., Hannam, K., Merriman, P., & Sheller, M. (Eds.). 2013. *The Routledge Handbook of Mobilities* (1st ed.). London: Routledge.

3. Bhatt, Jay P, Sudha Tiwari & Maharaj K. Pandit. 2017. Environmental impact assessment of river valley projects in upper Teesta basin of Eastern Himalaya with special reference to fish conservation: a review. *Impact Assessment and Project Appraisal*, 35:4, 340-350, DOI: 10.1080/14615517.2017.1354642.

4. Cresswell, Tim and Peter Merriman. 2016. *Geographies of Mobilities: Practices, Spaces, Subjects.* United Kingdom: Taylor & Francis.

5. Dalakoglou, D. 2010. The road: An ethnography of the Albanian-Greek cross-border motorway. *American Ethnologist*, no. 37 (1):132-149.

6. Delmon, Jeffrey. 2011. *Public Private Partnership projects in Infrastructure: An essential guide for policy makers*. Cambridge: Cambridge University Press.

7. Demenge, Jonathan P. 2013. The Road to Lingshed: Manufactured Isolation and Experienced Mobility in Ladakh. *Himalaya, the Journal of the Association for Nepal and Himalayan Studies*, 32 (1): 51–60.

8. Ferguson, J. 1994. *The Anti-Politics Machine: 'Development,' Depoliticization, and Bureaucratic Power in Lesotho*. 2003 ed. Minneapolis: University of Minnesota Press.

9. Gohain, Swargajyoti. 2020. *Imagined Geographies in the Indo-Tibetan Borderlands: Culture, Politics, Place.* Netherlands: Amsterdam University Press.

10. Gordillo, Gastón. 2014. *Rubble: The afterlife of destruction.* Durham: Duke University Press.

11. Gupta, Akhil. 2018. The future in ruins: Thoughts on the temporality of infrastructure. In N. Anand et al (eds.), *The Promise of Infrastructure.* Durham and London. Duke University Press.

12. Harvey, Penny., Knox, Hannah. 2012. The Enchantments of Infrastructure. *Mobilities*, 7:4, 521-536, DOI: 10.1080/17450101.2012.718935

13. Harvey, Penny., Knox, Hannah. 2015. *Roads: An Anthropology of Infrastructure and Expertise.* United States: Cornell University Press.

14. Masquelier, A. 2002. Road Mythographies: Space, Mobility, and the Historical Imagination in Postcolonial Niger. *American Ethnologist*, 29 (4):829-856.

15. Murton, Galen and Luke Heslop. 2021. *Highways and Hierarchies: Ethnographies of Mobility from the Himalaya to the Indian Ocean.* Netherlands: Amsterdam University Press, 2021.

16. Murton, Galen and Austin Lord. 2020. Trans-Himalayan power corridors: Infrastructural politics and China's Belt and Road Initiative in Nepal. *Political Geography*, 77 (102100): 1- 13.

17. Negi, D. P., & Abdul Azeez EP. (2022). 'No Means No': People's Protest Against Hydroelectric Development in Kinnaur, Himachal Pradesh, India. *Contemporary Voice of Dalit*. https://doi.org/10.1177/2455328X2110694.

18. Rest, Matthäus and Alessandro, Rippa. 2019. Road animism. *HAU: Journal of Ethnographic Theory,* 9: 373 - 389.

19. Saxer, Martin. 2022. *Places in Knots: Remoteness and Connectivity in the Himalayas and Beyond.* Cornell: Cornell University Press.

20. Simpson, Edward. 2022. *Highways to the End of the World: Roads, Roadmen and Power in South Asia.* United Kingdom: Hurst Publishers.

21. Simone, Abdou. Maliq. 2004. People as Infrastructure: Intersecting Fragments in Johannesburg. *Public Culture*, 16 (3): 407–429.

22. Star, Susan. Leigh. 1999. The Ethnography of Infrastructure. *American Behavioral Scientists*, 43 (3): 377-391.

23. Wiejaczka, Łukasz; Danuta Pirog; Lakpa Tamang; and Paweł Prokop. 2018. Local Residents' Perceptions of a Dam and Reservoir Project in the Teesta Basin, Darjeeling Himalayas, India. *Mountain Research and Development,* 38 (3): 203–210 http://dx.doi.org/10.1659/MRD-JOURNAL-D-16-00124.1

24. Ziipao, R. Raile. 2020. *Infrastructure of Injustice: State and Politics in Manipur and Northeast India.* New Delhi: Routledge.

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.	None	None	-	-

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

Approvals:

Faculty interested in teaching this course: Dr. Surya Prakash Upadhyay, Dr. Saumya Malviya.

Proposed by: Dr. Nilamber Chhetri.

School: School of Humanities and Social Sciences.

Signature: **Date: 22/04/2024**

The following faculty (at least 3 faculty) discussed on 22/04/2024 and approved the proposal on 22/04/2024.

Sl. No	Faculty Name	Signature
	Dr. Nilamber Chhetri	
	Dr. Surya Prakash Upadhyay	
	Dr. Saumya Malviya	

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi: Proposal for a New Course

Course Number: HS600
Course Name: Research Methodology
Credit: 1
Distribution: 1-0-0-1
Intended for: Ph.D./ MA by Research students at SHSS
Prerequisite: NA

Mutual Exclusion: None

1. **Preamble:** This course will give a methodological overview and guideline for researcher working in the area of Humanities and Social Sciences.

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

Unit 1: Thinking like a researcher [2 hr]
- What constitutes research?
- Types of research
- What is the role of a researcher?
- Concepts and constructs
- How to write a research proposal

Unit 2: Selecting and defining a research problem [2 hr]
- Propositions and hypothesis formulation
- Framing research objectives
- Framing research questions

Unit 3: Literature Review [2 hrs]
- Scoping and identification of a preliminary set of literature
- Annotated bibliography vis-à-vis literature review
- Methods of literature review
- Summarizing literature review

Unit 4: Managing Bibliography [2 hrs]
- Types of citations
- Formats of bibliography
- Use of bibliography software

Unit 5: Research Communication [2 hrs]
- Oral communications
- Written communications
- Making effective presentations
- Use of multimedia

Unit 6: Interpersonal Skills: Building academic relationships [1 hr]
- Interaction with co-researchers and supervisors
- Effective workplace communication

Unit 7: Research Ethics [1 hr]

- Work-ethic (Time, quality, integrity of research input)
- Acquiring permission to use printed material/images from artists
- Vigilance against unintentional plagiarism

Unit 8: Field Work [1 hr]

- Different types of field work
- Need for field work
- Field work protocols

Unit 9: Managing Resources [1 hr]

- Key funding agencies in HSS
- How to manage and keep account of financial resources
- Library resources at IIT Mandi
- Other recourse at IIT Mandi

Reference Books

- NA.

Similarity with the existing courses:

- NA

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

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

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

Approvals:

Faculty interested in teaching this course: – SHSS Faculty

Proposed by: SHSS

School: School of Humanities and Social Sciences

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on _____ and approved the proposal on _____.

*The course syllabus was circulated with all faculty members of SHSS and approved thereafter.

Sl. No	Faculty Name	Signature
1		
2		
3		

School Chair
School: SHSS
Date:

Dean Academics
Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Annexure I

IIT Mandi
Proposal for a New Course

Course number : IC 181
Course Name : Introduction to Consciousness and Holistic Wellbeing
Credit : *3-Credit*
Distribution : ***L-T-P-C*** *(2-0-2-3)*
Intended for : All 1st year undergraduates
Prerequisite : **None**
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

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1. Preamble:

This is a compulsory core course for 1st year undergraduate students. All incoming students will take this introductory level course. It will cover topics like mind, consciousness, health and wellbeing from Western and Indian Knowledge System (IKS) perspectives. Latest understanding on these topics from philosophy, medicine, neuroscience, mind-body practices, cognitive science, psychology, and artificial intelligence will be presented. The course will equip students with a deeper understanding of matter, mind, life and mental health, theory and practice of meditation. Through the use of heart rate and brain signal recording devices, the students will gain a first-hand experience of the functional changes occurring within the body through various wellbeing practices.

2. Course Modules with quantitative lecture hours:

Unit/Topic 1: Theories of consciousness, Western and IKS perspectives on mind and consciousness, states of consciousness, effects of IKS art/dance forms on the mind, animal and plant consciousness, Supreme consciousness **(8 Hours)**

Unit/Topic 2: Anatomy and functionality of the physical body; perspectives from Western medicine and Ayurveda; attention, breath and mind **(8 Hours)**

Unit/Topic 3: Diet, Gut-mind connection, sleep, circadian rhythms, meditation **(8 Hours)**

Unit/Topic 4: Embryogenesis, concept of subtle body, reincarnation, near-death and out-of-body experiences **(4 Hours)**

Laboratory/practical/tutorial Modules:

Practical Module 1: Yoga, pranayama **(6 hours)**

Practical Module 2: Mindfulness, inward-focus, CBT meditation, spiritual and VR-based meditations **(8 hours)**

3. Text books:

(Latest, Only 2)

1. Trevor A. Harley, The Science of Consciousness, Cambridge University Press, 2021, ISBN 9781107563308
2. Mahadevan, Bhat, Pavana; Introduction To Indian Knowledge System: Concepts and Applications, PHI Learning, 2022, ISBN 978-9391818203

4. References:

- https://openstax.org/books/anatomy-and-physiology/
- https://openstax.org/books/psychology-2e/
- https://openstax.org/books/biology-2e/
- https://plato.stanford.edu/entries/consciousness/
- Beyond Physicalism: Toward Reconciliation of Science and Spirituality. (2015). United Kingdom: Rowman & Littlefield Publishers.
- Consciousness Unbound: Liberating Mind from the Tyranny of Materialism. (2021). United States: Rowman & Littlefield Publishers.
- Bryant, E. F. (2015). The Yoga Sutras of Patañjali: A New Edition, Translation, and Commentary. United States: Farrar, Straus and Giroux.
- Presti, D. (2018). Mind Beyond Brain: Buddhism, Science, and the Paranormal. United States: Columbia University Press.
- Phillips, S., Dasti, M. (2017). The Nyaya-sutra: Selections with Early Commentaries. United States: Hackett Publishing Company, Incorporated.
- Safina, C. (2016). Beyond Words: What Animals Think and Feel. United Kingdom: Souvenir Press Limited.
- Srimad-Bhagavatam, Third Canto: The Status Quo. (1972). United States: The Bhaktivedanta Book Trust.
- Lad, V. (1984). Ayurveda: The Science of Self-healing : a Practical Guide. Bahrain: Lotus Press.

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.				

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Prof. Laxmidhar Behera **School: IKSMHA**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : IK510
Course Name : Cognitive Neuroscience
Credit Distribution : (3-1-0-4) *(Lectures-Tutorial-Practical-Total credits)*
Intended for :3rd & 4th Year B. Tech, Masters and PhD
Prerequisite : None
Mutual Exclusion : None

1.Preamble:

Cognitive neuroscience deals with understanding human cognition from brain perspective based on rigorous experimental research. In an interdisciplinary era, exploring philosophical and spiritual perspectives of cognition also would require a fundamental understanding of cognitive neuroscience concepts and its experimental strategies and vice versa. This course will enable students from different disciplines to understand the fundamental concepts of mind, brain, consciousness and behavior from neurobiological perspective. This in turn could lead to appropriate interdisciplinary research facilitation among future scholars.

2.Course modules with quantitative hours (56 hours)

Theory (42 hours)

Structure and function of nervous system (5 hours)

1.1 Overview of nervous system

1.2 Brain & spinal cord anatomy

1.3 Cells of nervous system

1.4 Action potential

1.5 Neurotransmitters

1.6 Synapse

1.7 Networks

Sensation & Perception (6 hours)

2.1 Olfaction

2.2 Gustation

2.3 Somatosensation

2.4 Audition

2.5 Vision

2.6 Sensation to perception

Attention (4 hours)

3.1 Models of attention

3.2 Neural mechanism of attention

3.3 Attention control networks

Action (4 hours)

4.1 Anatomy & control of motor structures

4.2 Motor pathways & physiology

4.3 Motor planning, initiation and control

4.4 Motor learning and memory

Memory (4 hours)

5.1 Learning and memory-anatomical & cellular basis

5.2 Mechanisms of memory

5.3 Memory consolidation

5.4 Memory deficits and amnesia

Emotions (4 hours)

6.1 Defining & categorizing emotions

6.2 Theories of emotion generation

6.3 Neural systems of emotion processing

6.4 Emotion & cognition (learning & memory)

Language (4 hours)

7.1 Evolution & fundamentals of language

7.2 Sensory, motor and cognitive aspects of language

7.3 Theories of language comprehension & speech production

7.4 Language deficits

Cognitive control (4 hours)

8.1 Cognitive control anatomy, cross talks (sensorimotor) & deficits

8.2 Planning, Decision making & execution mechanisms

8.3 Cognitive control & neuropsychiatry

Social Cognition (4 hours)

9.1 Theories of self

9.2 Understanding mental states of others (Theory of Mind-ToM)

9.3 Experience sharing & simulation theory

9.4 Mental state attribution

9.5 Neurobiology of social cognition

9.6 Social cognition deficits

Consciousness (3 hours)

10.1 Mind-Brain problem

10.2 Consciousness theories- neuroscience perspective

10.3 Consciousness theories & practice-Yogic perspective

10.4 Miscellaneous-Plant & animal consciousness and others

10.5 Disorders of consciousness

Tutorial (14 hours)

Methods in cognitive neuroscience

11.1 Behavioral experiments-tools & techniques

11.2 Introduction to neurophenomenology

11.3 Basics of bio signals

11.4 Electroencephalograph (EEG) & Heart rate variability (HRV)

11.5 Transcranial electrical current stimulation(tECS)

11.6 Transcranial magnetic stimulation (TMS)

11.7 Functional neuroimaging techniques (fNIRS & fMRI)

11.8 Introduction to computational neuroscience (ML & AI)

3.Text book:

Gazzaniga, Michael S., et al. Cognitive Neuroscience: The Biology of the Mind. United Kingdom, W.W. Norton, 2018.

4.References:

Kandel ER, Koester JD, Mack SH, Siegelbaum SA. Principles of Neural Science, Sixth Edition. McGraw Hill LLC; 2021.

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.		IK-507	Structure & function of nervous system	10%

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

Not Applicable

Approvals:

Faculty interested in teaching this course: –

Dr Ramajayam G-IKSMHA
Dr Shubhajit Roy Chowdhury-SCEE
Dr Varun Dutt-SCEE
Dr Arnav Bhavsar-SCEE
Dr Siddharth Panwar-SCEE

Proposed by: Dr Ramajayam G **School: IKSMHA**

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on……and approved the proposal on……..

Sl. No	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……
Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Responses for the reviewer's comments:

Reviewer 1:

Dr Arun Sasidharan MBBS, PhD (Neuroscience)
Scientist-C
Centre for Consciousness Studies
National Institute of Mental Health & Neurosciences (NIMHANS)
Bengaluru

Comments:

1. The syllabus is well-structured and comprehensive. The topic and duration look good to me. I would suggest you add a subtopic 'Sensorimotor system in Cognition', maybe under 'Cognitive control'.

This is because students need to understand the role of crosstalk between sensory and motor systems in cognitive control and consciousness.

Response:

1. As suggested by the reviewer, Sensorimotor cross talk is added under cognitive control in page no. 2

Reviewer 2:

Dr Ravindra P N. MBBS, MD (Physiology), PhD (Neuroscience)
Additional Professor
Dept of Neurophysiology
National Institute of Mental Health & Neurosciences (NIMHANS)
Bengaluru

Comments:

The details of course are optimal.

Can you add an introduction to neurophenomenology under the methods section?

Response:

Introduction to neurophenomenology is added under methods section in page no. 3

Annexure J

IIT Mandi
Proposal for a New Course

Course number : **CE 600**
Course Name : *Research Methodology for Civil Engineering*
Credit Distribution : **1-0-0-1**
Intended for : **MS/MTech(R)/PhD**
Prerequisite : **None**
Mutual Exclusion : **Nil**

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1. Preamble:

This 14-week course comprehensively explores research principles and practices mainly tailored for civil engineering students. Aspiring researchers will explore the scientific method, literature review, and the art of formulating precise research questions. Emphasis is placed on diverse research designs, from quantitative experiments to qualitative case studies. Students will master data collection techniques, both quantitative and qualitative, and learn to wield statistical tools like SPSS. The course culminates in effective communication of research findings through writing and presentations. It will develop critical research skills essential for success in the dynamic field of civil engineering.

2. Course Modules with quantitative lecture hours: (14 hours)

- Introduction to research methodology
- Literature search and review
- Technical and scientific writing
- Data analysis and visualization
- Technical and scientific presentation
- Best practices in experimental research
- Best practices in numerical research
- Ethics in research
- Open sourcing, software, data sources
- IPR and outreach
- Time and stress management
- Writing proposals and grants

Laboratory/practical/tutorial Modules: Nil

3. Textbooks:

1. Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approach.
2. Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill-building approach.

4. References:

Notes and other material shared by the concerned faculty

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.				

6. Justification of new course proposal if cumulative similarity content is >30%:
As this is a generic course and assigned to civil engineering domain, the content can be similar to other research methodology courses in various disciplines

Approvals:

Faculty interested in teaching this course:

Proposed by: Dr K V Uday **School:** SCENE

Signature: **Date:**

The following faculty (at least 3 faculty) discussed on 25th Jan 2024 and approved the proposal on 25th Jan 2024

Sl. No	Faculty Name	Signature
01	K V Uday	
02	Sandip Saha	
03	Sayantan Sarkar	
04	Shashank Pathak	

05	Vivek Gupta	

School Chair: 12/04/2024

School: SCENE

Date: 25th Jan. 2024

This proposal is reported in .....th Board of Academics on .....

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi
Proposal for a New Course

Course number : **CE 356**
Course Name : **Reverse Engineering**
Credit Distribution : *0-0-2-1*
Intended for : **UG Core**
Prerequisite : **NA**
Mutual Exclusion : **None**

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1. Preamble:

This course provides a brief introduction of reverse engineering principles and their application in civil engineering. Students will gain proficiency in interpreting civil engineering drawings, and analyzing case studies involving structural failures, performance of construction materials, geotechnical challenges, environmental projects, and water resources management. Additionally, they will explore transportation infrastructure and the significance of infrastructure maintenance, while also examining case studies on sustainable design. This course also aims to enable students to acquire essential skills in construction safety, enhancing performance, and promoting sustainability in civil engineering projects.

2. Course Contents:

This course curriculum encompasses a diverse range of topics, including the overview of civil engineering case studies; reading and decoding construction drawings; study of site investigation reports, material testing reports; examination of civil infrastructure failures and the implementation of remediation measures; study of environmental impact assessment reports for existing large infrastructural projects; study of performance assessment of existing road facilities; and study of topographical and survey maps.

Some of the examples that students will be learning through this course include:

Case studies on structural design aspects of infrastructural facilities or geotechnical challenges and solutions or case studies on water resources management and infrastructure or environmental engineering case studies such as pollution remediation and sustainability or case studies on surveying, remote sensing, and GIS or case studies on transportation infrastructure.

3. Textbooks:

1. Reverse Engineering: An Industrial Perspective by Raja and Fernandes. Springer-Verlag 2008.
2. The Civil Engineering Handbook by W.F. Chen, J.Y. Richard Liew, CRC Press 2003.

4. References: NA

5. Similarity with the existing courses: NA

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

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: **School:**

Signature: **Date:**

Recommended/Not Recommended, with Comments:

_____ **Date:**_____

Chairperson, CPC

Approved / Not Approved

_____ **Date:**_____

Chairperson, BoA

Indian Institute of Technology Mandi

IIT Mandi
Proposal for a New Course

Course number : CE523
Course Name : Building Science
Credit Distribution : 3-0-0-3
Intended for : UG/PG
Prerequisite : Engineering Thermodynamics and Engineering Mathematics
Mutual Exclusion : None

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1. Preamble:

In the modern world, people spend most of their time in buildings. The rising demands for energy efficiency, comfort and safety in buildings makes the consideration of the interaction between internal and external environments and the aspect of fire safety critical to the design practice. This course introduces the science underlying the thermal, visual, and acoustic comfort of building occupants, offers an overview of the fire phenomenon, and is intended to enable a rational appreciation and implementation of the design guidelines suggested by the national building code. The course is also a precursor to the study of design of green buildings.

2. Course Modules with quantitative lecture hours:

Module 1: Building system **6 Hours**

Introduction: Life phases of a building; Resources utilized by buildings and the need for sustainability; Design goals and approach
Outdoor environment: Air temperature and humidity, solar radiation, wind, precipitation and driving rain; Climatic zones, urban climate, site climate
Indoor environment: Thermal comfort; Indoor air quality; Visual comfort; Effect of noise on wellness; Dangers associated with a building fire
Building envelope: Walls, roofs, openings; Thermal mass, air and water tightness

Module 2: Moisture **6 Hours**

Psychrometrics: Moist air properties; Psychrometric chart
Moisture transport mechanisms: Capillary action, permeation, vapor diffusion
Moisture transport in building elements: Glaser method; Overview of transient models and their numerical solution
Prevention of moisture uptake: Damp proofing, vapor barrier, role of thermal insulation and ventilation; Moisture meters

Module 3: Ventilation and Infiltration **6 Hours**

Natural ventilation: Aerodynamics around a building, ventilation due to wind and stack effects, cross-ventilation; Design guidelines for openings

Infiltration: Crack flow equation; Calculation of leakages; Energy implications

Module 4: Heat **6 Hours**

Mechanisms and laws of heat transfer: Conduction, Convection and Radiation
Heat transfer in building elements: Steady state transfer in **s**olid wall, wall with airspace, window, slab-on-grade, basement wall and floor, thermal bridges; Introduction to the continuous and distributed methods for analyzing transient heat flow
Calculation of heating and cooling loads: Instantaneous, cooling load temperature difference/cooling load factor methods; Overview of transfer function, heat balance and radiant time series methods
Thermal control: Overview of mechanical and structural controls

Module 5: Acoustics **6 Hours**

Fundamentals: Wave nature of **s**ound; Frequency, pressure, power and intensity of sound; Human perception of loudness; Environmental noise; Noise abatement; Sound meters
Room acoustics: Direct and diffuse sound fields; Echo, standing wave; Types of sound absorbers**;** Sound absorption coefficient and Reverberation time
Sound transmission and insulation: Resonance and Coincidence frequencies; Calculation of sound reduction index

Module 6: Illumination **6 Hours**

Fundamentals: Human perception of light; Photometric quantities; Optical properties of matter; Light meters
Daylight: Components of daylight; Solar altitude and azimuth, sun path diagram; Sky conditions and luminance; Illumination of horizontal and vertical surfaces; Daylight factor
Artificial light: Electric light sources; Properties of light sources

Module 7: Fire **6 Hours**

Fundamentals: Combustion process, development phases, fire classes, fire zones, smoke layer thickness, smoke temperature-time curve
Fire safety: Response of building materials to fire and related performance classes; Fire resistance classification; Smoke control; General safety requirements

3. Text books:

1. Pinteric, M., “Building Physics: From physical principles to international standards”, 2nd edition, Springer, Switzerland, 2022.
2. Medved, S., “Building Physics: Heat, Ventilation, Moisture, Light, Sound, Fire, and Urban Microclimate”, Springer, Switzerland, 2022.

4. References:

1. Zhai, Z., “Energy Efficient Buildings: Fundamentals of Building Science and Thermal Systems”, Wiley, USA, 2023.

2. Koenigsberger O.H., Ingersoll, T.G., Mayhew, A., and Szololay, S.V., "Manual of tropical housing and building", Springer, Switzerland, 2022.
3. Moss, K.J., "Heat and Mass transfer in Buildings", 2nd edition, Taylor & Francis, London and New York, 2007.
4. ASHRAE, "Handbook of Fundamentals", American Society of Heating, Refrigerating and Air conditioning Engineers, Atlanta, GA, 2021.
5. BIS, "National Building Code of India", Bureau of Indian Standards, New Delhi, 2016.
6. ECBC Code "Energy Conservation Building Code 2017", Bureau of Energy Efficiency, New Delhi 2017.

5. Similarity with the existing courses:

S. No.	Course Title	Course Code	Similarity Content	Approx. % of Content
1	Air conditioning and ventilation	ME605	Fundamentals; Comfort; Load estimation	10%
2	Acoustics	ME626	Hearing and speech; Environmental and Architectural acoustics	10%
3	Heat transfer	ME303	Introduction to heat and mass transfer	5%

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

Approvals:

Faculty interested in teaching this course: –

Proposed by: Dr. Kaustav Sarkar **School: SCENE**

Signature: **Date:**

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on 27-03-2024

Sl. No	Faculty Name	Signature
1	Dr. Dibakar Rakshit, IIT Delhi	
2	Dr. Bandana Jha, SPA	

Indian Institute of Technology Mandi

School Chair:

School:

Date:

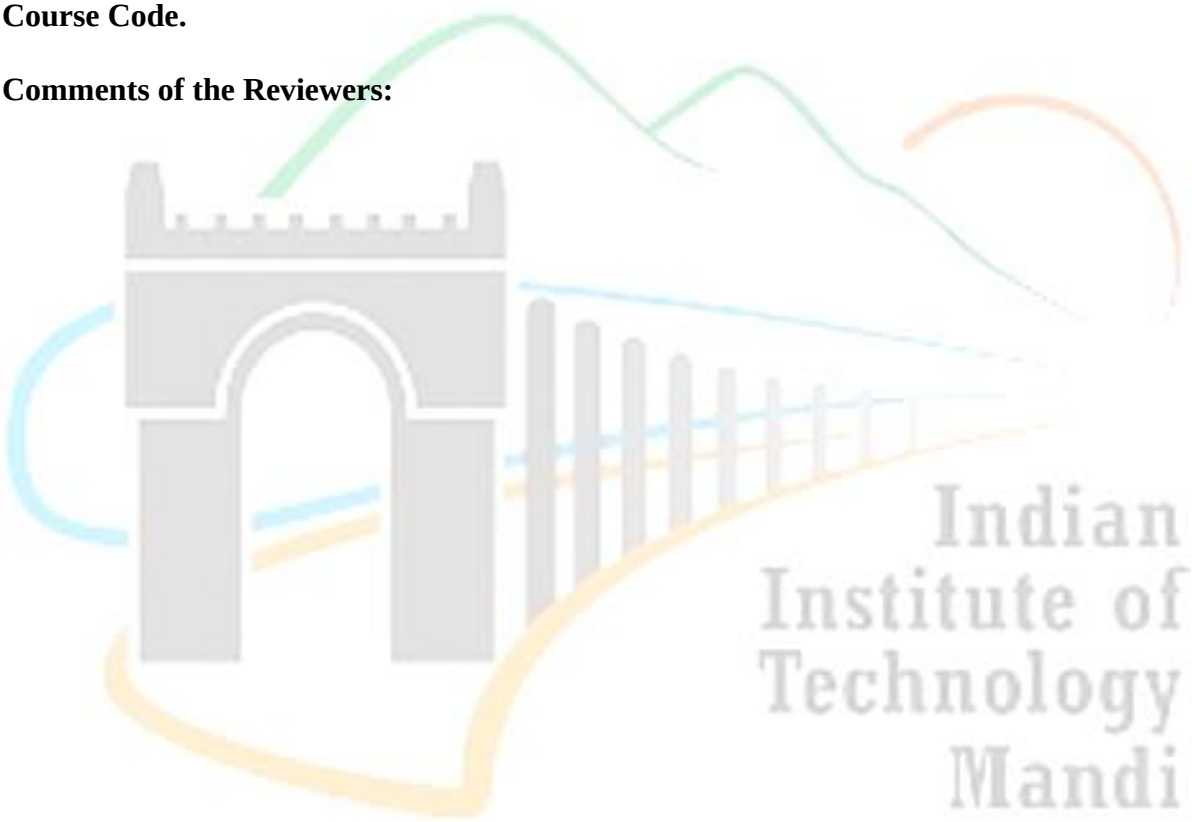
This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:



8-5-24

Annexure K

IIT Mandi
Proposal for a New Course

Course number : **ME303P**
Course Name : **Heat Transfer Lab**
Credit : **1**
Distribution : ***0-0-3-1***
Intended for : **UG**
Prerequisite : **ME303 – Heat Transfer & ME-213 Engineering Thermodynamics**; ME 210 Fluid Mechanics
Mutual Exclusion : NA

---

1. Preamble:

To introduce students to different heat transfer & thermodynamic systems and their evaluation.

2. Course Modules with quantitative lecture hours:

NA

Laboratory/practical/tutorial Modules:

1) **Calorific Value Measurement**
2) **Critical Heat Flux Measurement**
3) **Heat Transfer from Pin Fin Measurement**
4) **Heat Transfer in Natural Convection**
5) **Parallel Flow and Counter Flow Heat Exchanger**
6) **Radiation Law Verification**
7) **Refrigeration Cycle Verification**
8) **Air-Conditioning Cycle Verification – Open Cycle**
9) **Air-Conditioning Cycle Verification – Closed Cycle**
10) **Two-Phase Heat Transfer**
11) **Lumped Heat Transfer Analysis**
12) **Unsteady Heat Transfer Analysis**
13) **Analysis of Water Cooler**

3. **Text books:**

- J. P. Holman, Experimental Methods for Engineers, 7th edition, Tata McGraw-Hill 2001.
- T.G. Beckwith, J.H. Lienhard V, R. D. Marngoni, Mechanical Measurements, 5th edition, Pearson Education, 2010.
- E.O. Doebelin, Measurement systems, Application and Design, 5th edition, Tata McGraw-Hill, 2008
- Incropera and Dewitt, Fundamentals of Heat and Mass Transfer, Wiley India.
- Cengel, Heat and Mass Transfer, Tata McGraw Hill.
- Krieth and Bohn, Principles of Heat Transfer, Cengage Learnings

4. **References:**

NA

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

NA

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

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

NA

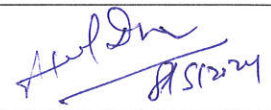
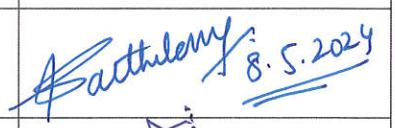
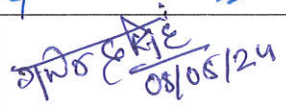
Approvals:

Faculty interested in teaching this course: –
Dr Gajendra Singh, Dr Atul Dhar, Dr Sarthak Nag, Dr. Parmod Kumar

Proposed by: Dr. Gajendra Singh **School: SMME**

Signature: 08/05/24 08/05/24 **Date:**

The following faculty (at least 3 faculty) discussed on……08/05/2024……..and approved the proposal on……08/05/2024……

S. No	Faculty Name	Signature
1	Dr Atul Dhar	
2	Dr Parmod Kumar	
3	Dr Sarthak Nag	
4	Dr Gajendra Singh	

School Chair: Dr Atul Dhar 

School: SMME

Date:

This proposal is reported in ……...the Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

प्राप्तांक अनुभाग
Inward No. 3910
09 MAY 2024
Academics Section

IIT Mandi
Proposal for a New Course

Course number : **ME526**
Course Name : Programming Paradigm for Open-source Software
Credit : **3**
Distribution : ***2-0-2-3***
Intended for : UG/MTech/M. Tech (R)/ PhD in engineering streams
Prerequisite : **None**
Mutual Exclusion: CSE or related branches' students

1. **Preamble:** A strong theoretical understanding is crucial for proposing improvements in engineering systems, and this understanding is often developed through simulation techniques. While simulations are valuable, commercial packages may not facilitate effective learning for students. On the other hand, open-source tools can be beneficial, but they often come with a steep learning curve. This course aims to familiarize students with the programming paradigm of open-source tools, thereby reducing the learning curve and enhancing their understanding.
2. **Course Modules with quantitative lecture hours:**

2.1 - Language -

Module 1: Object oriented fundamentals, C++ Basics, C++ Functions [6]

Module 2: Encapsulation, Constructors and Destructors, Function and Programming Overloading. [7]

Module 3: Inheritance, Virtual functions, Dynamic binding [5]

Module 4: Containment and Private Inheritance, Designing with C++: Template and exceptions. [5]

2.2 Debugger –

Module 5: Navigating Through Codes, Stopping and Running the Program, Examining data [3]

2.3 Introduction to Open-Source Software-

Module 6: File and folder systems, make and makefile, including a file to open-source software, correction of a bug [2]

Laboratory/practical/tutorial Modules:

3. Text books:

1. Bjarne Stroustrup, The C++ Programming Language (4th ed), Addison-Wisley Professional, 2013.
2. Andreas Zeller et al., Debugging with DDD, User's Guide and Reference Manual 2000.

3. **References:**

1. Stanley B. Lippman, Josee Lajoie, and Barbara E Moo, C++ Primer (5th ed), Addison-Wisley Professional, 2012
2. Steve Oualline, Practical C++ Programming (2nd Edition), O'Reilly Media, 2002
3. Bjarne Stroustrup, Programming: Principles and Practice Using C++, Addison-Wisley Professional 2008.
4. OpenFOAM: User Guide V2112

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.				

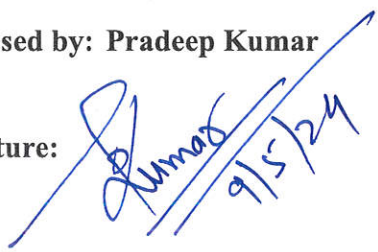
6. Justification of new course proposal if cumulative similarity content is >30%:

Approvals:

Faculty interested in teaching this course: –

Proposed by: Pradeep Kumar **School: SMME**

Signature: **Date:**



The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on……..

Sl. No	Faculty Name	Signature
1.	Dr Jinesh Machchhar	Email
2.	Dr Indu Joshi	Email

School Chair:

School: SMME

Date: 9/5/2024

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

Dr Jiensh Machchhar, IIT Mandi

Looks good and would be a good course for non-CS students.
The following may be optionally added: smart-pointers, threads, debugging parallel code.

Regards
Jinesh

Dr Indu Joshi, IIT Mandi

Looks okay to me.

Thanks and Regards

Dr. Indu Joshi
Assistant Professor at Indian Institute of Technology Mandi, India

Pradeep Kumar <pradeepkumar@iitmandi.ac.in>

Request for Feedback on Modified C++ Course for Open-Source Software Training

Indu Joshi <indujoshi@iitmandi.ac.in> Wed, May 8, 2024 at 5:00 PM
To: Aditya Nigam <aditya@iitmandi.ac.in>
Cc: Pradeep Kumar <pradeepkumar@iitmandi.ac.in>

Looks okay to me.

Thanks and Regards
Dr. Indu Joshi
Assistant Professor at Indian Institute of Technology Mandi, India

On Tue, 7 May 2024 at 2:51 PM, Aditya Nigam <aditya@iitmandi.ac.in> wrote:

Dear Dr. Indu,

May I request you to please give your comments on this course. This will be offered by our SMME department.

Thank you.

Aditya Nigam, SCEE, IIT Mandi

On 7 May 2024, at 2:21 PM, Pradeep Kumar <pradeepkumar@iitmandi.ac.in> wrote:

Dear Dr. Aditya,

We have revised the C++ course to focus on training for open-source software. The updated syllabus is attached for your review. Your feedback on this revised course structure would greatly assist us in presenting it to the BoA.

Thank you for your valuable input.

Best regards,
Pradeep

--
Pradeep Kumar, PhD || Associate Professor
Numerical Experiment Laboratory (Radiation & Fluid Flow Physics)
School of Mechanical and Materials Engineering
Indian Institute of Technology Mandi, Mandi, HP, 175075, India.
Phone no +91-1905-267121 || Fax no- +91-1905-267009

Pradeep Kumar <pradeepkumar@iitmandi.ac.in>

Request for Feedback on Modified C++ Course for Open-Source Software Training

Jinesh Machchhar <jinesh@iitmandi.ac.in> Mon, May 6, 2024 at 5:15 PM
To: Pradeep Kumar <pradeepkumar@iitmandi.ac.in>
Cc: Deepak Sachan <dsachan@iitmandi.ac.in>

Looks good and would be a good course for non-CS students.
The following may be optionally added: smart-pointers, threads, debugging parallel code.

Regards
Jinesh

On Mon, May 6, 2024 at 5:02 PM Pradeep Kumar <pradeepkumar@iitmandi.ac.in> wrote:

> Dear Dr. Jinesh,
>
> We have revised the C++ course to focus on training for open-source software. The updated syllabus is attached for your review. Your feedback on this revised course structure would greatly assist us in presenting it to the BoA.
>
> Thank you for your valuable input.
>
> Best regards,
> Pradeep
> --
> Pradeep Kumar, PhD || Associate Professor
> Numerical Experiment Laboratory (Radiation & Fluid Flow Physics)
> School of Mechanical and Materials Engineering
> Indian Institute of Technology Mandi, Mandi, HP, 175075, India.
> Phone no +91-1905-267121 || Fax no- +91-1905-267009

IIT Mandi
Proposal for a New Course

Course number : **GE 501**
Course Name : Creative Engineering Design
Credit : 3 Credits
Distribution : *L-T-P-C* = 2-0-2-3
Intended for : Open to all
Prerequisite : NIL
Mutual Exclusion: None

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1. Preamble:

This offers a comprehensive understanding of design thinking, systematic processes, and essential tools for crafting holistic artifacts. The course aims to instil a deep grasp of fundamental design concepts, design thinking, and systematic processes, along with hands-on experiences in tackling real-world design problems individually and within teams. Students will learn to navigate the entire product lifecycle, understanding the need to identify challenges and opportunities in the design process. The course explores the major steps of systematic conceptual design. It equips students with various methods and tools necessary for problem-solving, applied through team projects, fostering leadership and collaboration skills. Beginning with an introduction to the convergence of design, science, engineering, and creativity, the course steers learners through an immersive journey of practical application, preparing them to articulate their work effectively through presentation, prototyping, and evaluation. Ultimately, it cultivates a new generation of designers and innovators well-versed in the intricate art of design. The course is designed to instil a robust understanding of how detailed design considerations can significantly influence the success of a product in the real world.

2. Course Modules with quantitative lecture hours:

Understanding Design (6 hours)

Introduction to Design Principles and History: Evolution of design, key milestones, and influential figures, Comparison of design across cultures and eras, Terminologies and Definitions

Product Lifecycle and Systematic Design Process: Stages of the product lifecycle, Introduction to systematic design processes and methodologies

Thinking Methods (8 hours)

Introduction to Design Thinking: Core principles and stages of Design Thinking

Empathize: User journey mapping, persona development, empathy exercises, affinity diagram, mind map, Define, Ideate, Prototype, Test

Engineering Design (2 hours)

Characteristics of Successful Products: Analysis of market-leading products and their design attributes, Good Design vs Bad Design

Problem Design (8 hours)

Opportunity Identification and Customer Needs: Identifying target groups and stakeholders, Techniques for identifying market gaps and acquiring customer feedback.

Task Clarification and User Research: Conducting effective user research and habitat studies, Translating customer feedback into user needs

Problem Identification and Analysis: Establish Cause-Effect Relationships in user needs,

Benchmark existing products - product and patent study, Creating a requirements list and assigning importance to it and SNPS

Conceptual Design (8 hours)
Introduction to Conceptual Design: Function structures and the Sapphire Framework
Imagination, Motivation, and Inspiration: Techniques for fostering creativity, such as mood boards and bio-inspiration.
Ideation Techniques: Brainstorming, Synectics, Random words and other ideation methods
Concept Generation and Visualization Tools: Concept generation by combining ideas.
Concept Evaluation and Selection: Analytical, simulation, and physical evaluation techniques.

Systematic Embodiment Design (10 hours)
System Thinking and System Design, Embodiment Design, Detailed Design, Prototyping, Design for Manufacture, Assembly, and Environment (DFMAE)
Prototyping Technologies: Introduction to 3D printing, clay, and foam modeling Techniques for rapid prototyping and testing
Sketching and Sculpting: Traditional and digital sketching techniques using VR, Basics of sculpting for concept modeling

1. **Textbooks:**
   1. Chakrabarti, A. *Engineering Design Synthesis*, Springer, London, 2013.
   2. Kaushik Kumar, Muralidhar Kurni, *Design Thinking a Forefront Insight*, CRC Press, USA, 2023.

2. **References:**
   1. Pahl, G., Beitz, W., *Engineering Design: A Systematic Approach*, Vol. 3, Springer, Germany, 2007.
   2. Dieter, George E.; Schmidt, Linda C., *Engineering Design*, 5th Edition, McGraw-Hill Education, USA, 2012.
   3. Pressman, Andrew, *Design Thinking: A Guide to Creative Problem Solving for Everyone*, Routledge/Productivity Press, USA, 2019.
   4. Lewrick, Michael, *Design Thinking and Innovation Metrics*, Wiley Publications, USA, 2023.
   5. Brown, Tim, *Change by Design*, Harper Collins Publisher, USA, 2020.
   6. Eriksson, Yvonne, *Different Perspectives in Design Thinking*, CRC Press, USA, 2022.
   7. Müller-Rotterberg, Christian, *Design Thinking for Dummies*, John Wiley & Sons, Inc, USA, 2020.
   8. Cross, N., *Engineering Design Methods*, Vol. 4, John Wiley and Sons Ltd., Chichester, UK, 2008.
   9. Reid, K., Estell, J., *Engineering Design and the Product Lifecycle*, Momentum Press Engineering, USA, 2018.
   10.

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.	Product Design	ME523	Characteristics of Successful Products, Opportunity Identification and Customer Needs	6%

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

Approvals:

Other Faculty interested in teaching this course: – Dr. Satvasheel Powar, Dr. Gajendra Singh

Proposed by: Dr. Mrityunjay Doddamani **School: SMME**

Signature: **Date: 24.01.2024**

The following faculty (at least 3 faculty) discussed on Creative Engineering Design (New course) and approved the proposal on 24th January 2024.

Sl. No.	Faculty Name	Signature
1	Dr. Satvasheel Powar	
2	Dr. Sunny Zafar	
3	Dr. Gajendra Singh	

School Chair:

School: School of Mechanical and Materials Engineering (SMME)

Date:

This proposal is reported in .....th Board of Academics on .....

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

शैक्षणिक अनुभाग
Inward No. 3910
09 MAY 2024
Academics Section

IIT Mandi
Proposal for a New Course

Course number : **GE 502**
Course Name : **Consciousness and Professional Ethics**
Credit : **3**
Distribution : ***2-1-0-3***
Intended for : **UG/ PG/ PhD**
Prerequisite : **None**
Mutual Exclusion: NA

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1. Preamble:

The perceived contradictions in the individual and common aims result into lack of commitment in following the ethical conduct. Development of a holistic perspective based on self-exploration about themselves (human being) by understanding human being as co-existence of consciousness and human body is necessary for finding out the definite human conduct that can form the basis of mutually fulfilling behavior and sustainable production systems. Clarity about this perspective will lead to harmonious relation with family, society and nature/existence while ensuring the fulfillment of individual. Through the understanding of human being and professional ethics that is simultaneously fulfilling to the individual; the commitment and courage to act ethically naturally follows. Hence, exposure to holistic perspective leading to conflict free conduct is attempted in this course through the method of self-exploration.

2. Course Modules with quantitative lecture hours:

Unit 1/ Introduction and Background: Evolution of the engineering profession; Basis for universal human values and ethical human conduct; Engineering profession in the light of comprehensive human goal; Responsibility in engineering; Social and value dimensions of technology; Continuous happiness and prosperity as basic human goal?; connection of basic human goal with professional conduct; process of exploring human goal; Summary of few cases of professional ethics code developed by professional societies. **(4 Hours)**

Unit 2/ Exploring Harmony in the Human Being and Consciousness: Understanding human being as a co-existence of the sentient consciousness and the material 'Body', Understanding the needs of consciousness and body - happiness and physical facility, Appraisal of Physical needs, meaning of Prosperity in detail **(4 Hours)**

Unit 3/ Harmony in the Family (Human-Human Interaction): Understanding values in human-human relationship; meaning of Justice and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Notion of Justice as fulfilling relationship. **(4 Hours)**

Unit 4/ Harmony in the Society (Human-Human Interaction): Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and

co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society. **(4 Hours)**

Unit 5/ Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the various units of nature, recyclability and self-regulation in nature.
Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence. **(4 Hours)**

Unit 6/ Implications of the Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: (i) Ability to utilize the professional competence for augmenting universal human order (ii) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, (iii) Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems.
(5 Hours)

Unit 7/ Strategy for transition from the present state to Universal Human Order: (i) At the level of individual: as socially and ecologically responsible engineers, technologists and managers (ii) At the level of society: as mutually enriching institutions and organizations **(3 Hours)**

Laboratory/practical/tutorial Modules:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them for developing a holistic view so that basis for professional ethics can be established. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the instructor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the instructor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.
Scenarios may be used to initiate discussion. Observations and their analyses are shared and discussed among all students, in a group sitting. Indicative plan of fourteen tutorials is as follows: Differentiating the notions of Preconditioning, Sensation and Natural Acceptance; Notions of Happiness; Case study of current economic activities and associated expectations of humans through the short video "story of stuff"; Self-awareness through the list and analysis of individuals desires; Self-awareness and individuals role in ensuring the healthy condition of the body; Self-assessment of our status of prosperity; Appreciation of impact of individual behaviors on others through short movie "Right Here Right Now"; Observing the feeling of gratitude; Discussion through short movie "Economics of Happiness" for understanding the role in localization and globalization; Discussion through short movie "Swaraj in Hiware Bazar" for appreciating the possibility of transformation through relationship; Discussion through short movie "An inconvenient truth" for understanding the role of humans for mitigation of global warming; Discussion on the role of students for improving the status of justice in the institute and asking them to make a framework; Discussion on role of students for improving the economic sustainability of the institute; Discussion on role of students in reducing the carbon emissions impact of the institute; Differentiating the internal and external sources of happiness.

3. **Text books:**

R.R. Gaur, R. Asthana and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics. 3rd Revised Edition, 2023, UHV Publications, UHV Foundation, Delhi, Printed by PHI, 27 Pace City 1, Sector 37, Gurgaon (Haryana) 122001 ISBN: 978-81-957703-7-3

W. R. Bowe, Engineering Ethics: Outline of an Aspirational Approach, Springer, 2009, ISBN: 978-1-84882-223-8.

P. A.Vesilind, Engineering Peace and Justice: The Responsibility of Engineers to Society, Springer, 2010, ISBN:978-1-84882-673-1.

References:

C.E. Harris,M. S. Pritchard and M. J. Rabins, Engineering Ethics: Concepts and Cases, 4th Ed., Cengage Learning, 2009, ISBN:978-0-495-50279-1.

G. D. Baura, Engineering Ethics: An Industrial Perspective, Academic Press (Elsevier), 2006, ISBN:978-0-12-088531-2.

J. Lucena, Engineering Education for Social Justice: Critical Explorations and Opportunities, Springer, 2013, ISBN: 978-94-007-6349-4

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

NA

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

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

NA

Approvals:

Faculty interested in teaching this course: –
Atul Dhar, Dr Rajneesh Sharma, Dr Sarthak Nag, Dr. Parmod Kumar, Dr. Suryaprakash Upadhyay

Proposed by: Dr. Atul Dhar **School: SMME**

Signature: Atul Dhar **Date:** 9/5/2024

The following faculty (at least 3 faculty) discussed on……09/05/2024……..and approved the proposal on……09/05/2024……

S. No	Faculty Name	Signature
1	Dr Atul Dhar	Atul Dhar
2	Dr Parmod Kumar	Parmod
3	Dr Rajneesh Sharma	
4	Dr Suryaprakash Upadhyay	email attached.

School Chair: Dr Atul Dhar Atul Dhar

School: SMME

Date: 9/5/2024

This proposal is reported in ……..the Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Atul Dhar <add@iitmandi.ac.in>

Feedback Request on new course proposal on "consciousness and professional ethic

Dr Atul Dhar <add@iitmandi.ac.in>
To: Surya Prakash Upadhyay <surya@iitmandi.ac.in>
Cc: Parmod Kumar <parmod@iitmandi.ac.in>, Rajnish Sharma <rsharma@iitmandi.ac.in>, Sarthak Nag <sarthak@iitmandi.ac.in>, Raj Kiran <raj@iitmandi.ac.in>
Thu, May 9, 2024 at 10:36 AM

Dear Dr. Surya,
Thanks for your input. I have slightly edited the preamble.
The revised version is attached.

Rgds,
Atul

On Thu, May 9, 2024 at 8:47 AM Surya Prakash Upadhyay <surya@iitmandi.ac.in> wrote:

> Dear Dr. Atul
>
> I have gone through the content of the course and find it very interesting. Just a small suggestion, we can modify the preamble or Introduction so that it become more appealing and attractive.
>
> Wishes
> Surya
>
> On Wed, 8 May, 2024, 7:17 pm Dr Atul Dhar, <add@iitmandi.ac.in> wrote:
>
> > Dear Colleagues,
> > Please give your input for the improvement of this course by 09 May 2024.
> >
> > Rgds,
> > Atul

Proposal for GEXX Engineering Ethics.docx
24K

Atul Dhar <add@iitmandi.ac.in>

Feedback Request on new course proposal on "consciousness and professional ethics

Rajnish Sharma <rsharma@iitmandi.ac.in>
To: Atul Dhar <add@iitmandi.ac.in>

Thu, May 9, 2024 at 11:38 AM

Sir
We lack a course on professional ethics and this course fills the gap. The course contents are very good and will be beneficial to the UG and PG students. This can be a departmental elective for civil and mechanical engineering students.

Regards
HK
Rajneesh
[Quoted text hidden]

8-5-24

IIT Mandi

Proposal for a New Course

Course number : **GE522**
Course Name : **Entrepreneurship and Technology Commercialization**
Credit Distribution : *3-0-2-4*
Intended for : **UG and PG students**
Prerequisite : **None**
Mutual Exclusion : None

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1. Preamble:

In an age defined by innovation, the course "Entrepreneurship, Technology Commercialization & Intellectual Property" is a beacon for aspiring millennial entrepreneurs, it uniquely equips them with the strategic fusion of entrepreneurial acumen, technology commercialization skills, and intellectual property insights. As we witness a surge in millennial interest in entrepreneurship, this course is an indispensable guide to fostering creativity, business acumen, and ethical innovation.

2. Course Modules with quantitative lecture hours:

Module No	Details	Hours
1	Introduction, 4Ps of Entrepreneurship, S3: Entrepreneurship and Innovation in Today's Technological Environment, Technology Disruption	6
	Societal Problems – opportunity recognition ((hands-on exercise), Value Proposition- Business Models - & Business Canvas, Failure – Friend or Foe, learning is a habit T	6
2	Building Your Team (hands-on exercise), First steps towards commercialization, Building Your Minimum Viable Product (self-reflection exercise) (Mahesh leaves, Sanjay arrives)	6
	Organizing The Business Entity (Finance and Management) Critical Career Junctures for Founders and Early Employees Recruiting and Managing The Young Venture's Workforce	6
	Raising Venture Capital, Negotiating with Angels for Early Financing, Equity as Compensation	6
3	Exit Strategy: Selling The Hi-Tech Venture, Introduction to Patents and Intellectual Property, Conditions for Patentability ("New and Useful"), Comparison of Patent Law of India and other Countries	6
	Obtaining A Patent – The Process and The Challenges, Patent process – a demonstration, Other Forms of Intellectual Property	6

Laboratory/practical/tutorial Modules:

Team presentation on their ideas, Working with IIT Mandi Incubation Center, Team projects – Guidance for independent work by student team, Student teams work independently – with touchpoints with faculty via office hours, Final presentation (longer session -all teams -besides lead instructors others from IIT mandi to be invited)

3. Textbooks:

1. Entrepreneurial Finance: Strategy, Valuation, and Deal Structure by Janet Kilholm Smith, Richard L. Smith, and Richard T. Bliss
2. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist by Brad Feld and Jason Mendelson
3. Financial Management for Entrepreneurs by Philip Adelman and Alan M. Marks
4. The Business of Venture Capital: Insights from Leading Practitioners on the Art of Raising a Fund, Deal Structuring, Value Creation, and Exit Strategies by Mahendra Ramsinghani

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.	None	NA	NA	

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

Not Applicable

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: Prof. Raj Dave **School: SMME**
Dr. Satavsheel Powar

Signature: **Date: 20th January 2024**

The following faculty (at least 3 faculty) discussed on …… (New course) and approved the proposal on ……...

Sl. No.	Faculty Name	Signature
1	Dr. Atul Dhar	
2	Dr. Gajendra Singh	
3	Dr. Mrityunjay Doddamani	

School Chair:

School: School of Mechanical and Materials Engineering (SMME)

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

8-5-24

IIT Mandi

Proposal for a New Course

Course number	**: GE523**
Course Name	**: Startup Framework: Finance, Valuation, and Structure**
Credit Distribution	**:** *3-0-0-3*
Intended for	**: UG and PG students**
Prerequisite	**: None**
Mutual Exclusion	: None

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1. Preamble:

(Maximum of 100-120 words) All the text will be in Times New Roman, 12 pt, single spacing, and emphasis can be made through bold/Italics, No different fonts or sizes allowed)

This course delves into the financial aspects of entrepreneurship, providing students with a solid understanding of the complexities of startup financing, company valuation, structuring, and shareholding dynamics. Students will be equipped to make informed decisions about funding, valuing, and structuring their ventures through hands-on learning and real-world examples.

2. Course Modules with quantitative lecture hours:

Unit 1: Structuring and Business: Introduction to company Structures, Overview of various company structures, Explanation of legal and financial implications of each type **(2 Hours)**

Unit 2: Shareholding and Equity Distribution: Understanding basics of equity, shares, and stock options, Allocating equity between co-founders, employees, and investors, Fair equity distribution and common pitfalls, Vesting Schedules and Cliff Periods, Legal protections for different stakeholders, Implications of shareholding structure on company control and decision-making **(8 Hours)**

Unit 3: Company Valuation & Financial Forecasting: Introduction to Valuation Concepts, Factors Influencing Valuation, Approaches to Valuation: Income, Market, and Asset-based, Projecting Income Statements, Balance Sheets, and Cash Flows. Cash flow

estimation, assumptions of cash flow estimations, and financial models specific to different industry types **(12 Hours)**

Unit 5: Startup Financing Strategies: Self-financing and Bootstrapping, External Funding: Grant funding, Government Schemes, Angel Investors, Venture Capital, Crowdfunding, IPO, Private Equity, Pros and cons of teach type of funding, Understanding Term Sheets and Negotiation, Discussion on various funding options and their suitability **(10 Hours)**

Unit 6: Exit Strategies: Understanding and Designing Shareholder Agreements and Contracts, Key Clauses in Shareholder Agreements and their Implications, Best Practices and Common Pitfalls, Role and Significance of Promoter Shares in a Company, Exit Strategies and Liquidation Preferences, Overview of Various Exit strategies (IPOs, Mergers, and Acquisitions), Impact of exit strategies on company valuation and shareholder value **(10 Hours)**

Laboratory/practical/tutorial Modules:

3. Textbooks:

1. Entrepreneurial Finance: Strategy, Valuation, and Deal Structure by Janet Kilholm Smith, Richard L. Smith, and Richard T. Bliss
2. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist by Brad Feld and Jason Mendelson
3. Financial Management for Entrepreneurs by Philip Adelman and Alan M. Marks
4. The Business of Venture Capital: Insights from Leading Practitioners on the Art of Raising a Fund, Deal Structuring, Value Creation, and Exit Strategies by Mahendra Ramsinghani

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.	None	NA	NA	

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

Not Applicable

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: Satvasheel Powar **School: SMME**

Signature: **Date: 20th January 2024**

The following faculty (at least 3 faculty) discussed on ..... (New course) and approved the proposal on .....

Sl. No.	Faculty Name	Signature
1	Dr. Atul Dhar	
2	Dr. Gajendra Singh	
3	Dr. Mrityunjay Doddamani	

School Chair:

School: School of Mechanical and Materials Engineering (SMME)

Date:

This proposal is reported in .....th Board of Academics on .....

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi

Proposal for a New Course

Course number : **GE521**
Course Name : **Essentials of Entrepreneurship**
Credit Distribution : *3-0-0-3*
Intended for : **UG and PG students**
Prerequisite : **None**
Mutual Exclusion : None

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1. Preamble:

Building a sustainable and/or scalable business requires understanding of wide range of concepts, frameworks, and business strategies. While technological changes and forces in the business environment keep rendering many theoretical frameworks redundant, understanding of certain basics principles is a must. First-generation entrepreneurs need to learn rules of the fame so to not reinvent the wheel. The course will address elementary issues relating to idea screening, business models, marketing, handling money, and team building. The course is designed to inculcate an understanding of the theory and practice of entrepreneurship among students of varied disciplines so they can consider entrepreneurship as a career option and/or develop an understanding of the nature of entrepreneurship, driving forces of new venture success, and challenges that face entrepreneurs with new ventures.

2. Course Modules with Quantitative Hours:

Module 1: Entrepreneurship Concepts [4 Hours}
Understanding nuances of being an entrepreneur: Difference between a startup venture and small business: Identifying entrepreneurial styles

Module 2: Idea/Problem and Customer [12 hours]
Identifying problems worth solving, identifying business opportunities, methods for problem interviews: Design thinking process" Generation of potential solutions: Identifying customer segment and early adopters, the difference between a consumer and a customer, craft your value proposition, outcome-driven innovation, testing out solutions for the problem: Unique value proposition

Module 3: Business Model Validation [12 hours]
Basic lean approach and canvas, types of business models, documenting business plan with a lean canvas, documenting hypotheses: Introduction to risks: Develop solution demos: The problem-solution test, solution interviews, sizing the **opportunity**, building a minimum viable product: The product-market fit test: Revenue streams: How companies with different business models earn money: Understanding income, costs, gross and net margins: Identifying primary and secondary revenue stream: Costing and pricing: How to finance your business idea: Financing your venture at different stages, what investors expect from you: Various sources of funding and pros & cons of each

Module 4: Building a resourceful team [4 hours]
Shared leadership model, the role of a good team in a venture's success, what to look for in a team, define clear roles and responsibilities; How to pitch to candidates to attract to join your team, explore collaboration tools and techniques – brainstorming, mind mapping; Kanban board

Module 5: Marketing, Sales and Support [10 hours]
Understanding the difference between product and brand and the link between them; Product/service positioning; Channels and strategies, budgeting and planning; Sales planning, target setting; Unique sales proposition (USP); follow-up and closing sale: Planning and racking, the importance of project management to launch and track progress; Understanding time management, workflow, the delegation of tasks; Business regulations of starting and operating a business; Documentation, how to find help to get started; Various government scheme

3. Textbooks:
4. Reference
5. Similarity content declaration with existing courses
6. Justification for new course proposal if cumulative similarity content is> 30%

Indian Institute of Technology Mandi

Annexure L

IIT Mandi
Proposal for a New Course

Course number : MA211
Course Name : Ordinary Differential Equations
Credit : 3-1-0-4
Distribution : ***L-T-P-C***
Intended for : B. Tech 2nd Year (MnC) and optional for other branch of students
Prerequisite : **IC113, IC115**
Mutual Exclusion : **MA513 course from SMSS is not allowed to credit by the students after or along with this course**

1. **Preamble:** Differential equations are very important field in terms of applications as well as theory. This course introduces techniques for solving ordinary differential equations. First unit is basically on methods of solving. The next section "existence and uniqueness" is important especially when there is no way to solve a given differential equations. Other two units are focused on systems of differential equation and second order differential equations, which arises while modeling several physical and natural processes.

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

General Overview of Ordinary Differential Equations; Solutions methods to solve the first, second and higher order ordinary differential equations; Power Series methods, with properties of Bessel differential equations and Legendre differential equations. [12 Hours]

Existence and Uniqueness of solutions for Initial Value Problems: Picard's and Peano's Theorems, Gronwall's inequality, continuation of solutions and maximal interval of existence, continuous dependence. [14 Hours]

Algebraic properties of systems of differential equations, the eigenvalue-eigenvector method of finding the solutions of linear systems, Complex eigenvalues, Equal eigenvalues, Fundamental matrix solutions, Wronskian, Matrix exponential, Nonhomogeneous equations, Variation of parameters, Stability theory for linear and nonlinear systems, Lyapunov stability. [16 Hours]

Laboratory/practical/tutorial Modules: 1Tutorial in a week.

3. Text books:

a) Ahmad, S. Rao, M.R.M., Theory of ordinary differential equations with applications in biology and engineering, EWP publication,

b) L. Perko, Differential Equations and Dynamical Systems, Texts in Applied Mathematics, Vol. 7, 2nd ed., Springer Verlag, New York, 1998.

4. References:

1. Devaney, R., Hirsch, M. W. and Smale, S., Differential Equations, Dynamical Systems, and an Introduction to Chaos (2nd Edition), Academic Press, 2003.
2. Birkhoff, G. and Rota, G.-C., Ordinary Differential Equations, wiley, 1989
3. R. P. Agarwal and D. O. 'Regan, An Introduction to Ordinary Differential Equations, Springer- Verlag, 2008.

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.	Complete Syllabus	MA513	Complete Syllabus	85%

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

This course is for the B. tech 2nd year students of Mathematics and Computing as a core course.

Approvals:

Faculty interested in teaching this course: – Dr. Muslim Malik, Dr. Syed Abbas, Dr. Rajendra Kr Ray and Dr. Nitu Kumari

Proposed by: Dr. Muslim Malik **School: SMSS**

Signature: **Date: 14th May 2024**

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on……..

Sl. No	Faculty Name	Signature

School Chair: Dr. Muslim Malik

School: SMSS

Date: 14-5-2024

This proposal is reported in 54th Board of Academics on 14th May 2024……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers: Reviewed by the committee proposed by SMSS

IIT Mandi
Proposal for a New Course

Course number : MA210
Course Name : Real and Complex Analysis
Credit Distribution : *(2.5-0.5-0-3)*
Intended for : B. Tech. in Mathematics and Computing, 2nd Year Students
Prerequisite : IC-112, IC-113
Mutual Exclusion : (None)

1. Preamble:

The course starts with the concept of supremum and infimum, countable and uncountable sets, which are important part of the foundation of real analysis. The concepts like open sets, closed sets, interior points, limit points, compact sets in the Euclidean space will be covered in unit1. Unit 2 starts with the introduction of metric space which generalizes the notion of Euclidean distance in an arbitrary set. Also topics like convergent sequences, completeness, continuity of functions and compact sets etc, in metric spaces will be covered. In unit 3, Riemann integration theory will be discussed. Unit 4 aims at equipping the students with knowledge in the following topics of complex analysis- Power series, Laurent series, Classification of singularities, Residue theorem etc. In unit 5, we will cover Mobius transformation, Maximum Modulus theorem, Liouville's theorem.

2. Course Modules with quantitative lecture hours:

Unit 1: Analysis on R^n: Supremum and infimum property of the real number system**,** Countable and uncountable sets, Interior points and limits points, Closure of a set, Open sets and closed sets in R^n, Bolzano-Weierstrass theorem, Compact sets in R^n,

[7 Lectures]

Unit 2: Metric space: Definition of a metric space, Examples, Open and closed sets in a metric space, Dense sets, Compact sets, Convergent sequences in a metric space, Complete metric spaces, Continuous functions between two metric spaces, Continuous functions on compact sets, Uniform continuity and uniform convergence in a metric space, Connectedness. [10 Lectures]

Unit 3: Riemann integral: Definition of Riemann integral, Examples of Riemann integrable and non-Riemann integrable functions, Some properties of Riemann integral, Continuous functions and Riemann integrability, Fundamental theorem of calculus.

[4 Lectures]

Unit 4: Complex Analysis: Branch points and branch cuts, Radius of convergence of a power series, Taylor's series and Laurent's series, Classification of singularities, Poles, Picard's theorem, Zeros of analytic functions, Residue theorem, Identity/uniqueness theorem.

[7 Lectures]

Unit 5: Complex (continues): Mobius transformations, Poisson integral formula, Maximum modulus theorem, Liouville's theorem, Statement of uniqueness theorem for Dirichlet problem. [4 Lectures]

3. Text books:

1. **Apostol, Mathematical Analysis, 2nd Edition.**
2. ***E. Kreyszig, Advanced Engineering Mathematics, 10th Edition.***

4. References:

1. **R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 4th Edition, Wiley.**
2. **R. V. Churchill and J. W. Brown, Complex Variables and Applications, 9th Editions, 2021.**
3. ***S. Ponnusamy, Foundations of Complex Analysis, 2nd Edition, Narosa, 1995.***

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.	Riemann integration	IC-113	1 Hours	~3.12%
2.	Singularity, Residue theorem	IC-113	4 Hours	~12.5 %

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

Approvals:

Other Faculty interested in teaching this course: – Prof. Syed Abbas, Dr. Muslim Malik, Dr. Qaiser Jahan, Dr. Samir Shukla, Dr. Sampat Kumar Sharma.

Proposed by: Dr. Saswata Adhikari **School: SMSS**

Signature: **Date: 16. 04. 2024**

Recommended/Not Recommended, with Comments:

_____ Date:_____

Chairperson, CPC

Approved / Not Approved

_____ Date:_____

Chairperson, BoA

Indian Institute of Technology Mandi

IIT Mandi
Proposal for a new Course

Course name : Data-driven Dynamical Systems
Course code : MA570
Credits : 2.5-0-0.5-3
Prerequisites : Differential Equations, Linear Algebra, Statistics, Basic programming Skills
Intended for : M.Sc. / BTech / MTech/ PhD (SMSS)
Elective and Core: Elective for MSc (All branches), PhD (All branches), MTech (All branches),B. Tech (2nd year, 3rd year and 4th year, All branches)
Semester : Any semester
Mutual Exclusion :

1. Preamble:

This course will provide a comprehensive introduction to data-driven dynamical systems and its applications. Students will gain hands-on experience in modeling of dynamical systems using data-driven approaches. This course will first discuss the fundamental concepts in Machine Learning that will be used to model Dynamical Systems based on Data. Further, it will discuss fundamentals of neural network that will be used to understand and study data driven dynamical systems. It is useful for students and researchers in mathematics, engineering, physics and other related fields. By the end of this course, students will have a very good understanding of data-driven dynamical systems and be able to apply these techniques to study real-world problems.

2. Course Modules with Quantitative lecture hours:

1. **Dimensionality reduction and transformations (8 hours)**
   Pseudo-inverse, least-squares, regression, singular value decomposition (SVD), principal component analysis (PCA), Discrete Fourier Transform, Fast Fourier Transform, Transforming Partial differential equations.

2. **Basics of machine learning (8 hours)**
   Basic definitions, Types of learning: Supervised learning and Unsupervised learning, Linear regression, Nonlinear Regression and Gradient Descent, Over and Under-Determined Systems, Least-Squares Fitting Methods, The Pareto Front, Model Selection: Cross-Validation, Model Selection: Information Criteria.

3. **Basics of neural networks (8 hours)**
   Perceptron, single-layer neural networks, multilayer neural networks and Activation Functions, Backpropagation, Neural networks for Dynamical Systems – Recurrent Neural Networks, Genenerative Adversarial Networks (GANs)

4. **Data Driven Dynamical Systems (11 hours)**
   Overview, motivations, and challenges, Dynamic mode decomposition (DMD), Sparse identification of nonlinear dynamics (SINDy), Koopman operator theory, Data-driven Koopman analysis, Model Reduction and System Identification.

3. **Lab Components:** Singular value decomposition (SVD), principal component analysis (PCA), Linear regression, Least-Squares Fitting Methods, Single-layer linear neural network, neural networks for dynamical systems, DMD, Sparse identification of nonlinear dynamics and theirvariants. **(7 hours)**

4. **Textbooks:**
   1. Strang, Gilbert. Linear algebra and learning from data. Vol. 4. Cambridge: Wellesley-Cambridge Press, 2019.
   2. C.M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
   3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, MIT Press, 2016.
   4. Vega, J.M. and Le Clainche, S. Higher Order Dynamic Mode Decomposition and its Applications, Academic Press (Elsevier), 2020

5. **References:**
   1. Tom Mitchell, Machine Learning, First Edition, Mc-Graw Hills, 1997.
   2. Mauroy, A., Susuki, Y. and Meizic. Koopman Operator in Systems and Control, Berlin Springer, 2020

6. Similarity content declaration with existing courses:

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

S.No.	Course code & Title	Similarity Content	Approx. % of content	Remarks
1	EE 522 Matrix theory	Pseudo-inverse, least squares, regression, SVD, PCA	10%	Included as the pre-requisite for current course
2	CS 671 Deep Learning and its applications	Some of The Introductory material: Perceptron, single-layer neural networks, multilayer neural networks and Activation Functions, Backpropagation, and some parts of module-2	25%	Mainly offered for BTech and MS/PhD in CSE/EE
3.	CS 669 Pattern Recognition	Principal Component Analysis, Perceptron	10%	Intended for CSE BTech only
4.	MA 550 Statistical Data Analysis	Regression	5%	Prerequisite for current course

7. Justification for new course proposal if cumulative similarity content is > 30%.

Similarity with the other courses is less than 30%. So, no Justification is provided.

Approvals:

Other Faculty interested in teaching this course: – Nil

Proposed by: Dr. Nitu Kumari School: SMSS

Signature: Date: 16. 04. 2024

This proposal is reported in 54th Board of Academics on 14th May 2024

Recommended/Not Recommended, with Comments:

_____ Date: _____

Chairperson, CPC

Approved / Not Approved

_____ Date: _____

Chairperson, BoA

Annexure M

IIT Mandi Proposal for a New Course

Course number	**:** BY528
Course Name	**:** Sensory Biology
Credit Distribution	**:** *3-0-0-3*
Intended for	**:** B.Tech, M.Tech and Ph.D.
Prerequisite	**:** IC136 or equivalent /or consent of faculty instructor.
Mutual Exclusion	**:** None

1. **Preamble:** Sensory systems are complex networks present in living organisms, whose functions requires specialized peripheral cells and neural circuits dedicated to detecting and processing various environmental stimuli. It is responsible for perceiving the surroundings and reacting appropriately to external stimuli, as well as maintaining homeostasis. Nobel prize have been awarded for in-depth understanding of senses like vision (Ragnar Arthur Granit, Haldan Keffer Hartline and George Wald, 1965), smell (Richard Axel and Linda B. Buck, 2004), hearing (Georg von Békésy,1961), and touch (Ardem Patapoutian, David Julius, 2010).

   This course offers an overview of the biology of sensory systems, with a particular focus on the human sensory system. The curriculum covers the anatomy and physiology of the major sensory systems, the mechanisms of sensory transduction, and the neural processing of sensory information. The course also delves into the functional significance of the sensory system in both human and non-human organisms, as well as the common diseases associated with it and the tools used for studying and manipulating sensory systems. Additionally, there will be a brief introduction to non-living, nature-inspired electronic equivalents of human senses. This course could be appropriate for students interested in pursuing careers in biology, neuroscience or related fields. It may also be of interest to students interested in the medical or engineering applications of sensory biology.

I. **Module 1 (6 hours)**
Introduction to the Sensory System: Overview of sensory systems in living organisms. Types of sensory stimuli (e.g., light, sound, touch, taste, smell) in humans and non-human organisms (eg. plants, insects, fishes, bacteria, fungi etc.).

II. **Module 2 (8 hours)**
Anatomy of the Sensory System: Human brain anatomy with a focus on sensory lobes. Structure and function of the major sensory organs (e.g. eyes, ears, skin, tongue, nose). Cells and tissues involved in the sensory system and their properties. Neural pathways for transmitting sensory information to the brain.

III. **Module 3 (8 hours)**
Neuron and Action potential: Basic cell biology of neuron. The process of converting sensory stimuli into electrical signals. Sensory receptor cells and their properties. Molecular mechanisms of sensory transduction. Sensory adaptation and plasticity.

IV. **Module 4 (8 hours)**

Functional Significance of the Sensory System: Evolutionary origins and adaptive significance of sensory systems, sensory ecology and behavior, sensory system disorders and diseases.

V. **Module 5 (8 hours)**

Research and Applications of Sensory Biology: Tools for studying and modulation of sensory systems.

VI. **Module 6 (4 hours)**

Electronic equivalent of human senses: Bioinspired electronics for artificial sensory systems.

2. Textbook:

I. "Principles of Neurobiology" By Liqun Luo, published by Garland Science, ISBN- 9780815344940. https://web.math.princeton.edu/~sswang/Principles-of-Neurobiology.pdf

3. References:

I. "Principles of Neural Science" by Eric Kandel, James Schwartz, and Thomas Jessell
II. https://openstax.org/books/biology/pages/36-introduction
III. Related journal articles.

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.	Cell Biology and Physiology	BE201	Cell biology	2%
2.	Anatomy and Physiology	BE501	Brain anatomy and basics of nervous system.	5%
3.	Cell Physiology in Health and Diseases	BY511	Neurophysiology	5%

5. 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.	Cell Biology and Physiology	BE201	Cell biology	2%
2.	Anatomy and Physiology	BE501	Brain anatomy and basics of nervous system.	5%
3.	Cell Physiology in Health and Diseases	BY511	Neurophysiology	5%

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

Faculty interested in teaching this course:

Proposed by: Dr. Baskar Bakthavachalu
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

IIT Mandi Proposal for a New Course

Course number : **BY530**
Course Name : **Advanced Cell and Molecular Biology**
Credit Distribution : **3-0-0-3**
Intended for : Core for M.Tech Biotechnology and elective for B.Tech, M.Sc/M.Tech and PhD candidates
Prerequisite : IC136 - Understanding Biotechnology & its Applications or Consent of faculty member
Mutual Exclusion : NA

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1. Course objective: Cells are the fundamental units of the body and the major goal of this course is providing an introduction to the experimental methods that scientists have used to discover the mechanisms by which cells, at molecular level, control their specific functions, growth and differentiation into specialised tissues. Significant emphasis will be on the fundamentals of cell biology and to develop skill sets for reading and understanding scientific literature and to interpret experimental data.

2. Course Modules (42 total hours)

Module 1 [6 hrs]
INTRODUCTION

A tour to Cell: Exploring Eukaryotic, animal and plant cells; cell compartments, their structure and function. Introduction to DNA, RNA and Proteins. Replication and hereditary. Epigenetics, transcription, and translation and their regulatory mechanisms.

Module 2 [4 hrs]
CELL CYCLE

Eukaryotic cell cycle: Biochemical and genetics studies on cell cycle; mechanisms regulating mitotic events; meiosis - a special type of cell division; cell birth, lineage and death: Asymmetrical cell division, patterns of stem cell division; Biological description of apoptosis; Molecular basis of cancer, oncogenes and tumor suppressor genes.

Module 3 [12 hrs]
CELL SIGNALLING, MEMBRANE TRANSPORT and TRAFFICKING

Membrane structure, function and models; evolution of different membrane lipids, Membrane proteins and their functions, Membrane carbohydrates and their roles in cell-cell recognition; The permeability of the bi-layers: transport proteins; Passive, active and co transport by antiporters and symporters, transporter proteins in plant vacuoles exocytosis and endocytosis Cell signalling and transport across cell membranes: Signalling molecules and cell surface receptors; intracellular signal transduction; G protein coupled receptors; plant growth factors and hormones-auxins, gibberlines, cytokines and others passive and active transport; transport into prokaryotic cells; endocytosis, exocytosis; entry of viruses and toxins into cells. Membrane trafficking: Translocation of secretory proteins across the ER membrane; protein modifications, folding and quality control in the ER; export and sorting of proteins to mitochondria, chloroplast and peroxisomes.

Module 4 [12 hrs]
GENE MANIPULATION AND ITS APPLICATIONS

A tutorial on Software and online/freeware tools for analyzing DNA sequence and virtual cloning. PCR and variations of PCR. DNA manipulative enzymes (polymerases, DNA modifying enzymes, nucleases, ligases, etc.) and their molecular biology applications. Different kinds of cloning vectors, cloning and expression vectors, (bacterial, plant and animal vectors, viral vectors etc.). Cloning techniques: Traditional (restriction digestion/ligation) cloning and its variations with use of linkers and adaptors. PCR cloning, multi fragment cloning techniques (Golden gate assembly, infusion cloning, Gibson assembly, etc.). Techniques for selection and screening of clones. Methods for gene and genome manipulation (eg. RNAi, CRISPR etc) Applications of Genetic Engineering in Biotechnology (Therapeutic hormones/proteins, protein and RNA vaccines, Synthetic food, GM plants etc.).

Module 5 [8 hrs]
MOLECULAR TECHNIQUES FOR GENE EXPRESSION ANALYSIS

Introduction to chromatin organization and regulation. Techniques to study replication and transcription (eg. replication labeling, NGS, ChIP, ATACseq, 3D chromatin techniques, etc.), and translation (eg. reporter assays, Gel shift/EMSA, ribosome profiling etc.).

3. Text books:

1. Molecular Cell Biology, by Lodish et al (5th edition or recent), W.H. Freeman and Company, New York
2. Molecular Biology of the Cell, by Alberts et al (4th edition or later), Garland Sciences, New York

4. References:

Gene Cloning and DNA Analysis: An Introduction (8th edition), by T. A. Brown, Wiley-Blackwell

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

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

Faculty interested in teaching this course:

Proposed by: Dr. Baskar Bakthavachalu and Dr. Trayambak Basak
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

IIT Mandi Proposal for a New Course

Course number : **BY531**
Course Name : **Quantitative Biology and Data Analytics**
Credit Distribution : **3-0-0-3**
Intended for : Core for M.Tech Biotechnology and elective for B.Tech, M.Sc/M.Tech and PhD candidates
Prerequisite : IC136 - Understanding Biotechnology & its Applications or Consent of faculty member
Mutual Exclusion : NA

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1. Course objective: The course is intended to teach students how to handle and analyze biological data using basic mathematical and statistical models. The course will broadly cover useful models, algorithms, and theoretical analysis tools normally used for biological systems in numerous subfields of biology: from high-throughput sequencing to cellular imaging to population dynamics. Therefore, in this course we will be learning probability theory, linear algebra and matrices, basic calculus, dimension reduction methods, machine learning, etc. The course will include practical sessions/mini-projects using R, Python, Matlab, etc.

2. Course Modules (42 total hours):

Module 1 [4 hrs]

Introduction to statistics and probability theory (distributions, mean, standard deviations, variance, etc.), basic principles of statistical inference, statistical models, linear models, basic bayesian methods, confidence interval estimation and hypothesis testing, including P-values, significance level, power, sample size, and two types of errors.

Module 2 [8 hrs]

Linear algebra and matrices, inference for high dimensional data, distance and dimension reduction, PCA, t-SNE, etc., machine learning, and batch effects.

Module 3 [4 hrs]
Data visualization, exploratory data analysis, and robust summaries.

Module 4 [6 hrs]

Mathematical models for biological processes, basic calculus, logistic regression, bifurcation and steady state analysis in population growth models, epidemic models, and predator-prey models.

Module 5 [8 hrs]

Image processing in MATLAB: types of image - binary, grayscale, & color; image thresholding and segmentation; particle tracking, and z-stack projections.

3. Text books:

1. Quantitative Biology: Theory, Computational Methods, and Models. Brian Munsky et. al.

2. The Analysis of Biological Data (2nd edition). Whitlock, Michael C.; Schluter, Dolph. Freeman, W. H. & Company, 2014

4. References:

Data Science for Biology, Emily Ren et. al., Online materials, etc.

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

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

Faculty interested in teaching this course:

Proposed by: Prof. Tulika, Dr. Ekta Makhija, and Dr. K. Hungyo.
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

Proposal for a New Course

IIT Mandi Proposal for a New Course

Course number : **BY532**
Course Name : **Immunotechnology**
Credit Distribution : **3-0-0-3**
Intended for : Elective for B.Tech, M.Tech and Ph.D.
Prerequisite : IC136 - Understanding Biotechnology & its Applications or Consent of faculty member
Mutual Exclusion : NA

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1. Course objective: This course deals with the introduction to immunology and the use of these basics principles for the diagnosis, treatment of disease and their industrial use. It will cover the following topics: cell and organs of immune system; defining the host-pathogens interaction, major cell signaling; the immune-pathogenesis of prominent diseases, vaccine and drug designing. The course will emphasize on understanding the utility of immune reaction for the host defense and their subsequent uses as immune- therapeutics.

2. Course Modules (42 total hours)

Module 1 [8 hrs]
Introduction to immunology
Cells of Immune system, Organs of immune system, Organization of immune system, Innate and adaptive components, Clonal selection hypothesis, B and T-cell maturation, Antibody, structure, diversity and function, Complement system, Cytokines, chemokines and biological functions.).

Module 2 [6 hrs]
Immunology of the diseases
Tuberculosis, Malaria, HIV, Arthritis, Diabetes, Lupus, Cancer

Module 3 [14 hrs]
Immune diagnosis
Agglutination assays, ELISA: principles and procedures, In-house ELISA development and procedure (uses, type), Enzyme Electro immune transfer bot (EITB): principles and procedures, Lateral flow devices, Immuno fluorescence diagnostic tools: Principles and uses, ELISPOT, Flow cytometer: Principles and uses

Module 4 [3 hrs]
Immunoinformatics
Principles, tools and uses of AI and informatics in immunology

Module 5 [11 hrs]
Vaccines and therapeutics
Introduction to Vaccinology, Peptide Vaccine designing, Chimeric, Multi-epitope, RNA based Vaccine designing, Immune therapeutics, Mabs in therapeutics, Therapeutic peptides

3. Text books:

1. Kuby Immunology, Punt, Stranford, Jones, Owen

4. References:

1. Essential Immunology by Roitt, 12th edition. ISBN-13: 978-1405196833
2. Cell Physiology Source Book: A Molecular Approach by Nicholas Sperelaki ISBN: 978-0-12-656976-6
3. Molecular Biology of the Cell by Bruce Alberts, Julian Lewis, Alexander Johnson
4. Medical Microbiology, 4th edition by Editor: Samuel Baron.
5. ISBN-10: 0-9631172-1-1
6. Strachan, Tom, and Andrew P. Read. Human Molecular Genetics. 2nd ed. New York, NY: John Wiley & Sons Inc., 1999. ISBN: 9780471330615

5. 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

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

Faculty interested in teaching this course:

Proposed by: Dr. Amit Prasad
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

Proposal for a New Course

IIT Mandi Proposal for a New Course

Course number : **BY537**
Course Name : **Computational Biology-1**
Credit Distribution : **3-0-2-4**
Intended for : Core for M.Tech Biotechnology and elective for B.Tech, M.Sc/M.Tech and PhD candidates
Prerequisite : IC136 - Understanding Biotechnology & its Applications or Consent of faculty member
Mutual Exclusion : NA

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1. Course objective: This course teaches the students with the fundamentals computational biology. These are essential components for analysis of biological data and will allow student to learn the basic bioinformatics tools required to biologists. The computational biology aspects will introduce the students with additional practical skills that will allow them to handle biological data comprehensively.

2. Course Modules (42 total hours)

Module-1: **[6 hours]**

Introduction to Basic Programming

Introduction to basic scripting and programming routinely used in computational biology.

Module-2: **[2 hours]**

Biological Databases and Sequence File Formats

Introduction to different biological databases, their classification schemes, and biological database retrieval systems

Module-3: **[8 hours]**

Sequence Alignments

Introduction to concept of alignment, Scoring matrices, Alignment algorithms for pairs of sequences, Multiple sequence alignment.

Module-4: [10 hours]

Gene Prediction Methods

What is gene prediction? Computational methods of gene prediction-prokaryotic & eukaryotic.

Module-5: [12 hours]

Molecular Phylogeny

Introduction to phenotypic and molecular phylogeny. Representation of phylogeny, Molecular clocks, Methods of phylogenetic construction, statistical evaluation of the obtained phylogenetic trees.

Module-5: [4 hours]

Introduction to systems biology

Different Omics, Metabolic pathways and networks.

Lab Topics:

1. Basic Programming in Perl
2. Biological Databases
3. Biological Data file formats and their interconversion
4. Global Sequence Alignment
5. Local Sequence Alignment
6. Multiple Sequence Alignment
7. Tools for Prokaryotic Gene prediction
8. Tools for Eukaryotic Gene prediction
9. Phylognetics analsysis tools
10. Tools for pathway analysis

3. Text books:

1. Bioinformatics: Methods and Applications Genomics, Proteomics, and Drug Discovery S.C. Rastogi, N. Mendiratta, P. Rastogi (3rd Edition) PHI Learning Private Limited New Delhi (2011) ISBN 978-8120347854.
2. Bioinformatics Principles and Applications. Z. Ghosh and B. Mallick Oxford University Press. ISBN 978-0195692303.

3. Introduction to Bioinformatics. Arthur M. Lesk (3rd Edition) Oxford University Press. ISBN 978-0199208043

4. References:

Latest research articles will be advised related 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	BE304	16 hours	38%

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

Faculty interested in teaching this course:

Prof. Tulika P Srivastava, Dr. Ekta Makhija, and Dr. K. Hungyo.

Proposed by:
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

IIT Mandi Proposal for a New Course

Course number : BY533P
Course Name : Advanced Cell and Molecular Biology Lab
Credit Distribution : 0-0-2-1
Intended for : M. Tech Biotechnology
Prerequisite : NA
Mutual Exclusion : NA

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1. Course objective:

2. List of experiments (28 total hours)

- Handling cell culture
- Isolation and analysis of cell organelles
- Nucleic acids isolation, estimation, visualization.
- PCR
- Gene cloning
- Protein expression and purification
- SDS-PAGE and Westernblot

3. Text books and References:

- Relevant references will be provided by the instructor

Proposed by: Dr. Baskar Bakthavachalu and Dr. Trayambak Basak
School: Biosciences and Bioengineering

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

IIT Mandi Proposal for a New Course

Course number : BY534P
Course Name : Cellular Bioprocess Technology Lab
Credit Distribution : 0-0-2-1
Intended for : M. Tech Biotechnology
Prerequisite : NA
Mutual Exclusion : NA

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1. Course objective: This laboratory course delivers the fundamentals and practical training on handling industrial cellular strains, bioprocess principles, fermentation technology including the upstream and downstream bioprocessing. The scholars will perform hands-on experiments involving media design, optimization of growth parameters and cell growth monitoring in bioreactors, downstream product analysis and further processing. The laboratory component provides the right skills required for industrial, academic and research career.

2. List of experiments (28 total hours)

- Manual and automatic controls of bioprocessing parameters in different bioreactors
- Media design and Growth analysis of selected industrial microbes under
  - Different media components: Rich and Minimal media
  - Different reactors: Tube and Stirred tank bioreactor as batch cultivation
  - Different physiological parameters: pH/Temp/O2 levels
- Analysis and yield estimation of downstream products using various analytical platforms

3. Text books and References:

- Relevant references will be provided by the instructor

Proposed by: Dr. Shyam Kumar Masakapalli
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

IIT Mandi Proposal for a New Course

Course number : BY535P
Course Name : Analytical Biotechniques Lab
Credit Distribution : 0-0-2-1
Intended for : M. Tech Biotechnology
Prerequisite : NA
Mutual Exclusion : NA

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1. Course objective: In the rapidly evolving landscape of biotechnology, the proficiency in analytical techniques plays a pivotal role in driving innovation and facilitating accurate data interpretation. To supplement the theoretical understanding provided by the "Analytical Biotechniques" theory course, this laboratory course aimed at offering hands-on experience to students in diverse analytical methodologies. The proposed laboratory will enable students to bridge the gap between theory and practice, enhancing their skill set for a successful career in research and industry.

2. List of experiments (28 total hours)

- Experiments on the application of different spectroscopic techniques (UV Visible Spectroscopy/ Fluorescence spectroscopy/ IR spectroscopy/ CD spectroscopy)
- Experiments on the application of chromatographic techniques (Gel Filtration/Ion exchange)
- Experiments on the application of microscopic techniques (Fluorescence microscopy/ Confocal Microscopy/ Electron microscopy)
- Experiments on the application of Flow Cytometry/ELISA based techniques/Real Time PCR

3. Text books and References:

1. Principles of Fluorescence Spectroscopy, Joseph R. Lakowicz, Springer, 2006
2. An Introduction to Practical Biochemistry, Third Edition, David Plummer, 1998
3. Articles from the Journal of Chemical Education, ACS

Proposed by: Dr. Amit Jaiswal
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Indian Institute of Technology Mandi

IIT Mandi Proposal for a New Course

Course number : BY536P
Course Name : Immunotechnology Lab
Credit Distribution : 0-0-2-1
Intended for : M. Tech Biotechnology
Prerequisite : NA
Mutual Exclusion : NA

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1. Course objective:

2. List of experiments (28 total hours)

- Isolation of primary cells from blood
- Immunohistochemistry principle and uses
- Isolation and characterization of some common bacteria from human samples.
- In house ELISA for bacterial diseases
- EITB/WB for diagnosis
- qPCR for quantification of viral load
- Immunofluorescence staining technique

3. Text books and References:

Proposed by: Dr. Amit Prasad
School: Biosciences and Bioengineering

This proposal is reported in 54th Board of Academics on 14th May 2024.

Dean Academics

Date:

Annexure N

Course Name: Research Methodology for Chemistry
Course Number: CY-600
Credits: 1-0-0-1
Intended for: PhD
Semester: Odd/Even
Grading Pattern: Pass/Fail

Evaluation: Research review article (evaluated by research supervisor)

Course Preamble: The objective of this course is to learn about how to formulate research problems and communicate them at an appropriate level. Gaining the knowledge about safety and ethics in research.

Course Modules:

Unit 1: Literature Survey (3 Lectures)

Literature search *via* journals and using various search engines. Knowledge of journal abbreviations and parameters, and different publishing platforms. Citation matrices.

Unit 2: Scientific Writing, Communication, and Ethics (3 Lectures)

Structure of research paper/article/literature review. Scientific writing and presentation techniques. Ethical conduct in scientific research and knowledge of plagiarism detecting tools. Bioethics in experiments with living organisms.

Unit 3: Chemical Safety (2 Lectures)

Safety protocols in the laboratory, first aid, and emergency response procedures. Proper disposal methods for waste chemicals.

Unit 4: Data Analysis and Chemistry Software (5 Lectures)

Quantitative and Qualitative data analysis. Knowledge of data analysis software, data reliability, and validity. Exposure to various chemistry software.

Unit 5: Intellectual Property (1 Lecture)

Briefing about intellectual property, patents, copyrights, and trademarks.

References

1. Fraenkel F. J. & Warren N. E. How to Design and Evaluate Research in Education. 4th ed. New York: McGraw-Hill, 2002.
2. Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. Practical skills in chemistry 2nd Ed. Prentice-Hall, Harlow, 2011.
3. Hibbert, D. B. & Gooding, J. J. Data analysis for chemistry. Oxford University Press, 2006.
4. Levie, R. de. How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge University Press, 2001.
5. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
6. Internet resources.

IIT Mandi
Proposal for a New Course

Course number : **CY404**
Course Name : **Fundamentals of Soft Matter Science and Applications**
Credit Distribution : 3-0-0-3
Intended for : **BS**
Prerequisite : None
Mutual Exclusion : None

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1. **Preamble:** Soft materials like liquid crystals, surfactants, polymers, and soft biomaterials, are present in various aspects of our lives. Designed for beginners in the field with a basic scientific background, this course introduces and explores the study of soft matter and molecular self-assembly, covering the classifications of materials, their structure and characteristics, and applications.

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

Module 1: Introduction to Soft Matter **(7 hours)**

Definition and examples of soft matter, Self-assembly, and structures in soft matter, Intermolecular forces, and properties.

Module 2: Liquid Crystals: Chemical and Physical Aspects **(15 hours)**

Introduction and historical development of liquid crystals, Physical and structural properties, Anisotropy, Order parameter, Birefringence, Defect textures (demonstration of textures using polarizing microscopy), Alignment in liquid crystals, Classification of liquid crystals, Chirality in liquid crystals, Photoswitchable liquid crystals, Brief introduction to liquid crystal gels, colloids, nanoparticles, polymers and elastomers, Liquid crystals in biology.

Module 3: Surfactants and Amphiphiles **(7 hours)**

Micelles (cationic, anionic, and neutral, CMC determination and applications), Vesicles, Bilayers, Cylinders, Micro-emulsions, Ionic liquids, Lyotropic liquid crystals, Membranes,

Self-assembly and their phase behavior.

Module 4: Instrumentation and Characterization Techniques: (6 hours)

Polarized optical microscopy, X-ray scattering (XS): Small-angle (SAXS), Wide-angle (WAXS), Grazing incidence (GI-SAXS/WAXS), Differential Scanning Calorimetry (DSC), Rheology, Dynamic light scattering (DLS), Langmuir-Blodgett technique, Microfluidics.

Module 5: Applications in Technology and Beyond (7 hours)

Liquid crystals in displays, photonics, drug delivery, biological and chemical sensors, discotic LCs in organic opto-electronics.

3. Textbooks:

1. L. S. Hirst, Fundamentals of soft matter science. CRC press (2019).

2. J. W. Goodby, P. J. Collings, T. Kato, C. Tschierske, H. Gleeson, P. Raynes and V. Vill, Handbook of liquid crystals, (Vol. 1), John Wiley & Sons (2014).

3. P. J. Collings and J. W. Goodby, Introduction to liquid crystals: chemistry and physics. CRC Press (2019).

4. B. Bahadur, Liquid crystal-applications and uses (Volume 1), World scientific (1990).

5. R. Borsali and R. Pecora, Soft-matter characterization. Springer Science & Business Media (2008).

4. References: (Books and articles)

1. I. W. Hamley, Introduction to soft matter: synthetic and biological self-assembling materials. John Wiley & Sons (2007).

2. S. Kumar, Chemistry of discotic liquid crystals: from monomers to polymers. CRC press (2014).

3. A. A. Collyer, Liquid crystal polymers: from structures to applications (Vol. 1). Springer Science & Business Media (2012).

4. H. K. Bisoyi, and Q. Li, Liquid crystals: versatile self-organized smart soft materials. Chemical reviews, 2021, 122, 4887-4926.

5. S. W. Ula, N. A. Traugutt, R. H. Volpe, R. R. Patel, K. Yu, and C. M. Yakacki, Liquid crystal elastomers: an introduction and review of emerging technologies. Liquid Crystals Reviews, 2018, 6, 78-107.

Indian Institute of Technology Mandi

6. A. M. Lowe, N. L. Abbott. Liquid crystalline materials for biological applications. Chemistry of Materials, 2012, 24, 746-58.

7. B. R. Kaafarani. Discotic liquid crystals for opto-electronic applications. Chemistry of Materials, 2011, 23, 378–396.

8. S. Setia, S. Sidiq, J. De, I. Pani and S. K. Pal, Applications of liquid crystals in biosensing and organic light-emitting devices: future aspects. Liquid Crystals, 2016, 43, 2009-2050.

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.	NA	NA	NA

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

NA

Approvals:

Other Faculty interested in teaching this course: –

Proposed by: **Dr. Indu Bala** **School: Chemical Sciences**

Signature: **Date:**

Recommended/Not Recommended, with Comments:

_____ **Date:** _____

Chairperson, CPC

Approved / Not Approved

_____ **Date:**_____

Chairperson, BoA

Annexure P

IIT Mandi
Proposal for a New Course

Course number : PH-600
Course Name : Research Methodology
Credit : 1-0-0-1
Distribution : *L-T-P-C*
Intended for : MS/Ph.D.
Prerequisite :
Mutual Exclusion : (*RM-600 in other schools*)

1. **Preamble:** This course serves as a foundational platform, which aims to equip the physics scholars with the essential tools, skills, and mindset necessary to conduct rigorous and impactful research outcomes. For aspiring physicists, this course will be instrumental in shaping the approach towards scientific temperaments for research in the fields of physics.

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

   Unit/Topic 1: Formal communication of email and verbal, Teacher-student relationship, Technical and scientific presentation Skills **(3 Hours)**

   Unit/Topic 2: Ethics in research, Copyright and plagiarism, Interdisciplinary research work, Project management **(3 Hours)**

   Unit/Topic 3: Safety and precautions, best practices in experimental as well as simulation research **(2 Hours)**

   Unit/Topic 4: Literature Survey, Designing of the experimental and theoretical research, Data analysis and presentation **(3 Hours)**

   Unit/Topic 5: Drafting the reports, Reading and Writing research paper **(3 Hours)**

Laboratory/practical/tutorial Modules:

1. A technical presentation on the specific topic and write a report on the same topic in journal format.
2. Task on data analysis of scientific data sets.
3. Group discussions on a specific topic.

Assessment will be based on a combination of individual and group assignments, presentations, and a final research report.

3. **Textbooks:**

1. **Michael P. Marder, Research Methods for Science, Cambridge University Press, 2012.**
2. **Caroline Van Den Brul, Crackle And Fizz: Essential Communication And Pitching Skills For Scientists, Imperial College Press , 2014.**

4. References:

- E.M. Phillips and D.S. Pugh, How to get a Ph.D.? (UBSPD, New Delhi, 1993)
- The Craft of Research, by Wyne C. Booth, Colomb, William, University of Chicago Press (eBook)
- Research Methodology: A Step-by-Step Guide for Beginners, by Ranjit Kumar, Publisher: Sage South Asia (2011)
- Research Methodology, by R Panneerselvam, Publisher: Phi Learning (2009)
- Research Methodology: Methods and Techniques, by C. R. Kothari, Publisher: New Age International (2004)

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.			

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

Approvals:

Faculty interested in teaching this course: – All faculty members of School of Physical Science, IIT Mandi

Proposed by: Dr. Ajay Soni and Dr. Hari Varma **School: SPS**

Signature: **Date:**

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/center faculty on……..

Sr. No.	Faculty Name	Signature

School Chair:

School:

Date:

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

IIT Mandi
Proposal for a New Course

Course Number	: PH -530
Course Name	: Cosmology – I
Credit Distribution	: 3-0-0-3
Intended for	: UG/PG/IPhD/PhD elective
Prerequisite	: None
Semester	: Even

1 Preamble

This course aims to provide an overview of Modern Cosmology and is part 1 of a two semester course. It is expected to be helpful for a student intending to pursue research in the same. General Relativity (GR) isn't a prerequisite for this course. The relevant aspects of GR needed for this course will be discussed as and when they are needed. Though it is assumed that the interested student is familiar with tensor manipulations a bit. The course puts a strong emphasis on problem solving, either numerically or analytically.

2 Course Modules with qualitative lecture hours

Module 0: Introduction **[1 Hour]**

☐ What is Cosmology? ☐ A brief history of the Universe ❁ Cosmological eras – inflation, reheating, recombination, etc. ☐ Time and length scales involved in Cosmology ☐ What is our beloved universe made of?

Module 1: Homogeneous Universe **[14 hours]**

☐ The Cosmological Principle ☐ Geometry of the Universe ❁ The FLRW Metric ☐ Kinematics ❁ The Hubble Law ❁ Geodesics ❁ Redshift ☐ Distances ❁ Luminosity ❁ Angular Diameter ☐ Dynamics ❁ Energy Budget of the Universe ❁ Friedmann Equations ☐ Some Exact solutions ☐ Our Universe

Module 2: Hot Big Bang **[15 hours]**

☐ Thermal Equilibrium ❁ Some aspects of Statistical Mechanics ❁ Primordial Plasma ❁ Entropy and Expansion History ❁ Cosmic Microwave Background ❁ Cosmic ν Background ☐ Beyond Equilibrium ❁ The Boltzmann Equation ❁ Dark Matter Freeze Out ❁ Big Bang Nucleosynthesis ☐ More on recombination

Module 3: Cosmological Inflationary Theory **[12 hours]**

☐ Problems faced by the Big Bang Theory ❁ The Horizon Problem ❁ The Flatness Problem ❁ Superhorizon Correlations ☐ Before the Hot Big Bang ☐ The Physics of Inflation ❁ How inflation solves these problems? ❁ Slow Roll Inflation

3 Text Books & References

1. Daniel Baumann, Cosmology, Cambridge University Press, 2021
2. Scott Dodelson & Fabian Schmidt, Modern Cosmology, Academic Press, Elsevier, 2021

3.1 References

1. Steven Weinberg, Cosmology, Cambridge University Press, 2008
2. Valery Rubakov and Dmitry Gorbunov, Introduction to the theory of Early Universe, Volume 1 & 2, World Scientific, 2011
3. Luca Amendola, Cosmology Lecture Notes, University of Heidelberg, 2023
4. Viatcheslav Mukhanov, Physical Foundations of Cosmology, Cambridge University Press, 2005
5. Andrew Liddle, David Lyth, Cosmological Inflation and Large Scale Structure, Cambridge University Press, 2000

4 Similarity with existing courses

NA

5 Approvals

Faculty interested in teaching : Nirmalya Kajuri & Krishna Parattu
Proposed by : Rahul Kothari
School : School of Physical Sciences

Signature **Date:** January 23, 2024

The following external faculties provided the feedback and it was discussed among school faculty on 23 January 2024

1. Prof Roy Maartens, University of the Western Cape, South Africa
2. Prof Somnath Bharadwaj, IIT Kharagpur
3. Prof Ruth Durrer, University of Geneva, Switzerland

School Chair : Prof Suman Kalyan Pal
School : School of Physical Sciences
Date :

This proposal is reported in ... Board of Academics on ...
Dean Academics
Date:

Comments of the Reviewers

Annexure Q

IIT Mandi

Proposal for a New Course

Course number : **QS 501P**
Course Name : **Experiments in Quantum Optics**
Credit Distribution : *0-0-5-3*
Intended for : B.Tech, M.Tech, M.Sc, Ph.D.
Prerequisite : First course on Quantum Mechanics
Mutual Exclusion : None

Preamble:
The objective of the proposed lab course is to introduce the concepts of the Quantum Mechanics and Photonics to the students. The course will help the students to visualize the theoretical concepts in the lab.
Course Outline: The Lab Course includes basic Quantum Optics experiments including Fourier Optics, Quantum Eraser, 3D Projection using circularly polarized light, Interaction-Free Quantum Measurements, Quantum Cryptography Demonstration and Portable Optical Tweezers etc.

Laboratory/practical/tutorial Modules:

1. **Fourier Transform:** To demonstrate the Fourier Transform of sample images
2. **Optical Tweezers:** Demonstrate microscale particle manipulation dynamics through laser induced forces using Portable Optical Tweezers.
3. **Optical Vortices:** Demonstrate the Optical Vortices corresponding to various topological charges.
4. **Quantum Eraser:** To demonstrate the sensitivity of path information on the measurement process
5. **Polarized 3D Cinema:** Create a 3D Projection using circularly polarized light based on Real 3D Cinema Technology
6. **Bomb Tester:** Experiment on Interaction-free Quantum measurements: Testing the Bombs in Michelson Interferometer
7. **Quantum Cryptography:** Demonstration of BB84 Quantum Cryptography Protocol and detection of eavesdropper on Encrypted data

Text books:

1. Christopher Garry, Introductory Quantum Optics, Cambridge University Press, UK, 2012 (ISBN: 9780511791239)

2. Mark Fox, Quantum Optics: An Introduction, Oxford master series in Physics, UK 2006 (ISBN: 9780198566731)
3. Laboratory manual for experiments

References: NA

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.				

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

Approvals:

Other Faculty interested in teaching this course: – Prof. S. K. Pal

Proposed by: Dr C.S.Yadav **School: CQST**

Signature: **Date:**

Recommended/Not Recommended, with Comments:

_____ **Date:**_____

Chairperson, CPC

Approved / Not Approved

_____ **Date:**_____

Chairperson, BoA

Indian Institute of Technology Mandi

Annexure R

IIT Mandi
Proposal for a New Course

Course number : AR 516
Course Name : Introduction to Blockchain and Web3
Credit : 3 Credits
Distribution :L-T-P-C (3-0-0-3)
Intended for : Undergraduate (Elective)/ Postgraduate
Prerequisite : Knowledge of basic computer terminology
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course*.)

1. Preamble:

The course will outline the fundamentals of Blockchain and Web3 technologies and will provide a thorough coverage of topics ranging from Cryptocurrencies, NFT, Business Blockchain, Defi, DEX / CEX etc. The program will also introduce the programming and practical that will include some of the

2. Course Modules with quantitative lecture hours:

Course outline – Blockchain Technology Introduction (8 hours)

- ✓ What is Blockchain
- ✓ How it evolved
- ✓ Key Terminologies – Ledger, Smart Contract, Peer Network, Wallet, Hashing, Cryptography, Distributed vs Centralized Database, Blocks, Merkle Trees
- ✓ Popular Blockchain Variants – Bitcoin, Ethereum, Hyperleder
- ✓ Consensus Algorithms
- ✓ Types of Blockchain
- ✓ SideChains

Course outline – Cryptocurrency and Bitcoin Introduction (6 hours)

- ✓ Transformation of Financial Systems
- ✓ How current System Works and Related Problems
- ✓ Distributed Ledger Technology
- ✓ Bitcoin Evolution
- ✓ Bitcoin Ecosystem
- ✓ Bitcoin Clients and Wallets
- ✓ Buy and Sell Bitcoin
- ✓ Bitcoin Transaction and Structure

Course outline – Bitcoin Details and Mining Process (4 hours)

- ✓ Initiating Bitcoin Transaction
- ✓ Transaction Propagation in Distributed Network
- ✓ Role of Miners
- ✓ Block Structure of Bitcoin
- ✓ Merkle Tree Formation
- ✓ Transactions Storage in Digital Ledger
- ✓ Mining Algorithms – Proof of Work
- ✓ Consensus Algorithms
- ✓ Fraud and Hack Inversion mechanism
- ✓ Other Mining Algorithms – Proof of Stake, PBFT

Course outline – Overview of Ethereum Blockchain (6 hours)

- ✓ Introduction to Ethereum and differences from Bitcoin
- ✓ Introduction to Smart contracts and solidity
- ✓ Ethereum tools and development eco-system
- ✓ Solidity language constructs and programming examples
- ✓ Ethereum clients and Wallets
- ✓ Layer 1 – Layer 2 differences and development

Course outline – Overview of Hyperledger Fabric Blockchain (4 hours)

- ✓ Enterprise Blockchain and Linux foundation
- ✓ Architecture of Hyperledger Fabric
- ✓ Network / explorer / installation.
- ✓ Smart contract using Go / Node.JS
- ✓ Other Enterprise Blockchains

Course outline – Blockchain Applications and Hands on (10 hours)

- ✓ Industry wide applications of Blockchain / web3
- ✓ Current market size / outlook / industry trends
- ✓ Career options and research opportunities

Practical application 1 : Defi based application from finance sector
Practical application 2 : Smart contract / token based application for multiple sectors
Practical application 3: Trade Bot / AI based prediction models for Crypto.
Practical application 4: Blockchain based Gaming application.

Laboratory/practical/tutorial Modules:

3. Text books:

1. Julie EG, Nayahi JJ, Jhanjhi NZ, editors. Blockchain Technology: Fundamentals, Applications, and Case Studies. CRC Press; 2020 Nov 9.
2. Li KC, Chen X, Jiang H, Bertino E, editors. Essentials of blockchain technology. CRC Press; 2019 Nov 27.

4. References:

1. Banafa, A., 2022. Blockchain technology and applications. CRC Press
2. Laurence, T., 2019. Introduction to blockchain technology. Van Haren.
3. Kim S, Deka GC, editors. Advanced applications of blockchain technology. Berlin/Heidelberg, Germany: Springer; 2020.

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.				

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

Approvals:

Faculty interested in teaching this course: –

1. Dr. Amit Shukla
2. Mr. Anuj Garg
3. Dr. Narendra Kr. Dhar

Proposed by: Dr. Amit Shukla **School: Centre for AI & Robotics**

Signature:  **Date: 06.05.2024**

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on……..

Sl. No	Faculty Name	Signature

School Chair: **Dr. Amit Shukla**

School: **Centre for AI & Robotics**

Date: 06.05.2024

This proposal is reported in ……..th Board of Academics on ……

Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers:

IIT Mandi
Proposal for a New Course

Course number : AR 517
Course Name : **Introduction to Cyber security**
Credit : 3 credit
Distribution : ***L-T-P-C (3-0-0-3)***
Intended for : Undergraduate (Elective)/ Postgraduate
Prerequisite : Knowledge of basic computer terminology
Mutual Exclusion: (Specify the equivalent courses in other schools. These *Courses (with high similarity) are not allowed to credit by the students after or along with this course.*)

1. Preamble:

Cybersecurity plays a critical role in safeguarding digital assets, sensitive information, in additional to ensuring individual privacy and the organisation integrity. As our world becomes increasingly interconnected, the importance of cybersecurity cannot be overstated. This course is designed to provide you with a comprehensive understanding of the fundamental principles, techniques, and best practices in the field of cybersecurity and business resiliency.

2. Course Modules with quantitative lecture hours:

Domain 1: Understand the basic fundamentals of cybersecurity including asset, data protection and risk assessment and management

Domain 2: Learning cryptography, network security and the core concepts of holistic security models and architecture

Domain 3: Explore the Identity and access management ecosystems

Domain 4: Respond and mitigate cybersecurity attacks and understanding of the entire landscape

Individual Bifurcations

Domain 1: Understanding Security, Total hours – 14 Hours

Unit 1: Understanding Security Governance Principles

Types of plans: Strategic, Tactical and Operational
Understanding and Applying Security Concepts, Confidentiality (Data at Rest, Motion and in Process), Integrity (Preventing unauthorized modification) and Availability (Always available data) , Access Control Methodologies: IAAA
Understanding Risk Management: Defining Assets Threats, Vulnerabilities risk, Exposure, Breach, Countermeasures, Safeguards, Covering Risk Analysis/Assessment, Qualitative and Quantitative Process, Cost Benefit Analysis, Dealing with Risk (Concept of MATAR), Understanding Risk Frameworks, NIST 800-37 and NIST 800-53A, Control Types: Administrative, Technical and Physical, Control Methodologies or Mechanism, Threat

Modelling , Intellectual Property: Trade Secrets, Patent, Copyright and Trademarks

Defining the various DRP and BCP Plan and how they help organisation, Detailing the incident response process, and designing an Incident Response Plan workflow. Understanding ISO 27001 and ISO 22301

Unit 2: Data and Asset Management

Policies, Standards, Procedures, and Guidelines, Data classification vs categorisation, Security Roles and Responsibilities, Managing the data and asset lifecycle , Destruction, Purging, Clearing

Understanding Personal data, Information lifecycle: Creation, Store, use, Achieve and Destroy, GDPR and DORA (Digital Operational Resiliency Act)

Suggested Reading

- *Kim. D., and Solution, M.G., Fundamentals of Information System Security. Jones & Bartlett Learning, 2010*
- *Paul A. Watters, Cyber Security: Concepts and Cases, CreateSpace Independent Publishing Platform, 2012.*
- *Peter W. Singer, Allan Friedman, Cybersecurity: What Everyone Needs to Know, Oxford University Press.*
- *David Sutton, Cyber Security: A Practitioner's Guide, BCS Learning & Development • Limited, 2017*

Domain 2 : Network Security and Cryptography, Total Hours – 14

Hours Unit 1 : Understanding Security Models and Architecture

Lattice based vs Rule based, Enterprise Security Architecture, Security Frameworks i.e., Risk vs Privacy vs Security

Understanding security systems: Client and Server system, Industrial Control Systems (ICS), Cloud-based systems (e.g., Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS))

Cryptography: Understanding Plaintext, ciphertext, key, encrypt, decrypt, IV, Confusion, diffusion, work factor, Key Lifecycle and Management, methods (Symmetric and Asymmetric), Substitution vs Transposition, Hidden watermark, PKI, Hashing, Digital signature, Fundamental of Non-repudiation,
Cryptanalytic attacks: MITM, Side Channel attack, Brute Force, Ciphertext only, Known plaintext, fault injection, rainbow attack, Birthday attack

Physical Security: Control Category, Deter, Delay, Detect, Assess and Respond, Layered defence inclusive of perimeter , infra , fire detection and suppression and Building Management System (BMS)

Unit 2 : Network Security

OSI Model and TCP/IP Model
Layer 1-Layer 7 : Physical, data , network, transport, session, presentation and Application layer

Understanding the Networks:
WAN, Wireless, IP Protocols, Converged Protocols, Network Authentication Défense in Depth, Routers, switches, Bridge, proxy, Port addressing, Firewalls: Firewall Basics, Types of Firewalls, Network Address Translation Issues, Public and Private address, Ingress and Egress, Understanding Virtualisation
Remote Access: Tunnelling, Remote Authentication, Remote Access Management, IPsec Protocols, VLAN

Suggested Reading

- *Kahate, A. Cryptography and Network Security. McGraw-Hill Higher Ed., 2009.*
- *Riggs, C., Network Perimeter Security: Building Defence In-Depth, AUERBACH, USA, 2005.*
- *Northcutt S., Inside Network Perimeter Security, 2ndEd., Pearson Education, 2005.*
- *Stallings, W., Network Security Essentials: applications and standards. 3rd ed. Pearson Education India, 2007.*
- *Douglas E. Comer ,"Internetworking with TCP/IP, Principles, Protocols, and Architecture",*
- *Addison-Wesley, 5th edition, Vol 1, 2005,ISBN-10: 0131876716 | ISBN-13: 978-0131876712 .*
- *Douglas E. Comer, David L. Stevens ,"Internetworking with TCP/IP Vol. III, Client Server*
- *Programming and Applications", Addison-Wesley, 2nd edition*
- *Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill, 5th edition*

Domain 3 : Access Control, Total Hours – 6 Hours

Unit 1: Secure Design Principles

Défense of depth, principle of least privilege, Separation of duties, Need to know, Zero Trust
Management Approach: Centralised, Decentralised and Hybrid
Authorisation vs Authentication, Type of authentications, (Knowledge vs ownership vs characteristic)

Single Sign on (SSO) vs Federated Identity, Management of Authorisation mechanism: Rule based access, Role based access, DAC, ABAC, MAC, Identity and access provisioning lifecycle, Understanding Authentication system: OAuth, OpenID SAML, SPML, Remote Authentication, Kerberos, IDaas Identities

Suggested Reading

Identity & Access Management: A Systems Engineering Approach by Omondi
Orondo Cybersecurity and Identity Access Management by Bharat Rawal
Bryan and Vincent, "Web Application Security, A Beginners Guide ",McGraw-Hill, 2011 Bhavani Thuraisingham, "Database and Applications Security", Integrating Information Security and Data Management, Auerbach Publications, 2005.

Domain 4 : Security Assessment Total Hours – 8 Hours

Unit 1: Ethical Hacking and Pen Testing
Internal, External and third-party testing. Information Gathering, Vulnerability assessment, Security vulnerabilities and countermeasures.
Owasp top 10 attacks, Web server attacks: XSS attacks, CSRF Attacks

Application related attacks, Database Related attacks, SQL injection attacks, Buffer overflow attacks and Client-side browser exploits, Penetration testing, Introducing Metasploit

Social Engineering attacks, Password attacks, Privilege Escalation, ICS Related attacks, Network Infrastructure Vulnerabilities, IP spoofing, DNS spoofing, Wireless Hacking, WPA, WEP,WPA2

Unit 2 : Logging and Monitoring

IDS, SIEM, UEBA, SOAR, Threat Intelligence (Dark web vs Surface web), Log Management, Continuous monitoring, Egress monitoring, EDR, PCAP, NDR

SDLC Integrated Security: Maturity models, Software development methods, Change Management, SAST and DAST, Testing a system, Verification vs validation, Testers and Assessors (SOC1 vs SOC2 vs SOC2, Type 1 and Type 2), Metrics (KPI, KRI)

Suggested Readings

- *Jon Friedman. Mark Bouchard, CISSP. Foreword by John P. Watters. (2015) Cyber Threat Intelligence. Definitive GuideTM.*
- *Baloch, R., Ethical Hacking and Penetration Testing Guide, CRC Press, 2015.*
- *McClure S., Scambray J., and Kurtz G, Hacking Exposed. Tata McGraw-Hill Education, 6th Edition, 2009*
- *Ross J Anderson, Security Engineering: A Guide to Building Dependable*
- *Distributed Systems, 2nd Edition, Wiley, 2008.*
- *Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead,*
- *Software Security Engineering: A Guide for Project Managers, Addison Wesley, 2008*

Laboratory/practical/tutorial Modules: ***NA***

3. Text books: ***Updated with each course domains***

1. Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.

2. Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-2019.

3. Johnston, A.C. and Warkentin, M. Fear appeals and information security behaviors: An empirical study. MIS Quarterly, 2010.

4. References: ***Updated with each course domains***

1. Arce I. et al. Avoiding the top 10 software security design flaws. IEEE Computer

Society Center for Secure Design (CSD), 2014.
2. Smith, H. J., Dinev, T., & Xu, H. Information privacy research: an interdisciplinary review. MIS Quarterly, 2011.
3. Subramanian R. Security, privacy and politics in India: a historical review. Journal of Information Systems Security (JISSec), 2010.
4. Acquisti, A., John, L. K., & Loewenstein, G. What is privacy worth? The Journal of Legal Studies, 2013
5. Xu H., Luo X.R., Carroll J.M., Rosson M.B. The personalization privacy paradox: An exploratory study of decision making process for location-aware marketing. Decision Support Systems, 2011.

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.				

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

Approvals:

Faculty interested in teaching this course: –

1. **Dr. Amit Shukla**
2. **Mr. Raj Mishra**
3. **Mr. Neeraj Gupta**

Proposed by:Dr. Amit Shukla **School: Centre for AI & Robotics (CAIR)**

Signature:  **Date: 06.05.2024**

The following external faculty (at least 2 faculty) provided the feedback and it was discussed among school/centre faculty on……..

Sl. No	Faculty Name	Signature

School Chair: **Dr. Amit Shukla**

School: **Centre for AI & Robotics (CAIR)**

Date: 06.05.2024

This proposal is reported in ……..th Board of Academics on

…… Dean Academics

Date:

Note: School is responsible for the Course Code. Academic Office provides the IC Course Code.

Comments of the Reviewers: