

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



MINUTES OF 35TH BOARD OF ACADEMICS MEETING

VENUE : A-4(SC) and A-10(NC) CONFERENCE ROOM, KAMAND
DATE : 19th August, 2020 (WEDNESDAY)
TIME : 03:00 P.M.

Following members attended the meeting

Sl.No	Responsibilities	Name
1	Dean Academics	Dr. Pradeep Parameswaran
2	Associate Dean (Research)	Dr. Rahul Vaish
3	Associate Dean (Courses)	Dr. Anil K Sao
4	Chairman Library Advisory Committee	Dr. Astrid Kiehn
5	Chairman Course Proposal Committee	Dr. Kunal Ghosh
6	Course Coordinator (B.Tech.-EE)	Dr. Rahul Shrestha
7	Course Coordinator (B.Tech.-CE)	Dr. Maheshreddy Gade
8	Course Coordinator (B.Tech.-EP)	Dr. Pradeep Kumar
9	Course Coordinator (B.Tech.-M.Tech. Integrated Dual Degree in Bio-Engg.)	Dr. Shubhajit Roy Chowdhury
10	Course Coordinator (M.Tech.-(Mechanical Engg. (Energy Systems))	Dr. Pradeep Kumar
11	Course Coordinator (M.Tech.-(Structural Engg.))	Dr. Sandip Kumar Saha
12	Course Coordinator (M.Tech.-(Communication and Signal Processing))	Dr. Siddhartha Sarma I/c
13	Course Coordinator (M.Tech.-(VLSI))	Dr. Hitesh Shrimali
14	Course Coordinator (M.Tech.-(Power Electronics and Drives))	Dr. Narsa Reddy Tummuru
15	Course Coordinator (M.Tech.-Biotechnology)	Dr. Shyam K Masakapalli
16	Course Coordinator M.Sc. (Chemistry)	Dr. Chayan K Nandi
17	Course Coordinator (M.Sc.-Applied Mathematics)	Dr. Rajendra K Ray
18	Course Coordinator (M.Sc.-Physics) + (I-Ph.D. (Physics))	Dr. Ajay Soni
19	Course Coordinator (MA Dev. Studies)	Dr. Shyamasree Dasgupta
20	Nominee-1: School of Computing & Electrical Engineering	Dr. Srikant Srinivasan
21	Nominee-2: School of Computing & Electrical Engineering	Dr. Manas Thakur
22	Nominee-1: School of Basic Sciences	Dr. Nitu Kumari
23	Nominee-2: School of Basic Sciences	Dr. C.S.Yadav
24	Nominee-1: School of Humanities & Social Sciences	Dr. Devika Sethi
25	Assistant Registrar (Academics): Secretary	Mr. Vivek Tiwari

Following members could not attend the meeting

Sl.No.		Name	
1	Course Coordinator (IC Courses)	Dr. Aniruddha Chakraborty	Member
2	Course Coordinator (HSS Courses)	Dr. Suman Sigroha	Member
3	Course Coordinator (B.Tech.-CSE)	Dr. Dileep A D	Member
4	Course Coordinator (B.Tech.-ME)	Dr. Gaurav Bhutani	Member
5	Course Coordinator (B.Tech.-DSE)	Dr. Manoj Thakur	Member
6	Course Coordinator (M.Tech.- (Energy Engg. (Materials))	Dr. Sumit Sinha Ray	Member
7	Nominee-1: School of Engineering	Dr. Gaurav Bhutani	Member
8	Nominee-2: School of Engineering	Dr. Subhamoy Sen	Member
9	Nominee-2: School of Humanities & Social Sciences	Dr. Puran Singh	Member
10	Industry Member – 1	Dr. Nadeem Akhtar	Member
11	Academic Affairs Secretary		Member
12	Research Affairs Secretary		Member

Special Invitee

Sl.No.	Name	
1.	Prof. Ajit P. Annachhatre	Visiting Professor, SE
2.	Dr. Swati Sharma	Asst. Prof., SE
3.	Dr. Jinesh Machchar	Asst. Prof., SCEE
4.	Dr. Sreelakshmi Manjunath	Asst. Prof., SCEE
5.	Dr. Prosenjit Mondal	Asso. Prof. , SBS
6.	Dr. Amit Prasad	Asst. Prof., SBS
7.	Dr. Moumita Das	Asst. Prof., SCEE
8.	Dr. Ashutosh Kumar	Asst. Prof., SE
9.	Dr. Trayambak Basak	Asst. Prof., SBS
10.	Dr. Sayantan Sarkar	Asst. Prof., SE
11.	Dr. Suman K Pal	Asso. Prof. , SBS
12.	Dr. Hari Varma	Asso. Prof. , SBS

PART-A

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

35.1 Confirmation of the minutes of 34th meeting of Board of Academics:

The minutes of the 34th Board of Academics meeting held on 30th June, 2020 were confirmed.

35.2 To consider approval of courses presented by the Course Proposal Committee (CPC):

The Chairperson, Course Proposal Committee (CPC) presented ten courses for the consideration and approval of the BoA. After due deliberations, the BoA recommended all the courses with minor modifications for the consideration of the Senate and its approval. The final course proposals are placed as **Annexure - A**.

Sl. No.	Course No.	Course Title	Credits (L-T-P-C)
1	EE 540	Wide Band Gap Devices in Power Electronics Applications	3-0-0-3
2	EE 580	Network Systems: Modelling and Analysis	3-0-0-3
3	CS 451	Computer Graphics and Game Design	2-0-2-3
4	ME 515	Carbon Materials and Technology	3-0-0-3
5	CE 558	Air Pollution and Its Mitigation	3-0-0-3
6	CE 559	Biological Wastewater Treatment	3-0-0-3
7	CE 560	Soil Dynamics	3-0-0-3
8	BE 201	Cell Biology	3-0-2-4
9	BE 202	Biochemistry and Molecular Biology	2-0-2-3
10	EP 301	Engineering Mathematics-2	3-1-0-4

35.3 To consider a proposal for the admission of M.Sc. (Physics) candidates through Joint Admission Tests for Masters (JAM) from AY 2021-22 onwards:

Dr. Ajay Soni, Programme Coordinator for M.Sc. (Physics), proposed to admit the M.Sc. (Physics) students through JAM from AY 2021-22 onwards. The Board deliberated and recommended the following to the Senate for approval.

- (i) IIT Mandi would like to join JAM for admitting students for M.Sc. (Physics) from AY 2021-22 onwards.
- (ii) The minimum eligibility criteria will be as follows:
“Essential subjects in Bachelor’s degree with minimum durations: The students should have studied Physics for at least two years/four semesters and Mathematics for at least one year/two semesters.”
- (iii) The total number of seats proposed is 40 for AY 2021-22.
- (iv) The actual number admitted in each year and the reservation roster will be decided administratively.

35.4 To consider a proposal to offer new Minor programmes from SCEE:

Dr. Hitesh Shrimali made a proposal to the BoA for offering new Minor Programmes from SCEE. After due deliberations, the BoA recommended the proposal with minor changes for consideration of the Senate and its approval. The final modified proposal is placed as **Annexure – B**.

35.5 To consider modifications in the course distribution of M.Tech. in Structural Engineering Curriculum:

Dr. Sandip Saha, Program Faculty Group Chair, made a proposal to the BoA for modifications in the course distribution of M.Tech. in Structural Engineering curriculum. After due deliberations, the BoA recommended the proposed modifications for the consideration of the Senate and its approval. The final modified proposal is placed as **Annexure – C**.

35.6 To consider the Ordinances & Regulations for Master of Arts programme:

Dr. Shyamasree Dasgupta presented Ordinances and Regulations for Master of Arts programme. After due deliberations, the BoA recommended the Ordinances and Regulations with minor changes for the consideration of the Senate and its approval. The final modified document is placed as **Annexure – D**.

35.7 Any other item with the permission of the Chair.

As a measure to increase the overall research output of the Institutes in terms of Ph.D. awarded and research publications, there is a continuous demand from faculty members to increase the existing M.S./Ph.D. scholar cap per faculty. Accordingly, Dr. Rahul Vaish, Associate Dean (Research) made a proposal for increasing the number of M.S./Ph.D. students allowed for a faculty under the HTRA/External funding etc categories. The BoA deliberated the proposal in detail and suggested the following:

Present norms

3 PhD scholars including HTRA (institute funded) / Sponsored candidate like UGC/CSIR/Inspire etc., JRF/SRF) are allowed and there is no upper cap on sponsored projects funded scholars. There is no possibility of shifting the funding scheme of research scholars from sponsored projects to HTRA.

Proposed norms

6 PhD scholars (HTRA/ Government sponsored candidates like UGC/CSIR/Inspire etc., JRF/SRF) and there is no upper cap on the sponsored projects funded scholars/Part time and ERP candidates. Funding can be switched within the cap of maximum 6 PhD scholars (HTRA/Government sponsored scholars) to sponsored projects or vice versa at any time subject to the condition that the candidate is eligible for such conversion.

Rest of the guidelines will remain unchanged as per existing institute notifications.

BoA suggested that the implementation of the proposed increase in the MS/Ph.D. scholar cap can be subject to the financial and infrastructural situation of the Institute every year. BoA recommended to have a minimum period of one year working in a project before switching to HTRA or other funding options. BoA also noted that the other existing norms of allotment of MS/Ph.D. scholars to a faculty will be continued.

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


Secretary, Board of Academics


Chairman, Board of Academics



IIT Mandi

Proposal for a New Course

Course number: EE 540

Course Name: Wide Band Gap Devices in Power Electronics Applications

Credit: L-T-P-C: 3-0-0-3

Prerequisite: Power Electronics (EE 309/EE527/ EE504) or Power Semiconductor Devices (EE526) or equivalent

Intended for: UG/MS/MTech/PhD

Distribution: Elective: B. Tech III and IV year /M.S./ M.Tech / PhD

1. Preamble:

This course is designed to build up an in-depth understanding among the UG/PG students about the wide bandgap devices for power electronics applications. The major goal of this course is to familiarize the students with the properties of the wide bandgap devices and designing driver board to demonstrate the basic operating principles and their designing in PCB and thermal distribution for real world applications. Moreover, the modern designing challenges associated for high frequency power converter design by considering parasitic elements will also be presented, such as parasitic inductance and parasitic capacitance of the PCB. Power density advantages by using these devices for high power applications while operating at high operating frequency for emerging power applications are integral part of the course. Additionally, it will introduce methods of designing high frequency magnetics for high frequency operation of the power converters. Finally, the benefits of using the device in real life application will be discussed. In brief, the objective of this course is to provide a detailed understanding of wide bandgap devices and the state-of-the-art of design of power converters for real life application using these devices.

2. Course Modules with quantitative lecture hours:

Module 1: Wide band gap devices

[4 hours]

- Introduction of wide band-gap
- Vertical and lateral structures of wide band-gap devices
- Different types of the wide band gap devices
- Advantages of wide band-gap semiconductors
- Challenges in designing converters with wide band-gap devices

Module 2: Switching characteristics

[4 hours]

- Turn-on and Turn-off characteristics of the device
- Hard switching loss analysis
- Double pulse test set-up



- Module 3: Drivers for wide band-gap devices** [8 hours]
- Gate driver
 - Impact of gate resistance
 - Gate drivers for wide bandgap power devices
 - Transient immunity integrated gate drivers
 - Overcurrent protection, UVLO protection
- Module 4: Thermal management of power converters** [6 hours]
- Thermal modelling
 - Thermal management and reliability
 - Improving the performance with heatsink
- Module 5: High frequency design complexity** [4 hours]
- Effects of parasitic inductance
 - Effects of parasitic capacitance
 - EMI filter design for high frequency power converters
- Module 6: PCB designing** [4 hours]
- High frequency PCB design
 - Conventional power loop design
 - High frequency power loop optimization
 - Single and multi-layer PCBs
 - Separation of power from signal PCB
- Module 7: Power density advantages** [4 hours]
- Power density of wide bandgap devices
 - High power density power electronics converters
- Module 8: Applications of wide bandgap devices** [8 hours]
- Consumer electronics applications
 - Wireless power transfer applications
 - Electric vehicle applications
 - Renewable energy sources applications
 - Students will carry out one project based on modeling, simulation of any of the wide bandgap device in power electronics applications. This work can be extended with the practical work.



3. Text books:

1. A. Lidow, J. Strydom, M. D. Rooij, D. Reusch, GaN Transistors for Efficient Power Conversion, Wiley, 2014, ISBN-13: 978-1118844762.
2. G. Meneghesso, M. Meneghini, E. Zanoni, "Gallium Nitride-enabled High Frequency and High Efficiency Power Conversion," Springer International Publishing, 2018, ISBN: 978-3-319-77993-5.

4. References:

- A. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics," John Wiley & Sons, 2003.
- B. F. Wang, Z. Zhang and E. A. Jones, Characterization of Wide Bandgap Power Semiconductor Devices, IET, ISBN-13: 978-1785614910 (2018).
- C. L. Umanand and S. R. Bhat, "Design of Magnetic Components for Switched Mode Power Converters," John Wiley & Sons Australia, Limited, 1992.
- D. B.J.Baliga, "Gallium Nitride and Silicon Carbide Power Devices," World Scientific Publishing Company (3 Feb. 2017).
- E. L. Corradini, D. Maksimovic, P. Mattavelli, R. Zane, "Digital Control of High-Frequency Switched-Mode Power Converters", Wiley, ISBN-13: 978-1118935101 (9th June, 2015).

5. Similarity Content declaration with existing courses:

S. No.	Course Code	Similarity Content	Approx. % of Content
1.	EE 526 (Power Semiconductor Devices)	Power semiconductor devices	~ 5

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

Approvals:

Other Faculty interested in teaching this course: – Dr. Narsa Reddy Tummuru

Proposed by: **Dr. Moumita Das**

School: **SCEE**

Signature: 

Date: **October 25, 2019**

Recommended/Not Recommended, with Comments:

Date: _____

Chairman, CPC

Approved / Not Approved

Date: _____

Chairman, Senate



IIT Mandi

Proposal for a New Course

Course number	: EE 580
Course name	: Network Systems: Modelling and Analysis
Credits	: 3-0-0-3
Prerequisites	: MA 512 Linear Algebra or EE 522 Matrix theory for engineers and EE509 Linear Dynamical Systems or instructor's consent
Intended for	: 3 rd / 4 th year B.Tech. (all branches), MSc., M.Tech, Ph.D.
Elective/Core	: Discipline elective for B.Tech. (EE, CSE), free elective for others
Semester	: Any

Preamble: This course serves as a first formal introduction to the broad area of networks. It uses concepts from linear algebra (introduced in MA 512/ EE 522) and graph theory to model complex networks. It touches upon some broad classes of network systems enabling students to see these systems as tractable mathematical models. Further, concepts from EE 509 Linear Dynamical Systems will be extended to study linear networks. Stability of linear and nonlinear networks will also be touched upon. This course could serve as a prerequisite for courses based on control/optimization of network systems or design of multi-agent systems, which could be of interest to students/scholars in the field of Electrical/Mechanical Engineering as well as Computer Science and Engineering.

Objective: Recent past has seen the rise of network systems that consist of diverse devices that function independently to collectively achieve an overarching goal. For example, next generation Internet, wireless sensor networks, connected vehicular networks, robot swarms, the social network. Today's engineers are required to analyse the performance, scalability and reliability of these networks, in order to achieve efficient and optimal design. This requires one to understand the underlying properties of these systems.

This course introduces the mathematical background required for understanding properties of network systems. The main components of this course are:

- Concepts in linear algebra and graph theory
- Averaging and compartmental systems
- Stability of networks

Upon completion of this course students will be able to

- i. appreciate some pivotal results from linear algebra by perceiving their implication in the context of networks.
- ii. use graph theory to model complex networks.
- iii. understand important properties of averaging systems (eg. sensor networks, opinion networks) and compartmental systems (eg. epidemiology, drug kinetics).
- iv. analyse stability of networks.



- v. view complex networks as tractable mathematical models, thereby finding their analysis and design feasible.

Modules: Topics to be covered are:

Introduction (2 lectures) Examples of networks systems, engineered (sensor & robotic networks) and natural (social & compartmental networks). Need for tools to understand and analyse these systems.

Review of Matrix theory & Graph theory (4 lectures) Jordan normal form, stochastic matrices and spectral radius, Perron-Frobenius theory. Graphs and digraphs, weighted digraphs.

Algebraic graph theory (4 lectures) Adjacency matrix, graph theoretical characterization of primitive & irreducible matrices. Elements of spectral graph theory.

Averaging systems (10 lectures) Discrete-time and continuous-time averaging systems. Consensus in averaging systems. Convergence properties. Laplacian flow. Design of weighted digraphs. Scalability, optimization. Time-varying and randomized averaging algorithms. Examples: sensor networks, opinion dynamics over social networks.

Compartmental systems (8 lectures) Positive systems and Metzler matrices. Compartmental matrices. Dynamic properties. Spectral properties. Algebraic and graphical properties. Examples: epidemiology, drug kinetics.

Stability theory for networks (7 lectures) Dynamical systems and stability notions, Lyapunov stability criteria, Krasovskii-LaSalle invariance principle. Linear, nonlinear and linearized systems. Negative gradient systems.

Introduction to simulation (3 lectures) Motivation - role of simulation in understanding and engineering network systems. Discussion on available tools MATLAB/Simulink, NetSim, NS2. Design of simulation experiments for sensor networks, computations on models for compartmental systems.

Advanced topics (3 lectures) Multi-agent systems, Wireless sensor and actuators networks, robot swarms. Problems and trends.

Textbooks:

1. *Lectures on Network Systems*, Francesco Bullo, Edition 1, 2018, CreateSpace.
2. *Network Science*, Albert-Laszlo Barabasi, 2016, Cambridge University Press.

Content Similarity Declaration with Existing Courses: N/A

Additional References:

1. *The structure and dynamics of networks*, Mark Newman, Albert-Laszlo Barabasi and Duncan J. Watts. 2006, Princeton university press.



2. *Networks An Introduction*, Mark Newman, 2018, Oxford University Press.
3. *Fundamentals of complex networks: models, structures and dynamics*, Guanrong Chen, Xiaofan Wang, and Xiang Li, 2014, John Wiley & sons.
4. Selected publications to be chosen by the instructor.

Approvals:

Other faculty interested in teaching the course: Dr. Siddhartha Sarma, SCEE

Proposed by: Dr. Sreelakshmi Manjunath, SCEE

Signature _____

Date: _____

Recommended/Not Recommended, with comments:

Chairman, CPC

Date: _____

Approved/ Not Approved

Chairman, Senate

Date: _____



IIT Mandi

Proposal for a New Course

Course Name: Computer Graphics and Game Design

Course Number: CS 451

Credits: 2-0-2-3

Prerequisites: Experience in writing computer-code.

Intended for: B.Tech. (all branches) II/III/IV year

Distribution: Elective for B.Tech. II/III/IV year

Semester: Odd/Even

Preamble: Creating video games is an endeavor that lies at the merger of two main disciplines, viz., computer programming and creating artwork. This course aims to focus on the former aspect via design and development of 2D games. The architecture of a modern game consists of subcomponents such as the graphics engine, the physics engine, the audio engine, etc., which are orchestrated by the game logic. This logic assumes the form of a number of scripts that run asynchronously and in an even-driven manner. The course will introduce all these components of game development in a hands-on manner wherein the students will write a 2D game as part of lab exercises. The course is intended to bridge the rich talent pool in engineering academia, with the vast gaming industry which has grown manifold in the last two decades.

Learning outcome: After taking this course, students will

1. be familiar with the workflow for creating 2D video games.
2. understand different types/genres of video games and the components thereof.
3. be familiar with all the steps of creating a 2D game.
4. get hands-on experience with game engines, e.g., Unity.
5. be familiar with usage of subcomponents of game engines such as graphics, physics and audio engines.
6. be able to write scripts which control the behavior of different game components.
7. get familiarity with creating game assets such as sprites, tiles, textures and audio.
8. be able to create realistic scenes and environments.
9. be able to design, write and deploy 2D video games.

Course modules:

1. *Introduction:*

(5 hours)

Motivation; Types of games, Different aspects of game design; Different components in a game; Game engines; Geometric primitives, 2D and 3D linear transforms, Homogeneous matrices; Examples of games.



2. *Sprites and animation:* (6 hours)
Different image formats; Polygon file formats; Creating sprites; Rigging; Animations using sprite-sheets; Animations using keyframes; Animation controllers.
3. *Level design:* (6 hours)
Scenes; Tiles, visual continuity in tiles; Adding objects to scene; Prefabs; Lighting, RGB space, transparency, texture mapping; Collectibles; Navigation and pathfinding.
4. *World interaction:* (6 hours)
Physics engines; Gravity simulation; Rigid body interaction; Collisions.
5. *User interface:* (3 hours)
Layout; Menu system; Visual components; Event system; Skins.
6. *Audio:* (2 hours)
Audio assets; Different audio formats; Audio mixing.

Lab exercises:

Lab to be conducted on a 2-hour slot, in tandem with the theory course so the topics for problems given in the lab are already initiated in the theory class. The topics taught in the theory course shall be appropriately sequenced for synchronization with the laboratory. The students will progressively design and write a 2D video game as part of the lab.

Lab1-2: Installation of a game engine, e.g., Unity, familiarization of the GUI. Conceptualize the theme for a 2D game.

Lab3-4: Character design, sprites, movement and character control.

Lab5-7: Level design: design of the world in form of tiles along with interactive and collectible objects.

Lab8-9: Design of interaction between the player and the world, optionally using the physics engine.

Lab9-11: Design of menus and user interaction in mobile platform.

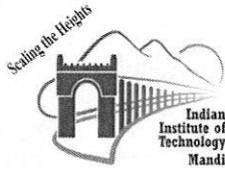
Lab12: Insert audio.

Textbooks:

1. Nystrom Robert, *Game Programming Patterns*, 3rd edition, Genever Benning, 2014

Reference Books:

1. Paris Buttfield-Addison et al., *Unity Game Development Cookbook: Essentials for Every Game*, 1st Edition, O'Reilly Media, 2019



Content Similarity Declaration with Existing Courses: N/A

Sr #	Course code	Similarity content	Approx. % of content
1	CS594	Linear transforms, RGB space	5%
2	CS662	Game engine concepts such as physics, prefabs, user interaction and player control	10%

Justification for new course proposal if cumulative similarity content is > 30%: N.A.

Approvals:

Other Faculty who may be interested in teaching this course:

Proposed by Jinesh Machchhar

School: SCEE

Signature: _____

Date _____

Recommended/Not Recommended, with Comments:

_____ Date: _____

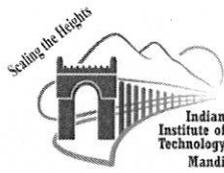
Chairman, CPC

Approved / Not Approved

_____ Date: _____

Chairman, Senate

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IIT Mandi

Proposal for a New Course

Course Number : ME 515

Course Name : Carbon Materials and Technology

Credits : 3-0-0-3

Prerequisites : None (basic knowledge of material science expected)

Intended for : M.Tech. / M.S./ Ph.D./ B.Tech. (4th year)/ M.Sc.

Distribution : Free Elective

Semester : Odd/Even

1. Preamble:

This course will introduce the students to the preparation and structure-property relationship of various carbon materials for the purpose of device manufacturing. Carbon is one of the most important technological materials in modern-day industries. Consequently, a lot of cutting-edge research is also focused on carbon materials and technology, both in India and internationally. Applications of carbon range from micro/ nano biomedical devices to automobile and aerospace industry, smart textiles, water and environmental pollution controllers and energy storage devices. At present there is no comprehensive course being offered at IIT Mandi that is specific to carbon, and/or is focused on explaining the properties of different carbon materials based on their underlying microstructure. Proposed course not only covers carbon as a material but also includes basic manufacturing techniques and real-life device examples. Notably, carbon is a hard and brittle material that is extremely difficult to machine. It is therefore not compatible with the traditional manufacturing techniques. Moreover, often each carbon material can only be manufactured using a certain technique, which means that carbon technology must always be taught in a “material-manufacturing pair”. All of these factors have been considered in the proposed course modules that will make this course unique and useful to all students, whether they pursue higher studies or wish to join an industry.

2. Course Modules:

Module 1: Introduction to carbon (6 hours)

- Why should one study carbon materials and manufacturing?
- Carbon economy
- Atomic structure and hybridization
- Carbon allotropes
- Nomenclature and terminology

Module 2: Microstructure of carbon materials (15 hours)

- (a) Bulk industrial carbon
 - Graphite: natural and pyrolytic
 - Activated carbon
 - Glass-like carbon
 - Granular amorphous carbon
- (b) Carbon fibers and composites
 - Activated carbon fiber
 - Carbon fiber reinforced plastics



- (c) Carbon nanomaterials
 - Graphene
 - Carbon Nanotube
 - Fullerene
 - Graphite whiskers
 - Diamond-like carbon
- (d) Characterization of carbon materials (discussed in a-c) by X-Ray Diffraction, Raman spectroscopy and electron microscopy

Module 3: Raw materials (4 hours)

- Polymer precursors (Polyacrylonitrile, cellulose, resins, PVC etc.)
- Needle coke (petroleum and pitch based)
- Coal and its distillation
- Gaseous hydrocarbons (for CVD)
- Carbon yield and mechanism of carbonization (thermodynamic and kinetic aspects)

Module 4: Properties of carbon materials (4 hours)

- Crystallinity and electrical conductivity
- Electrochemistry and surface chemistry
- Mechanical and thermal properties

Module 5: Manufacturing techniques for carbon materials (4 hours)

- Pyrolysis (activated carbon, glassy carbon, pyrolytic graphite)
- Electrospinning (carbon fibers)
- Chemical vapor deposition (graphene and CNT)
- Composite preparation (material/ binder interface)
- Mechanical property testing methods

Module 6: Applications (6 hours)

- Graphite electrodes
- Carbon-fiber composites in automobile industry
- Carbon-based micro and nano devices (sensors, microelectrodes etc.)
- Filters and adsorbers

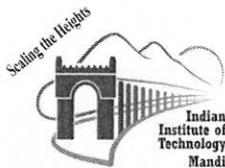
Module 7: Special topics (3 hours)

- Health and environmental safety of carbon nanomaterials
- Carbon-based flexible electronics
- Future of carbon technology

3. **Textbook:** Timothy D. Burchell, *Carbon Materials for Advanced Technologies*. (Elsevier, 1999), (ISBN: 978-0-08-042683-9)

4. **Reference books:**

1. Jenkins, G. M. & Kawamura, K. *Polymeric carbons--carbon fibre, glass and char*. (Cambridge University Press, 1976).
2. Marsh, H. & Rodríguez-Reinoso, F. *Activated carbon*. (Elsevier, 2006).



3. Kong, L. B., *Carbon nanomaterials based on graphene nanosheets*. (CRC Press, Taylor & Francis Group, 2017).
4. Chung, D.D.L. *Carbon fiber composites*. (Butterworth-Heinemann, 1994).

5. Similarity Content Declaration with Existing Courses

S.N.	Course Code	Similarity Content	Approx. % of Content
1	CY241 Nano-scale Science and Technology	Science (mainly synthesis) of carbon nanotubes, graphene and fullerene	15
2	CY342 Nanoscience: Understanding Small Systems	Fundamentals of nanosystems	5

5. Justification for new course proposal if cumulative similarity content is > 30%: N/A

Approvals:

Proposed by: Dr. Swati Sharma School: SE

Other Faculty interested in teaching this course: Dr. Viswanath Balakrishnan, Dr. Sumit S. Ray, Dr. Ajay Soni

Signature: _____

Date: _____

Recommended/Not Recommended, with Comments:

Chairman, CPC

Date: _____

Approved/Not Approved

Chairman, Senate

Date: _____



IIT Mandi

Proposal for a New Course

Course Number : CE 558
Course Name : Air pollution and its mitigation
Credits : 3-0-0-3
Prerequisites : IC 230 (Environmental Science) for B.Tech.
Intended for : 3rd and 4th year B.Tech., Post-graduate
Distribution : Elective
Semester : Odd/Even

1. Preamble:

The atmospheric system mediates phenomena ranging from local- and regional-scale air pollution to global-scale climate change, thereby affecting the environment, human health and the sustainability of the planet as a whole. A robust understanding of these processes and the complexities of the earth-atmosphere-climate system is critical to the ability to design effective mitigation technologies and policies. This course aims to foster this understanding by focusing on the fundamental physical and chemical processes that govern atmospheric behaviour, especially related to the residence, transformation, transport, and deposition of gaseous and aerosol species. This is followed by analyses of the natural and anthropogenic controls on various aspects of air pollution, and perspectives on their measurement, monitoring, risk assessment and mitigation.

Learning outcomes: The students would i) develop a thorough understanding of the interactive processes that lead to atmospheric pollution on varying spatial scales; ii) appreciate the links between air quality and health; iii) develop insights into the theoretical and practical aspects of air pollution control engineering; and v) draw lessons from the success stories and failures of local, regional and global policies to tackle air pollution.

2. Course Modules:

Module 1: The atmospheric system

[5 Hours]

Vertical profiles of pressure and temperature; atmospheric structure; hydrostatic equilibrium and scale height; stability and lapse rates; temperature inversions; atmospheric dispersion; general circulation and surface winds; timescales of atmospheric transport

Module 2: Basics of atmospheric chemistry

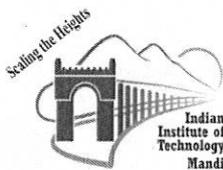
[2 Hours]

Photochemical and radical-assisted reactions; daytime vs nighttime and tropical vs polar chemistry; species lifetimes; atmospheric measurement units

Module 3: Stratospheric processes

[5 Hours]

Dynamics of stratospheric transport; formation and distribution (latitudinal, seasonal and vertical) of stratospheric O₃; UV shielding and effect on climate; role of HO_x, NO_x and chlorofluorocarbons in catalyzing O₃ depletion – observational evidence, mitigation measures, recovery and challenges



Module 4: Tropospheric gas-phase species

[8 Hours]

Local, regional and global pollutants; the oxidizing capacity of the troposphere; constraints on CO and CH₄; the CO-HO_x-NO_x-VOC-O₃ cycle; photochemical smog – case study of Los Angeles, USA; dry and wet removal of pollutants; acidic deposition – case study of the Northeastern USA; current scenario in Asia and the Indian perspective; mitigation, challenges and opportunities

Module 5: Aerosols

[7 Hours]

Historical perspectives on air pollution; physical properties of aerosols – formation, growth, aging and size distribution; primary vs secondary and externally- vs internally-mixed aerosol; core-shell theory; major aerosol chemical components and their sources; tracers

Module 6: Effects on climate

[4 Hours]

Greenhouse effect and interaction of potential greenhouse gases; solar and terrestrial emission spectra; radiative transfer; planetary energy balance; aerosol-light interaction; radiative forcing and global warming potential

Module 7: Air pollution control technologies

[6 Hours]

Mitigation technologies in stationary systems – fluidized bed combustion, integrated gasification combined cycle, flue gas desulfurization, baghouses, scrubbers, cyclone collectors, and electrostatic precipitators; mitigation technologies in mobile systems – catalytic converters, diesel particulate filters, fuel modification and blending

Module 8: Risk assessment and policy intervention on air pollution

[5 Hours]

Link between air pollution and mortality/morbidity; risk assessment for carcinogenic and non-carcinogenic pollutants; air quality indices – case study of India; air pollution as an externality; ambient, emission and technology standards; policies for air pollution control

3. Textbooks:

- i) Atmospheric Chemistry and Physics: From Air Pollution to Climate Change; 3rd Edition, 2016; John H. Seinfeld and Spyros N. Pandis; Wiley.
- ii) Introduction to Atmospheric Chemistry; 1st Edition, 2000; Daniel J. Jacob; Princeton University Press.

4. References:

- i) Chemistry of the Upper and Lower Atmosphere; 2nd Edition, 2000; Barbara J. Finlayson-Pitts and James N. Pitts Jr; Academic Press.
- ii) Air Pollution Control Engineering, 2nd Edition, 2000; Noel De Nevers; McGraw-Hill.
- iii) Environmental Chemistry, 5th Edition, 2012; C. Bard and M. Cann; W.H. Freeman and Company.
- iv) Research articles will be advised as required.



5. Similarity Content Declaration with Existing Courses

S.N.	Course Code	Similarity Content	Approx. % of Content
1	IC 230 (Environmental Science)	Introduction to air pollution	5%

Justification for new course proposal if cumulative similarity content is > 30%: N.A.

Approvals:

Other Faculty interested in teaching this course:

Proposed by: Dr. Sayantan Sarkar

School: School of Engineering

Signature: _____

Date: _____

Recommended/Not Recommended, with Comments:

Date: _____

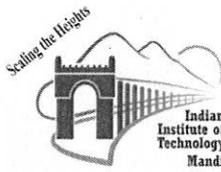
Chairman, CPC

Approved/Not Approved

Date: _____

Chairman, Senate

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IIT Mandi

Proposal for a New Course

Course Number: CE559

Course Title: Biological Wastewater Treatment

Credits: 3-0-0-3

Prerequisites: None

Intended for: UG/M.Tech./MS/PhD

Distribution: Elective

1. Preamble:

Domestic as well as industrial wastewaters, when discharged into environment without prior treatment, pose major threat to surface water quality as well as to flora and fauna. As a result, these wastewaters need to be treated prior to their discharge into environment. The main objective of this course is to provide theoretical knowledge and practical application of various biological processes employed in wastewater treatment and how to design and operate these treatment processes. The course also familiarizes the students with the operation and maintenance methods as well as the troubleshooting techniques employed in various wastewater treatment processes.

2. Course Modules:

Module 1: Introduction

(2 hours)

Need for wastewater treatment, Need for sludge treatment, Benefits of biological wastewater treatment, Overview of wastewater treatment processes

Module 2: Water and wastewater quality parameter

(6 hours)

pH and DO, Solids: total, dissolved, volatile and fixed solids, Organic carbon: BOD, COD and TOC, Nitrogen: Total Kjeldahl Nitrogen (TKN), Ammonia-nitrogen (NH_3N), Nitrite-nitrogen (NO_2N) and Nitrate-nitrogen (NO_3N), Phosphorous, Microbial analysis: Most probable number (MPN)

Module 3: Process Analysis

(6 hours)

Rate of reaction, Order of reaction, Effect of temperature on reaction rate, Enzyme Reaction and kinetics, Types of reactors: CSTR and plug flow reactor, Reactor analysis, Residence time

Module 4: Biological Systems

(6 hours)

Overview and application in wastewater treatment, Biological growth and kinetics, Half-life and doubling time, Yield and decay, Monod's kinetics, Estimation of kinetic parameters

Module 5: Aerobic Process

(10 hours)

Suspended growth processes: Ponds and lagoons, Activated sludge process: Process description and its modifications, Substrate utilization and biomass growth, Process design, Hydraulic and Solids residence time, Activated sludge process with and without biomass recirculation, Efficiency and loading criteria, Effect of temperature on process performance, Trouble shooting, Attached growth processes: Rotating biological contactor (RBC), Trickling filter



Module 6: Anaerobic Processes

(6 hours)

Process description, Process design, Startup and operation, High-rate anaerobic processes, Biofilm and biofloc processes, Loading criteria and biogas generation rate, Biogas yield and composition, Biogas cleanup and use, Trouble shooting and maintenance, Sludge digestion

Module 7: Downstream Treatment

(6 hours)

Need for nutrient removal, Nitrogen removal processes, Biological nitrification and denitrification, Phosphorus removal, Disinfection

3. Textbooks:

- i) Metcalf & Eddy. Inc. George Tchobanoglous, Franklin Burton, H. David Stensel (2003). Wastewater Engineering: Treatment and Reuse. (4th Edition), McGraw-Hill International Edition, New York
- ii) Henze, M., Mark C. M. Van Loosdrecht, George A. Ekema, Damir Brdjanovic (1997). Biological Wastewater Treatment: Principles, Modelling and Design, IWA Publishing, London

4. Reference Books:

- i) Sawyer, C. N., Parkin, G. F. and McCarty, P. L. (2008). Chemistry for Environmental Engineering. New York: McGraw-Hill.
- ii) Bailey, J. E. and Ollis, D. F. (1987). Biochemical Engineering Fundamentals. (2nd Edition). New York: McGraw-Hill International

5. Similarity Content Declaration with Existing Courses: N/A

6. Justification for new course proposal if cumulative similarity content is > 30%: N.A.

Approvals:

Other Faculty interested in teaching this course:

Proposed by: Prof. Ajit P. Annachhatre

School: School of Engineering

Signature: _____

Date: _____

Recommended/Not Recommended, with Comments:

Chairman, CPC

Date: _____

Approved/Not Approved

Chairman, Senate

Date: _____



IIT Mandi

Proposal for a New Course

Course Number: CE 560
Course Name: Soil Dynamics
Credits: 3-0-0-3
Prerequisites: Geotechnical Engineering I (CE 302), Geotechnical Engineering II (CE 402) or Equivalent course.
Intended for: UG and PG students
Distribution: Discipline Elective
Semester: Odd/Even

Course Preamble:

In the undergraduate curriculum, the basic course on Geotechnical Engineering introduces students to the fundamentals of the engineering behaviour of soil under static loading. The aim of this course "Soil Dynamics" is to explore, in some detail, the behaviour of soil when it is subjected to time-dependent cyclic loading. Starting with the principle of wave propagation in the soil media, this course takes the student through the estimation of dynamic soil properties by laboratory and in-situ methods of testing. The student will learn the geotechnical site characterisation, site response analysis and the methods for evaluation of liquefaction potential of a site. A part of this course is dedicated to explaining the modes of vibration and design of machine foundation.

Course outcome:

By the end of the course, the students will be familiar with the approaches to understand the dynamic behaviour of soil and determine the strength and stiffness of soil and the application of these properties in practice. It will help in preparing a background for further study and research in the area of geotechnical earthquake engineering and the related fields.

Course modules with lecture hours:

- 1. Introduction to soil dynamics:** Importance of soil dynamics, nature and types of dynamic loading, concept of dynamic loading, Simple harmonic motion, degrees of freedom, types of vibration, free and forced vibration, decay of motion, vibration measuring instruments. **(8 hours).**
- 2. Wave propagation in elastic half space:** Elastic response of continua, Wave propagation in soil media, Earthquake waves, Seismic travel time curve, Three-circle method of estimation of Earthquake epicentre. **(6 hours).**
- 3. Dynamic soil properties:** Stresses in soil element, concept of soil stiffness, damping ratio and plasticity properties of soil, techniques for estimation of dynamic soil properties from field (intrusive and non-intrusive testing) and laboratory testing. Correlation for obtaining various geotechnical parameters. **(6 hours).**
- 4. Site response analysis:** Transfer function, homogeneous and layered un-damped and damped soil resting on rigid block, equivalent and non-linear approach of ground response analysis, convolution and deconvolution of the earthquake wave, site classification. **(6 hours)**



5. **Liquefaction and lateral spreading:** Concept of liquefaction (static and cyclic), cyclic mobility, estimation of liquefaction potential of soil from field and laboratory testing data, cyclic stress ratio of soil and its importance, post liquefaction lateral spreading of soil, effect of liquefaction on various geotechnical structures. **(6 hours).**
6. **Design of machine foundations:** Types of machine foundation, Mass-spring dashpot model, concept of vibration isolation, Tschebotarioff's reduced natural frequency method; Elastic half space method; Vertical, sliding, torsional (yawing) and rocking (and pitching) modes of oscillations; Design guidelines as per codes; Typical design problems. **(10 hours).**

Textbooks:

1. Shamsheer Prakash "Soil Dynamics", McGraw Hill Book Company (1981).
2. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall Inc (2003).

References:

1. Robert W. Day, "Geotechnical Earthquake Engineering Handbook", McGraw Hill, New York. (2002)
2. Kenji Ishihara, "Soil Behaviour in Earthquake Geotechnics", Oxford University Press, USA. (1996).
3. G.V. Ramanna and B.M. Das "Principles of Soil Dynamics" CENGAGE Learning, USA. (2011).
4. Richart, F.E., Woods, R.D. and Hall, J.R. Vibrations of soils and foundations. Prentice-Hall, 1970.

Additional Readings

Journal papers in the area of Soil Dynamics.

Similarity content declaration with existing course:

Sl. No.	Course Code	Similarity Content	Approximate % of Content
1	CE 605	Wave propagation, ground response analysis	<5%
2	CE 511	Single and multiple degree of freedom, free and forced vibrations	<10%
3	ME 602	Free and forced vibrations	< 5%

Justification for new course proposal if cumulative similarity content is more than 30%:

Not applicable.

Approvals:

Other faculty interested in teaching this course:

Proposed by: Ashutosh Kumar

School: School of Engineering (SE)

Signature: *Ashutosh Kumar*

Date: 01.05.2020

Recommended / Not Recommended, with comments:

Chairman, CPC

Date:

Approved / Not Approved:

Chairman, Senate

Date:



IIT Mandi

Proposal for a New Course

Course Number: BE 201

Course Name: Cell Biology

Credits: 3-0-2-4

Prerequisites: None

Intended for: B. Tech M.Tech Integrated Dual Degree Bioengineering students

Distribution: Core for Integrated Dual Degree Bioengineering students, elective for other B.Tech students

1. Preamble:

The objective of the course is to provide students with a comprehensive and concise overview of biological science and provide knowledge on the fundamentals of cell biology with emphases on its relationship with bio-engineering.

2. Course modules with Quantitative lecture hours:

Theory: [42 hours]

Module I: Cells: The fundamental units of life [8 hours]

The structure and ultrastructure of the cell (the prokaryotic cell and the eukaryotic cell). Membrane enclosed Organelles (nucleus, chloroplast, mitochondria, ribosome etc) Model organisms (Yeast; simple eukaryotic cell, Arabidopsis; model plant, Fish/worms/mice; model animal)

Module 2: Cell Membranes and membrane transport [8 hours]

Membrane structure (lipid bilayer, and membrane protein), Passive and Active Transport, Ion channels, ATP pumps. Na⁺ / K⁺ / Ca²⁺ pumps uniport, symport antiporter system. Ligand gated / voltage gated channels, Agonists and Antagonists

Module 3: The cell-division cycle [8 hours]

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, Extra cellular matrix, role of matrix in cell enthrone: Gap junctions, Tight junctions, Desmosomes, Hemidesmosomes

Module 4: Cell-cell communication and protein transport [8 hours]

General principles of cell signaling, G-protein couple receptor, enzymes-couple receptor, protein sorting, vesicular transport, endocytic pathways

Module 5: Techniques used to study cells [10 hours]

Cell fractionation, Morphology and identification of cells using microscopic studies like SEM, TEM and Confocal Microscopy. Localization of proteins in cells – Immunostaining.



Lab:

[28 hours]

To demonstrate various techniques to learn the morphology, identification and propagation of cells

LIST OF EXPERIMENTS

1. Introduction to principles of sterile techniques and cell propagation
2. Principles of microscopy, phase contrast and fluorescent microscopy
3. Gram's Staining
4. Leishman Staining
5. Trypan Blue Assay
6. Staining for different stages of mitosis in *Allium Cepa* (Onion)

3. Text book:

- a. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, "Molecular Biology of the Cell" - 6th Edition; Garland Science, 2014.

4. Reference books:

- a. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. Martin, "Molecular Cell Biology" - 8th Edition W.H. Freeman, 2016.
- b. George Plopper, David Sharp, Eric Sikorski, "Lewin's Cells" – 3rd Edition – Johns & Bartlett Publishers, 2015
- c. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, "Campbell Biology"- 11th Edition, Pearson, 2020.

5. Similarity content declaration with existing courses: None

Sl. No.	Course Code	Similarity Content	Approx. % of content

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

Approvals:

Other faculty interested in teaching this course: Dr. Amit Prasad, Dr. Trayambak Basak

Proposed by: Dr. Prosenjit Mondal

School: SBS

Signature:

Date:

Recommended/Not Recommended, with comments:

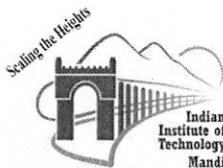
Chairman, CPC

Date:

Approved/Not approved

Chairman, Senate

Date:



IIT Mandi

Proposal for a New Course

Course Number: BE 202

Course Name: Biochemistry and Molecular Biology

Credits: 2-0-2-3

Prerequisites: None

Intended for: B. Tech M.Tech Integrated Dual Degree Bioengineering students

Distribution: Core for Integrated Dual Degree Bioengineering students, elective for other B.Tech students

Preamble: The objective of the course is to provide students with a comprehensive and concise overview of biological science with emphases on its relationship with biomedical engineering.

Course Outline:

Theory: [28 hours]

Module1: Cell composition: [6 hours]

Chemical bonds, water, pH and buffers

Amino acids, peptides and proteins

Carbohydrates: Monosaccharides, Disaccharides, Polysaccharides and glycoconjugates

Nucleotides and Nucleic acids

Lipids: Storage lipids, structural lipids, lipid as signal, cofactors and pigments

Module 2: Bioenergetics and Biochemical Reaction [6 hours]

Bioenergetics and Thermodynamics, ATP, Biological oxidation-reduction reactions, Overview of central and secondary metabolism

Amino acid Oxidation: Metabolic fates of amino acids, Nitrogen excretion and urea cycle, amino acid degradation

Oxidative Phosphorylation: Electron transport reaction in mitochondria, ATP synthesis, Photophosphorylation, Light absorption and light driven electron flow, ATP synthesis by photophosphorylation

Module 3: Cellular energy [8 hours]

Breakdown of Sugar: Glycolysis, Gluconeogenesis and the Pentose Phosphate Pathway

The Citric acid cycle

Fatty acid metabolism: Digestion, metabolism and transport of fats, oxidation of fatty acids, ketone bodies

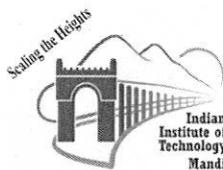
Module 4: Central Dogma of Life [8 hours]

Genes and Chromosomes

DNA metabolism: DNA replication, DNA repair and recombination

RNA metabolism: Transcription, RNA processing, RNA dependent RNA and DNA synthesis

Protein metabolism: The genetic code and Translation Gene Regulation

**Lab:****[28 hours]**

1. Preparation of buffers,
2. Quantitative determination of proteins,
3. Quantitative determination of carbohydrates and lipids,
4. Isolation of nucleic acid (DNA or RNA) and its estimation,
5. Gel Electrophoresis- Protein and nucleic acid
6. DNA amplification using PCR,
7. Isolation of chloroplasts, its estimation and assay for Hill reaction

Text book:

- a. David L. Nelson, Michael M. Cox, "Lehinger Principles of Biochemistry", 7th Edition, McMillan Learning, 2017.

Reference books:

- a. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. Martin, "Molecular Cell Biology" - 8th Edition W.H. Freeman, 2016.
- b. George Plopper, David Sharp, Eric Sikorski, "Lewin's Cells" – 3rd Edition – Johns & Bartlett Publishers, 2015
- c. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, "Molecular Biology of the Cell" - 6th Edition; Garland Science, 2014.

Similarity content declaration with existing courses: None

Sl. No.	Course Code	Similarity Content	Approx. % of content

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

Other faculty interested in teaching this course: Dr. Prosenjit Mondal, Dr. Trayambak Basak

Proposed by: Dr. Amit Prasad

School: SBS

Signature:

Date:

Recommended/Not Recommended, with comments:

Chairman, CPC

Date:

Approved/Not approved
Chairman, Senate

Date:



IIT Mandi

Proposal for a New Course

Course Number : EP 301

Course Name: Engineering Mathematics-2

Credits : 3-1-0-4

Prerequisites : IC110, IC111 and/or faculty consent. Out of PH511 and EP301, a student is allowed to take only one course.

Intended for : B.Tech.

Distribution : Core course for B.Tech. in Engineering Physics and elective for others.

Semester : Odd/Even

Preamble : Mathematics for Physicists provides solid foundation in various mathematical methods developed and used for understanding different physical phenomena.

Course Outline : The course starts with introduction to the concept of linear vectors space. The course continues to introduce differential equations and special function that are used to understand physical phenomena in different geometries with focus on application to physical problems. This followed by complex analysis and finally ends with the introduction to the partial differential equations and green functions.

Modules

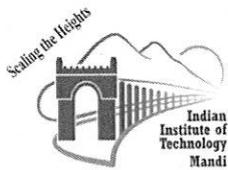
1. Linear vector spaces, Gram-Schmidt orthogonalization, Self-adjoint, Unitary, Hermitian, Non-Hermitian Operators, transformation of operators, eigenvalue equation, Hermitian matrix diagonalization; with focus on application to physical problems **(8 hours)**
2. Second order Linear ODE, Series Solution- Frobenius Method, Inhomogeneous linear ODE. Sturm Liouville equation Hermitian operators-eigenvalue problem; with focus on application to physical problems **(7 hours)**
3. Special functions: Bessel, Neumann, Henkel, Hermite, Legendre, Spherical Harmonics, Laguerre, Gamma, Beta, Delta functions, with focus on application of these functions to physical problems. **(10 hours)**
4. Complex analysis, Cauchy- Riemann conditions, Cauchy's Integral theorem, Laurent expansion, Singularities, Calculus of residues, evaluation of definite integrals, Method of steepest descent, saddle point. **(11 hours)**
5. Partial differential equations and introduction to Green's functions. **(6 hours)**

Text books

1. Mathematical methods for physicists by Arfken and Weber (Elsevier Academic Press, 6th edition, 2015)
2. Mathematical Methods in Physical Sciences by Mary L Boas (Wiley 3rd edition, 2011)

References

1. Mathematical Methods for Physics and Engineering: A Comprehensive Guide by K. F. Riley and M. P. Hobson (Cambridge India South Asian Edition, 2009)
2. Mathematical Methods for Physicists by J. Mathews and R. L. Walker (Imprint, New edition 1973)
3. Mathematics of Classical and Quantum Physics by F. W. Byron and R. W. Fuller (Dover Publication, New edition, 1992)



4. Methods of theoretical Physics Vol. I and II by P. M. Morse and H. Freshbach (McGraw-Hill, 1953)
5. Advanced Engineering Mathematics by E. Kreyszing (Wiley India Private Limited, 10th edition, 2003)
6. Mathematics for Physicists by Philippe Dennery and Andre Krzywicki (Dover Publications Inc. 1996).

1. Similarity Content Declaration with Existing Courses

S.N.	Course Code	Similarity Content	Approx. % of Content
1	PH511	Part of 1-3	60%

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

This course has content similarity to that of course titled PH511 which is a core course for master students. However, this course is specifically intended for B.Tech. EP students and designed for that purpose with special focus on tutorial and few new topics added. A student cannot take these two course to complete his/her degree.

Proposed by: Course Interest Group

School:

Signature: _____

Date: _____

Recommended/Not Recommended, with Comments:

Chairman, CPC

Date: _____

Approved/Not Approved

Date: _____

Chairman, Senate

Proposal: Minor Programmes
School of Computing and Electrical Engineering

The minor in various programmes from school of computing and electrical engineering have been proposed for the students outside the discipline of computer science engineering and electrical engineering. A minor is intended for a student to gain expertise in an area outside his/her major B. Tech. discipline. A specialist basket of 3-6 courses is proposed for each Minor. Each basket may rest on two foundation courses. A basket may have sequences within it, i.e. advanced courses may rest on basic courses in the basket. In order to successfully complete a Minor, a student needs to take at least **9 credits** with a CGPA of 7.0 out of the courses defined in that Minor basket. The area of the Minor must be different from the Major discipline of the student; the courses that are part of the common core, or the discipline core/electives cannot be counted towards a Minor. A student is allowed to take any number of Minors, but a particular course cannot be counted for more than 1 Minor. The name of the Minor will appear on the Transcript and the degree certificate of the student.

Requirements

- The opted minor must be outside the branch of the B.Tech. student.
- For the completion of minor programme, the students must be completing 3-6 courses (9 credits) from the suggested course list.

List of suggested minor programmes:

1. Computer Science Engineering
2. Power Engineering
3. Electronics Engineering
4. Communication Engineering
5. Measurement and Instrumentation Engineering
6. Control Engineering

Suggested list of courses for minors

Followings are the additional minors that SCEE plans to offer.

No.	Minor/ Eligible streams	Foundation courses (compulsory to get minor)	List of suggested courses [#]
1	Computer Science & Engineering All other than DSE/CSE	<ul style="list-style-type: none"> • Data Structures and Algorithms (IC250) • Communicating Distributed processes (CS310) • Mathematical Foundations of Computer Science (CS208) 	<ul style="list-style-type: none"> • Algorithms Design and Analysis (CS403) • Formal Languages and Automata Theory (CS304) • Information and Database Management System (CS309) • Deep Learning and its Applications (CS671)
2	Power Engineering All other than EE	<ul style="list-style-type: none"> • Electromechanics (EE201) • Power Electronics (EE309) 	<ul style="list-style-type: none"> • Power Systems (EE303) • Fundamental of Electrical Drives (EE508) • Advanced Electric Drives (EE601) • Switch Mode Power Conversion (EE504) • Special Electrical Machines (EE513) • Introduction to High Voltage Engineering and Dielectric Breakdown (EE606) • Analysis and Design of Power Electronic Converters (EE527)

			<ul style="list-style-type: none"> • Modeling and Analysis of Electrical Machine (EE528)
3	Electronics Engineering All other than EE	<ul style="list-style-type: none"> • Network Theory (EE203) • Digital System Design (EE208) 	<ul style="list-style-type: none"> • Analog Circuit Design (EE211) • Digital signal processing (EE305) • Device electronics for integrated circuits (EE311) • Microelectronics practicum (EE312P)
4	Communication Engineering All other than EE	<ul style="list-style-type: none"> • Communication Theory (EE304) • Probability (IC210) 	<ul style="list-style-type: none"> • Advance Communication Theory (EE502) • Digital Signal Processing (EE305) • Applied Optimization (EE530)
5	Measurement & Instrumentation All other than EE	<ul style="list-style-type: none"> • Measurement and Instrumentation (EE313) 	<ul style="list-style-type: none"> • Control Systems (EE301) • Digital Signal Processing (EE305) • Advance Digital Signal Processing (EE620)
6	Control Engineering All other than EE	<ul style="list-style-type: none"> • Control Systems (EE301) 	<ul style="list-style-type: none"> • Linear Dynamical Systems (EE509) • Robust Control Systems (EE514)

[#]The list is suggestive courses only. However, more courses can be added to this list later.

Master of Technology in Structural Engineering
School of Engineering, Indian Institute of Technology Mandi

Course and credit distributions accords the semester, and list of approved courses.

1. Details of the courses and credit distribution

Semester – I (18 Credits)					
Sl. No.	Course Title	Credit Structure			
		L	T	P	C
1	CE557 - Solid Mechanics in Structural Engineering (DC)	3	0	0	3
2	CE555 - Advanced Design of Structures (DC)	3	0	0	3
3	CE511 - Structural Dynamics with Application to Earthquake Engineering (DC)	3	0	0	3
4	ME504 - Numerical Methods for Engineering Computation (MC)	3	0	0	3
5	Discipline Elective-I (DE)	3	0	0	3
6	CE556P - Structural Engineering Laboratory (DC)	0	0	4	2
7	HS541 - Technical Communication (TC)	1	0	0	1
Semester – II (22* Credits)					
Sl. No.	Course Title	Credit Structure			
		L	T	P	C
1	CE586P - Mini Project*	0	0	6	3
2	ME513 - Finite Element Methods in Engineering (DC)	3	0	2	4
3	Discipline Elective-II (DE)	3	0	0	3
4	Discipline Elective-III (DE)	3	0	0	3
5	Discipline Elective-IV (DE)	3	0	0	3
6	Outside Discipline Elective-I (ODE)	3	0	0	3
7	Outside Discipline Elective -II (ODE)	3	0	0	3
Semester – III (15^s Credits)					
Sl. No.	Course Title	Credit Structure			
		L	T	P	C
1	CE587P - Industrial/Academic Internship ^s	0	0	2	1
3	CE688P - Post Graduate Project – I	0	0	28	14
Semester – IV (15 Credits)					
Sl. No.	Course Title	Credit Structure			
		L	T	P	C
1	CE689P - Post Graduate Project - II	0	0	30	15

DC – Discipline Core.

MC – Mathematics Core.

*3 credits (CE586P) is to be completed during the winter break, course registration and grade submission are to be done along with the second semester.

^s1 credit is to be completed during the summer break, course registration and grade submission are to be done along with the third semester.

2. Categorical distribution of the minimum credits

Sl. No.	Course Category	Credits
1	Discipline Core (DC)	15
2	Mathematics Core (MC)	03
3	Discipline Electives (DE)	12
4	Outside Discipline Electives (ODE)	06
5	Technical Communication (TC)	01
6	Mini Project and Design Practicum/Internship	04
7	Postgraduate Project (PGP)	29
	Total Credits	70~72*

*Up-to 72 credits will be considered in the calculation of cumulative grade point average (CGPA).

3. Discipline Core (DC) courses

- (i) Solid Mechanics in Structural Engineering (CE557)
- (ii) Advanced Design of Structures (CE555)
- (iii) Structural Dynamics with Application to Earthquake Engineering (CE511)
- (iv) Finite Element Methods in Engineering (ME513)
- (v) Structural Engineering Laboratory (CE556P)

4. Mathematics Core (MC) course

- (i) Numerical Methods for Engineering Computation (ME504)
- (ii) Any suitable courses with prior permission of the faculty advisor and the course instructor

5. Discipline Elective (DE) courses

- (i) Analysis and Design for Earthquake Resistant Structures (CE610)
- (ii) Bridge Engineering (CE509)
- (iii) Engineering Seismology and Seismic Hazard Assessment (CE605)
- (iv) Structural Health Monitoring (CE611)
- (v) Advanced Concrete Science (CE507)
- (vi) Concrete Technology (CE552)
- (vii) Mechanics of Composite Materials (ME617)
- (viii) Prestressed Concrete Structures (CE554)
- (ix) Slope Stability and Retaining Structures (CE504)
- (x) Theory of Plates and Shells (CE612)
- (xi) Soil Dynamics (CE560)
- (xii) Any other courses with prior permission of the faculty advisor and the course coordinator

ORDINANCES & REGULATIONS

for

Master of Arts



School of Humanities and Social Sciences

Indian Institute of Technology Mandi, Himachal Pradesh, India

2020

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ORDINANCES

M.A Program

O.1 Name of the Degree Program

- Master of Arts

O.2 Abbreviation

- Master of Arts is abbreviated as M.A.

O.3 Duration

- The minimum and maximum duration of the Program are 2 and 3 years, respectively. Each academic session is divided into two regular semesters and two vacation semesters (Winter & Summer) and follows a Senate approved calendar of academic activities.

O.4 Credits to be Earned

- The students have to earn a minimum of 80-82 credits for the degree of M.A.

O.5 Credit Distribution

- Credits should be evenly distributed across semesters to the extent possible.
- Research components should be at least 10 credits with an upper limit of 25 credits.
- Open electives from outside the discipline (i.e. Outside Discipline Elective) of the Program should be at least 6 credits.
- Independent study courses, research-based academic or industrial projects and courses offered by on-line platforms supported through Government of India initiatives like SWAYAM/NPTEL, etc. can contribute towards fulfilment of a maximum of 3 credits with a Pass/Fail (P/F) grade. Such credits can be earned only under Discipline Elective or Outside Discipline Elective in the M.A. Program.

O.6 Eligibility

- Candidates who have qualified for the award of a three/four year Bachelor Degree (B.A./B.Sc./B.Tech./B.E. or equivalent), after 10+2 or equivalent schooling, from a recognized University or Institute with at least 55% marks (or 6.0 CGPA on a scale of 10), are eligible to apply for admission to the Program.
- Exact eligibility criteria will be announced by the Institute in the advertisement for admission each year.
- Students belonging to reserved categories will get relaxations as per the Institute rules.
- The admission of the candidate is subject to approval by the Chairperson, Senate and this shall be reported to the Senate.

O.7 Number of Seats

- The number of seats shall be as approved by the Senate with reservations as per the

Institute norms.

O.8 Award of Degree

- Award of the M.A. degree shall be in accordance with the regulation of the Senate in relation to the requirements of the given Program.

O.9 Academic Events

- The dates of academic events scheduled during the academic session shall be specified in the academic calendar.

O.10 Campus Stay

- The students admitted to this degree Program are required to stay on campus and complete all requirements of the Program. Any exception to this requires prior approval through the proper channel.
- The students, with prior approval, may stay off-campus/on field-sites for a specific duration as per course requirements.

O.11 Exception

- Any exception to the above clauses will require the approval of the Senate or by the Chairperson, Senate.

REGULATIONS

M.A Program

R.1 Academic Calendar

- R.1.1 Each academic session is divided into two regular semesters of approximately eighteen weeks durations (with at least seventy working days for classes in each semester): An Odd Semester (normally August-November) and an Even Semester (normally February-June). Further, there are two vacation semesters (Winter & Summer) of nearly 8-10 weeks duration as well.
- R.1.2 The Senate approved schedule of academic activities for a session, including dates of enrolment, registration, examinations, result declaration, semester breaks, etc. shall be laid down in the Academic Calendar of that session.

R.2 Admission

- R.2.1 All students, admitted to the Program, will be regular full-time students.
- R.2.2 The maximum number of students to be admitted in each M.A. Program will be decided by the Senate.
- R.2.3 Candidates who have qualified for the award of a three/four year Bachelor Degree (B.A./B.Sc./B.Tech./B.E. or equivalent), after 10+2 or equivalent schooling, from a recognized University or Institute with at least 55% marks (or 6.0 CGPA on a scale 10), are eligible to apply for admission to the Program.
- R.2.4 Exact eligibility criteria will be as prescribed in the regulations approved by the senate of the Institute from time to time and announced by the Institute for admission each year.
- R.2.5 For admission to the M.A. Program, the School of Humanities and Social Sciences shall adopt qualifying criteria for short-listing applications and carrying out the selection process.
- R.2.6 The selection committee shall decide on the mode of selection and prepare a merit list of selected candidates on the completion of the selection process.
- R.2.7 Students belonging to reserved categories will get relaxations as per Institute rules.
- R.2.8 The admission of the candidate is subject to approval by the Chairperson, Senate and this shall be reported to the Senate.

- R.2.9 If at any point in time after admission, it is found that a candidate has not fulfilled all the requirements stipulated in the information brochure/advertisement/ offer letter or has furnished the wrong information then the admission of the candidate will stand cancelled and the matter shall be reported to the Senate.

R.3 Structure of the M.A. Program

- R.3.1 Every M.A. Program will have a specific curriculum and course contents approved by the Senate.
- R.3.2 The curriculum consists of courses mainly in the following categories: Discipline Core Courses, Discipline Elective Courses, and Outside Discipline Elective courses.
- R.3.3 Independent study courses, research-based academic or industrial projects and courses offered by on-line platforms supported through Government of India initiatives like SWAYAM/NPTEL, etc. can contribute towards fulfilment of a maximum of 3 credits with a Pass/Fail (P/F) grade. Such credits can be earned only under Discipline Elective or Outside Discipline Elective in the M.A. Program.
- R.3.4 The curriculum of the M.A. Program is designed to have a minimum credit requirement of 80 i.e. the minimum requirement of credits under various courses should add up to 80. However, a range of 80-82 credits is generally prescribed to accommodate the varying number of credits in different courses.
- R.3.5 Students are also permitted to take extra credits, beyond 82. However, the extra credits earned will not be counted towards the calculation of the final CGPA. In the final transcript, the courses which are not counted for final CGPA will be denoted by an asterisk with a note '*the course is not considered in CGPA calculation*'.

R.4 Definition of Credit System

- R.4.1 For theory courses and tutorials, 1credit indicates an effort of 50 minutes (1 contact-hour) per working week (14 contact hours per semester).
- R.4.2 A student is expected to spend 2-3 hours outside the class for every contact hour. This time is devoted to self-study, assignments and so on.
- R.4.3 For laboratory courses, practical and practicums, the credit distribution is as follows:
1-2 hour lab session per week - 1 credit
3-4 hour lab session per week - 2 credits
5-6 hour lab session per week - 3 credits
7-8 hour lab session per week - 4 credits
- R.4.4 A student is expected to spend 1 hour outside the lab per lab hour, for preparation,

self-study, etc.

R.4.5 L-T-P-C Notation: L-T-P-C => Lecture – Tutorial – Practicum/Practical – Credits

The credit structure of each course is given in the L-T-P-C form (e.g. 2-1-0-3). The numbers corresponding to L, T and P denote the contact hours per week for Lecture, Tutorial and Practical/Practicum respectively, and that of C denotes the total number of credits for that course in a semester.

R.5 Program Coordinator/Program Faculty Group (PFG)

R.5.1 A Program Coordinator shall be appointed for each M.A. Program as per institute norms.

R.5.2 A Program Faculty Group (PFG) shall be formed consisting of faculty members who have taught courses for the particular Program in the past, doing so currently, scheduled to do so in the immediate future, and/or are interested to supervise postgraduate projects in the Program.

R.5.3 Institute norms will be followed regarding the formation of the Program Faculty Group and also to decide the responsibilities of the Program Coordinator/ Program Faculty Group.

R.6 Faculty Advisor

R.6.1 To help students in planning their courses of study and for getting general advice on the academic program, a faculty member shall be appointed as the Faculty Advisor for each batch of students in an M.A Program as per institute norms. Generally, a Faculty Advisor shall have responsibility for a particular batch of students from their first year until graduation.

R.7 Class Committee

R.7.1 The Class Committee is a body consisting of faculty and students to monitor the conduct and progress of a set of courses in a semester. There will be one Class Committee for each set of courses being offered in a semester. The constitution of the Class Committee will be as follows: One faculty member as the Chair who is not associated with the teaching activities of the courses listed under that Class Committee, instructors of the courses listed under that Class Committee and 1 or 2 student representatives for each course.

R.7.2 The Class Committee shall meet at least thrice in a regular semester: once at the

beginning of the semester, once before the 2nd quiz and once after the end semester examination to finalize the grades. After each meeting of the full Class Committee, the Chair shall meet separately with the student representatives for confidential feedback. The final Class Committee meeting for the grade finalization should be conducted in the absence of the student representatives.

- R.7.3 The basic responsibilities of a Class Committee are:
- a) to review periodically the progress of the courses.
 - b) to discuss any issues concerning the conduct of the classes.
 - c) to discuss and record the attendance criteria and evaluation scheme for each course. This should be done in the first Class Committee meeting.
- R.7.4 The Class Committee Chair will communicate the minutes of the Class Committee meetings, especially those of the first and second Class Committee meetings, to the Dean (Academics).

R.8 Enrollment and Registration

- R.8.1 The enrollment for the first semester will take effect after the payment of prescribed fees. From the second semester onwards, all students will have to report and register on a day specified in the Academic Calendar at the beginning of the semester. A student will be eligible for registration only if he/she satisfies the conditions under R.9 and will be permitted to register only if he/she has cleared all dues to the Institute up to the end of the previous semester, provided he/she is not debarred from enrolment, on disciplinary grounds.
- R.8.2 If a student fails to report on the specified date, he/she may be allowed by the Dean (Academics) to enroll within one week from the reporting date with a fine. The amount of fine will be specified from time to time.
- R.8.3 Under exceptional circumstances, a student may be allowed to enroll after one week of enrolment date with permission from Chairperson, Senate through Faculty Adviser and Dean (Academics).
- R.8.4 If the student is away on approved leave for a credited internship/ field-based study/ archival work, etc. within the scope of the Program, at the time of semester-registration, the student may be exempted from reporting in-person to the Faculty Advisor and no fine will be applicable in that case. This will be applicable second semester onward
- R.8.5 Except for the first semester, course pre-registration for other semesters will be done during a specified week before the end-semester examination of the previous

semester.

R.8.6 Pre-registration is to be done through an online portal of the Office Automation System (OAS) of the Institute.

R.8.7 If a student wants to modify the pre-registered courses, he/she may do so by adding or dropping courses after the start of the semester within the course add or drop deadline mentioned in the Academic Calendar with the approval of the Faculty Advisor and the concerned course instructors. However, the student should ensure that the total number of credits registered in any semester should enable him/her to earn the minimum number of credit requirement

R.8.8 Students should register for the minimum prescribed credits during each semester and not exceed the maximum credit limit (including backlogs, if any) without prior permission as per the curriculum of the Program.

R.9 Minimum Requirement to Continue the Program

R.9.1 At the end of a semester, the student must maintain a minimum CGPA of 5.0 to continue the Program. If the CGPA of the student falls below 5.0, the student will be placed in academic probation and an advisory note will be issued. If the CGPA continues to be less than 5.0 in the following semester also, then he/she shall be terminated from the Program.

R.9.2 The student will automatically be terminated from the Program if he/she fails to graduate within the maximum permissible duration of the Program. If a student is suspended for any semester or obtains semester break, that semester will be counted towards the maximum duration of the Program.

R.9.3 The student will be terminated from the Program on grounds of unacceptable conduct. In such instances, the Students' Welfare & Discipline Committee (SWDC), or a similar committee empowered by the Senate, will deliberate on the violation and make a recommendation to the Senate.

R.9.4 The student who is terminated from the Program may appeal to the Chairperson, Senate through proper channel for mercy and a second chance to re-enroll in the Program. The Chairperson, Senate may take appropriate decisions on such applications on behalf of the Senate and the same shall be reported to the Senate.

R.10 Duration of the Program

R.10.1 The minimum and maximum durations of any M.A Program are of 2 and 3 years, respectively.

R.11 Semester Break from the Program

- R.11.1 A student may obtain semester break for a maximum period of 2 semesters on medical/ other valid grounds with the permission from the Dean (Academics) through the proper channel. Such semester breaks shall be counted towards the maximum duration of the Program.

R.12 Discipline

- R.12.1 Every student is required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity which will bring down the prestige of the Institute. The students should strictly follow the 'Student Code of Conduct' of IIT Mandi.
- R.12.2 Any act of indiscipline by a student shall be referred to the Students' Welfare & Discipline Committee (SWDC). The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated. Dean (Academics) will consider the recommendations for minor punishments and warnings and take appropriate action accordingly. In the case of major punishment, the Senate will take appropriate decisions.
- R.12.3 Appeal: The student may appeal against the disciplinary action to the Chairperson, Senate, whose decision will be final in such matters.
- R.12.4 Ragging of any dimension is a criminal and non-bailable offence in our country. The current State and Central legislations provide for stringent punishment, including imprisonment. Once the involvement of a student is established in ragging, the offending student will be dismissed from the Institute and will not be readmitted. Avenues also exist for collective punishment, if individuals cannot be identified in this inhuman act. Every student of the Institute shall give an undertaking at the time of admission in this regard.

R.13 Attendance

- R.13.1 Generally, the minimum attendance requirement of a course is 70%. However, a course instructor can have a different criterion for his/her course. In such a case, the changed criteria shall be announced to the students at the beginning of the course. It should also be announced in the 1st Class Committee Meeting and recorded in the minutes.

The percentage of attendance in a course will be indicated in the grade sheet by a

letter code as below:

Attendance Rounded to	Remarks	Code
92 to 100 %	Very Good	VG
80 to 92%	Good	G
70 to 80 %	Satisfactory	S
< 70%	Poor	P

- R.13.2 A student who has an attendance lower than the required minimum attendance in a course, whatsoever the reason for the shortfall in attendance, will not be permitted to appear in the end-semester examination of the course. His/her registration for that course will be treated as cancelled, and he/she shall be awarded an 'F' grade in that course.
- R.13.3 The instructor of a course must finalize the attendance on the last instructional day of the semester. The instructor must announce the particulars of all students who have attendance less than the required minimum in the class.

R.14 Assessment Procedures

- R.14.1 The system of assessment procedure may vary from course to course. However, the general practice of tests and examinations may consist of components such as mid-term tests/quizzes and end-semester examinations. In addition, there may be other components as part of the assessment procedure such as surprise quizzes, assignments, projects, practical tests, viva voce, etc. as per the requirements of a course.
- R.14.2 A continuous evaluation process will be followed to evaluate the progress of practicum-based courses/Post-Graduate Project. The assessment and valuation will be based on presentations (may include open house), project reports, viva-voce, etc.
- R.14.3 Evaluation in practicum-based courses will be carried out by the faculty mentor and an internal evaluation committee formed by the Program Coordinator in consultation with the Program Faculty Group. The detailed evaluation process will be formulated by the Program Coordinator in consultation with the Program Faculty Group.
- R.14.4 Evaluation of the Post Graduate Project will be carried out by the faculty mentor and an internal evaluation committee formed by the Program Coordinator in consultation with the Program Faculty Group. In the case of a guided internship under the Post Graduate Project, the faculty supervisor at IIT Mandi will be consulting with the

organization/Institute of internship and evaluate the student based on the inputs from the organization/Institute. External experts may be invited if required for evaluation of the Post Graduate Project. The detailed evaluation process will be framed by the Program Coordinator in consultation with the Program Faculty Group. In these assessments, the contribution of the faculty mentors' evaluation should not exceed 50% i.e. the contribution of the examination/evaluation committee should not be less than 50%.

- R.14.5 Based on the performance, each student is awarded a final letter grade at the end of the semester for each of the Post Graduate Project.
- R.14.6 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 or I, which implies incomplete.
- R.14.7 The details of the weightage of marks for various components of the assessment procedure have to be announced and recorded in the first Class Committee meeting. The Dean (Academics) should be informed about the scheme of evaluation of a course after the first Class Committee meeting.
- R.14.8 In case of any grievance, the student may appeal to the Dean (Academics).

R.15 Grading System

R.15.1 Letter Grades

The performance of a student in a course is denoted by a letter grade. The letter grades, their interpretation and the corresponding grade points are given below:

Letter Grade	Grade Point Value	Interpretation
O	10	Outstanding
A	9	Very Good
B	8	Good
C	7	Average
D	6	Below Average
E	4	Pass
F	0	Fail
I	0	Incomplete; subsequently be changed into a letter grade in the first month of the subsequent regular semester.
P	0	Passed the course; however, the credits earned will not be counted for SGPA/CGPA calculations.

- R.15.2 The I-grade indicates a temporary grade and that a small part of the total requirement of the course remains to be completed and that the student has done satisfactory work

in all other aspects of the course. The student is required to complete this small part within a prescribed date, generally within one month of the start of the following regular semester, and the course instructor will amend the I-grade to a regular grade within this period. If the conversion to a regular grade is not done within one month of the start of the following regular semester, the I-grade will be automatically converted to an F grade.

R.16 Method of Awarding Letter Grades

- R.16.1 A final meeting of the Class Committee without the student representatives will be convened within seven days after the last day of the end semester examination. The letter grades to be awarded to the students for different courses will be finalized in such meetings.

R.17 Declaration of Results

- R.17.1 After finalization by the Class Committee, the course instructor will submit the letter-grades awarded to the students in a course to the academic office in the prescribed format. The academic office will compile all the results and announce the same to the students through E-mail or the OAS portal of the Institute.

R.18 Re-evaluation of Answer Papers

- R.18.1 If a student has grievances about the result of a particular course, he/she can contact the concerned course instructor within one week from the commencement of the regular semester immediately following the announcement of the results. If the course instructor feels that the case is genuine, he/she may re-examine the case and submit a revised grade, if applicable. Any request to reconsider the grade after one week of the start of the subsequent regular semester will not be considered.
- R.18.2 The course instructor will return answer scripts to the students after evaluation, as part of the learning process. If any student does not collect his/her answer script by the 1st week of the subsequent regular semester, the course instructor may discard it.
- R.18.3 The evaluation pattern and all assignments, quizzes, exams, etc. used in evaluation shall be posted on the course Moodle page.

R.19 Supplementary Examination

- R.19.1 Students who have missed the regular quizzes/assignments/end-semester examination for valid reasons may request for a make-up examination to the respective course instructor within ten days from the date of the examination missed, explaining the reasons for absence. Applications received after this period shall not

be entertained. If the course instructor is satisfied with the explanation provided by the student, he/she may conduct the make-up exam either during the make-up exam slots mentioned in the Academic Calendar or as per the convenience of both the parties. If the instructor is not satisfied with the explanation, he/she may reject the application.

- R.19.2 A student who earns an F grade in a Discipline Core course must secure a pass grade in that course.
- R.19.3 A student who gets an “F” grade in a Discipline Core course is eligible to seek a Supplementary Examination in a subsequent semester to clear the backlog, provided he/she satisfies the minimum attendance criteria of the course. For taking such Supplementary Examination, the student need not attend classes of that course again.
- R.19.4 A student is eligible for only one Supplementary Examination in a course to clear the backlog. In case a student fails in the Supplementary Examination, he/she has to register for that course again in a regular semester/vacation semester and repeat the course by attending regular classes and exams.
- R.19.5 The Supplementary Examination may be offered by the same instructor who offered the course earlier or the instructor who offers the course in the current semester.
- R.19.6 The Supplementary Examination can be held along with the regular students of the subsequent semesters or during the make-up exam slots of the subsequent semesters or at the convenience of the course instructor.
- R.19.7 Generally, the end semester exam alone is given as the Supplementary Examination and the sessional marks (i.e. quiz marks, etc.) earned by the student in the original semester will be taken into account for calculating the final marks. The grade cut-off used in the original semester shall be used for finalizing the grade.
- R.19.8 A student securing an F grade in an Elective course may also attempt the Supplementary Examination option as per the conditions (R.19.2–R.19.6) mentioned above in the case of a Discipline Core course to get a successful grade in that course.
- R.19.9 However, a student may replace a failed Elective course with an equivalent course approved by the Faculty Advisor. In such cases, the student has to declare in advance that a particular course he/she is doing in a particular semester is an Equivalent course in place of a failed Elective course taken in a previous semester. This declaration has to be done before the course drop deadline of that semester that is given in the Academic Calendar by submitting the relevant form.
- R.19.10 A course successfully completed cannot be repeated/improved. In case a student passed all the required Core and Elective courses but failed to earn the required

minimum CGPA of 5.0 for graduation, the student may be permitted to repeat the Core or Elective courses to earn the minimum CGPA required to pass the Program.

R.20 Grade Sheet

R.20.1 The grade sheet issued at the end of a semester to each student will contain the following:

- a) the course number, course name and the credits for each course registered in that semester.
- b) the letter grade obtained in each course
- c) the total number of credits earned by the student up to the end of that semester
- d) the Semester Grade Point Average (SGPA, see R.20.4) for that particular semester
- e) the Cumulative Grade Point Average (CGPA, see R.20.5) of all the courses taken from the first semester

R.20.2 At the end of the Program, a final Transcript containing details of all the courses taken by the student mentioning the overall CGPA will be issued along with the Degree certificate.

R.20.3 The record of the F grade(s) obtained for a course will be retained in the Grade Sheets and final Transcript.

R.20.4 Semester Grade Point Average (SGPA): The performance of a student in a semester is indicated by SGPA, which is a weighted average of the grades in all the courses done by the student in the given semester. The SGPA is calculated as follows:

$$SGPA = \frac{\sum_{i=1}^n c_i g_i}{\sum_{i=1}^n c_i}$$

where c_i stands for the credit in a course and g_i is the point equivalent of the grade obtained in that course. The summation is over the number of registered courses in the semester.

R.20.5 Cumulative Grade Point Average (CGPA): The performance up to any time in the course of the student's Program is indicated by the student's CGPA, which is also calculated by the formula used for SGPA calculation, except that the averaging is done over all of the courses and credits that the student has taken during his/her entire Program up to that point. This includes F grades as well, if not cleared.

R.21 Leave Rules

- R.21.1 The leave rules will be as per the Institute leave norms for the students.
- R.21.2 In case students are going for a credited internship/ field-based study/ archival work, etc. within the scope of the Program, he/she needs to seek approval through the FA, at least 15 days before the day of the proposed departure.

R.22 Scholarships and Tuition Fee Exemption

- R.22.1 The details of various scholarships available for students shall be displayed on the Institute Website from time to time.
- R.22.2 The number of Merit Cum Means (MCM) scholarships for each year and each branch will be limited to 25% of the strength of students in that particular branch in that year.
- R.22.3 The eligibility criteria and other conditions for MCM scholarship shall be notified subject to terms and conditions and at the rates approved by the Government of India from time to time.
- R.22.4 The students who receive MCM scholarship are exempted from paying tuition fee and will receive a monthly scholarship as specified from time to time.
- R.22.5 In the cases of scholarships provided by private organizations, the rates and terms and conditions for the award of such scholarship shall be as approved by the Senate.
- In the case of the SC/ST candidates, all are exempted from payment of tuition fees. The award of scholarships and other benefits will be in accordance with the rules framed or amended by the Government of India from time to time.
- R.22.6 The Dean (Academics) will lay down the administrative procedures to be followed in the selection of students for the award of various scholarships consistent with existing Government regulations if any. The number and names of the candidates selected for various scholarships will be reported to the Senate.

R.23 Eligibility for the Award of M.A. Degree

- R.23.1 A student shall be declared to be eligible for the award of M.A. degree if he/she:
- has registered and successfully completed all the academic requirements including prescribed courses and the Post Graduate Project.
 - successfully acquired the minimum number of CGPA (5.0) prescribed in the

- curriculum within the stipulated time.
- submitted no dues to the Institute, Library and Hostels.
- has no disciplinary action pending against him/her.

R.24 Power to Modify

Notwithstanding all that has been stated above, the Senate has the right to modify any of the regulations from time to time.