

INDIAN INSTITUTE OF TECHNOLOGY MANDI
KAMAND, DISTT. MANDI – 175005 (HIMACHAL PRADESH)



MINUTES OF 30TH BOARD OF ACADEMICS MEETING

VENUE : A-4 CONFERENCE ROOM, KAMAND
DATE : 14TH JUNE, 2019 (FRIDAY)
TIME : 04:00 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 + Nominee (SCEE)	Dr. Kunal Ghosh
6	Course Coordinator (IC Courses)	Dr. Aniruddha Chakraborty
7	Course Coordinator (MA Dev. Studies) + Nominee (SHSS)	Dr. Shyamasree Dasgupta
8	Course Coordinator (B.Tech.-CSE)	Dr. Dileep A D
9	Course Coordinator (B.Tech.-EE)	Dr. Shubhajit Roy Chowdhury
10	Course Coordinator (B.Tech.-ME)	Dr. Arpan Gupta
11	Course Coordinator (B.Tech.-CE)	Dr. Mousumi Mukherjee on behalf of Dr. Deepak Swami
12	Course Coordinator (M.Tech.- (Energy Engg. (Materials))	Dr. Atul Dhar
13	Course Coordinator (M.Tech.- (Mechanical Engg. (Energy Systems))	
14	Course Coordinator (M.Tech.- (Communication and Signal Processing))	Dr. Renu M Rameshan
15	Course Coordinator (M.Tech.- (Power Electronics and Drives))	Dr. Narsa Reddy Tummuru
16	Course Coordinator (M.Tech.-Biotechnology)	Dr. Prosenjit Mondal on behalf of Dr. Shyam K Masakapalli
17	Course Coordinator (M.Sc.-Applied Maths)	Dr. Nitu Kumari
18	Course Coordinator (M.Sc.-Physics) + (I-Ph.D. (Physics))	Dr. Ajay Soni
19	Nominee-1: School of Engineering	Dr. Rajesh Ghosh
20	Nominee-2: School of Engineering	Dr. Venkata Uday Kala
21	Nominee-2: School of Computing & Electrical Engineering	Dr. Aditya Nigam
22	Nominee-2: School of Basic Sciences	Dr. Prosenjit Mondal
23	Nominee-1: School of Humanities & Social Sciences	Dr. Suman Sigroha
24	Academic Affairs Secretary	Mr. Anand Ramrakhyani
25	Assistant Registrar (Academics): Secretary	Mr. Suresh Rohilla

Following members could not attend the meeting

Sl.No.		Name	
1	Course Coordinator M.Sc. (Chemistry)	Dr. Chayan K Nandi	Member
2	Course Coordinator (M.Tech.-(VLSI))	Dr. Satinder Sharma	Member
3	Nominee-1: School of Basic Sciences	Dr. Syed Abbas	Member
4	Research Affairs Secretary	Mr. Ashish Tiwari	Member
5	Industry Member – 1	Dr. Nadeem Akhtar	Member

Special Invitee

Sl.No.	Name	
1.	Dr. Pradeep Kumar	Asst. Prof., SE
2.	Dr. Pradeep Kumar	Visiting Asst. Prof. , SBS
3.	Dr. Manoj Thakur	Asso. Prof., SBS
4.	Dr. Kalpesh Haria	Asst. Prof., SBS

PART-A

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

30.1 Confirmation of the minutes of 29th meeting of Board of Academics:

The minutes of the 29th Board of Academics meeting held on 07th March, 2019 were confirmed.

30.2 To consider restructuring of IC courses basket for B.Tech programme:

Dr. Aniruddha Chakraborty, Course Co-ordinator for IC courses briefed BoA on the restructuring of IC courses basket for B.Tech programme. The board deliberated and suggested some minor changes. He was requested to modify the proposal accordingly. The modified and final proposal placed at **Annexure-A** is recommended for consideration by the Senate for it's approval.

30.3 To consider Proposal for credits earned through NPTEL and other online courses:

Dr. Pradeep Kumar briefed BoA the proposal for credits earned through NPTEL (National Programme on Technology Enhanced Learning) and other online courses. The board deliberated and suggested some minor changes. He was requested to modify the proposal accordingly. The modified and final proposal placed at **Annexure-B** is recommended for consideration by the Senate for it's approval.

30.4 To consider the revision of JRF to SRF and comprehensive examination guidelines:



Dr. Rahul Vaish, Associate Dean (Research) briefed BoA the proposal for revision of JRF to SRF and comprehensive examination grades for Ph.D. and I-Ph.D. scholars. The board deliberated and suggested some minor changes. He was requested to modify the proposal accordingly. The modified and final proposal placed at **Annexure-C** is recommended for consideration by the Senate for it's approval.

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

The Chairperson, CPC presented seven courses for consideration and approval of BoA. After due deliberations, the BoA recommended all courses for consideration by the Senate for it's approval. The final course description after incorporating the suggested changes is placed at **Annexure – D**.

Sl.No	Course No.	Course Name	Credits	Remarks
1	MA 511	Real Analysis	3-1-0-4	-
2	EE 511	Computer Vision	3-0-2-4	-
3	EE 533P	Programming Practicum	1-0-3-3	-
4	MA 521	Functional Analysis	3-1-0-4	-
5	MA 604	Modelling Population Dynamics	3-0-0-3	-
6	MA 603	Advanced Partial Differential Equations	3-0-0-3	BoA suggested course no. MA 603 instead of MA 701
7	EE 534	Probability and Random Processes	3-0-0-3	

30.6 To consider Proposal of changing Industrial Internship to Industrial/Research Internship etc:

Dr. Atul Dhar, Course Co-ordinator M.Tech EEM & MES briefed BoA on the proposal for changing “DP512P (Industrial Internship)” into: DP512P (Industrial/Research Internship)” for current (Admitted in August 2018) M.Tech in Mechanical Engineering with Specialization in Energy Systems and M.Tech. in Energy Engineering with Specialization in Material students.

This recommendation is made by CIG based on the feedback from most of the students and supervisors who feel that value addition here from similar internship that students have done during B.Tech is not very significant. The summer break can be more efficiently utilized for research exposure for improving the quality of Dissertation.

Some CIG members strongly highlighted the importance of industrial training by exposure to industrial environment and converting this 1 credit internship into long duration internship during thesis and possibility into job placement. In view of this advantage, **students are encouraged to find industrial internship. If students are unable to find industrial internship then they may undergo the Research**

Internship with a guide designated by FA for 6 weeks at IIT Mandi or other academic institute. Performance of students will be assessed by a committee formed by FA at the completion on internship for 1 Credit (similar to existing evaluation method). The modified course structure will allow to undergo both industrial as well as research internship based on the discretion of supervisor. The student will get scholarship during this internship period.

This change is requested for M.Tech. in Mechanical Engineering with Specialisation in Energy systems and M.Tech. in Energy Engineering with Specialisation in Materials programmes.

The proposal is recommended for consideration by the Senate for it's approval:

30.7 Any other item with the permission of the Chair.

-NIL-

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


Secretary, Board of Academics


Chairman, Board of Academics

To.

14.06.2019

Dr. Pradeep P. Parameswaran,

Chair, Board of Academics,

IIT Mandi, H.P., India.

Subject: Proposal for revising IC courses structure of current B. Tech. Curriculum.

Dear Sir,

Based on the inputs from the CIG of IC courses, I am as a course coordinator proposing the following changes in the IC courses structure of the current B. Tech. curriculum for your consideration. If you find this proposal appropriate, please forward this proposal to senate for further consideration. In the following the details of this proposal is given for your reference.

IIT Mandi B.Tech. programme has been designed by looking at the current and future changes in the society and the nature of technology. It is at par with the vision of IIT Mandi to have a positive impact on Indian society through academics. Therefore our B. Tech. programme is designed to give students a broad base education to prepare them for their careers in diverse areas in the rapidly changing future. To achieve this above goals, we need to have a flexible curriculum, i.e., a curriculum with breadth. For making student experts in any field, we need to have a curriculum with depth. But every student should get training in the following areas. These are

(a) Basic Sciences.

(b) Humanities.

(c) General Engineering.

There are courses in these above three areas, which are made compulsory to all B.Tech. students while designing the current B.Tech. curriculum of IIT Mandi. Normally a curriculum revision is done after several batches of students have graduated. With this curriculum four batches have already been graduated in 2016-19. We have our own feedback system, as well as we have feedback from alumni, the Peer Review Committee and others. So it is a good time to revise our current curriculum. Based on different feedbacks we decided to revise the curriculum with more depth in different disciplines of engineering by adding more 'discipline courses' and also giving students more freedom to choose some courses by adding a basket in the current IC courses structure. As a result, we have all IC courses (in the current curriculum) retained but some of them are put in a basket and this allow student to choose a few of them as per their passion. Generally learning outcomes are not satisfied if the students are not passionate about the subject.

Also the basket size is increased by introducing new courses (also we have decided to modify some of the old courses as well). Following table presents the proposed course structures. It is important to note here that courses with zero credit are not compulsory for the students – students are allowed to choose any three courses among them as mentioned separately in Table 2.

Table 1: Institute Core Courses

Course No.	Course Name	credits
IC-110	ENGINEERING MATHEMATICS	3
IC-140	GRAPHICS FOR DESIGN	4
IC-152	COMPUTING AND DATA SCIENCE	4
IC-252	DATA SCIENCE II	4
IC-2XX	DATA SCIENCE III	3
IC-160	ELECTRICAL SYSTEMS AROUND US	3
IC-111	LINEAR ALGEBRA	3
IC-121	MECHANICS OF PARTICLES AND WAVES	0
IC-141	PRODUCT REALIZATION TECHNOLOGY	2
IC-142	ENGINEERING THERMODYNAMICS	3
IC-161	APPLIED ELECTRONICS	3
IC-130	APPLIED CHEMISTRY FOR ENGINEERS	0
IC-136	UNDERSTANDING BIOTECHNOLOGY AND ITS APPLICATIONS	0
IC-221	FOUNDATIONS OF ELECTRODYNAMICS	3
IC-240	MECHANICS OF RIGID BODIES	3
IC-241	MATERIALS SCIENCE FOR ENGINEERS	0
IC-260	SIGNALS AND SYSTEMS	0
IC-242	CONTINUUM MECHANICS	0
	Credits from IC Basket	9
		47
	IC Courses Lab	
IC-101P	REVERSE ENGINEERING	2
IC-160P	ELECTRICAL SYSTEMS AROUND US LAB	2

IC-141P	PRODUCT REALIZATION TECHNOLOGY LAB	2
IC-161P	APPLIED ELECTRONICS LAB	2
IC-130P	CHEMISTRY PRACTICUM	0
IC-222P	PHYSICS PRACTICUM	2
IC-201P	DESIGN PRACTICUM	4
		14
IC-010	INTERNSHIP	2
	HSS Basket	13
	Total credits for IC courses (Proposed)	76

In the current curriculum we have a total of 88 credits for IC courses but in the revised curriculum we will have a total of 76 credits. Therefore we 'saved' 12 credits, which can be used in adding more discipline oriented basket.

Table 2: Basket of IC courses.

IC Basket	Credits
APPLIED CHEMISTRY FOR ENGINEERS+ CHEMISTRY PRACTICUM	3
UNDERSTANDING BIOTECHNOLOGY AND ITS APPLICATIONS	3
MATERIALS SCIENCE FOR ENGINEERS	3
CONTINUUM MECHANICS (with refinement of contents)	3
SIGNALS AND SYSTEMS	3
MECHANICS OF PARTICLES AND WAVES (with refinement of contents)	3
Environmental Science (new addition)	3

Measurement and Instrumentation Practicum (new addition)	3
	24
Take 9 credits from the basket , with minimum 3 credits from Basic science, General engineering.	

Thanking You

Aniruddha Chakraborty

Coordinator, IC courses.



To

The Chairman,

Board of Academics,

Indian Institute of Technology Mandi.

June 15, 2019

Dear Sir,

Subsequent to the discussions that took place in the Board of Academics dated June 14, 2019, the courses mentioned in the IC basket referred to in Table 2 of this document (hereinafter referred to as IC basket courses), it was further resolved to sub-basket the IC basket courses into two sub-baskets – one in which the IC basket courses inclined towards the engineering side (hereinafter referred to as engineering sub-basket) are placed and the other one in which the IC basket courses inclined towards the science side (hereinafter referred to as science sub-basket) are placed.

Whereas a student has the freedom to opt for three IC basket courses, he/she is constrained to opt for at least one course from the engineering sub-basket and at least one course from the science sub-basket. Table 3 represents the contents of the science and engineering sub-baskets.

Table 3: Engineering and Science sub-baskets

A. Science sub-basket

Science sub-basket courses	Credits
1. Applied Chemistry for engineers + Chemistry practicum (IC130+IC130P) (with refinement of contents)	3
2. Understanding biotechnology and its applications (IC136)	3
3. Mechanics of particles and waves (IC121) (with refinement of contents)	3
4. Environmental Science (new course)	3

B. Engineering sub-basket

Engineering sub-basket courses	Credits
1. Material Science for Engineers (IC241)	3
2. Continuum Mechanics (IC242)	3
3. Measurement and Instrumentation Practicum (new course)	3
4. Signals and Systems (IC260)	3

As shown in table 3A, a new course on Environmental Science is proposed to be introduced in the Science sub basket. Similarly, as shown in table 3B, a new course on Measurement and Instrumentation Practicum is proposed to be introduced in the Engineering sub basket.

The minutes of CIG of existing B.Tech programmes (Civil Engineering, Computer Science and Engineering, Electrical Engineering and Mechanical Engineering) mentioning the observation of the existing IC courses are appended herewith as well.

Thank you.

Yours sincerely,

Dr. Shubhajit Roy Chowdhury,
Coordinator (Acting), IC Courses

A handwritten signature in blue ink, consisting of several loops and a final vertical stroke, positioned to the right of the typed name.

Proposal to consider credits earned through online courses towards the requirement of completion of degree

Members: Dr. Anil Sao, Dr. Manoj Thakur, Dr Pradeep Kumar (SE), Dr. Shubhajit Roy Chawdhury

Preamble:

The teaching curriculum at undergraduate/postgraduate level and research areas are getting quite diversified due to increasing demand of trained professionals in both industry and academia. This in turn requires speedy adaption of the academic curriculum to new concepts and research relevant with the need of the time in order to keep the students updated with the latest research field and associated courses to remain relevant. Quite often the students demand to run such courses that can enhance their understanding to greater depth in some particular area. Also, sometimes, such courses are so much specific to certain domain that student's registration is very few.

There are many initiatives by the MHRD to make use of information technology supported alternatives to enable the quality education to reach of everyone. The learning from NPTEL portal is one such solution and it can be quite helpful in addressing the above issues.

Keeping in view the institute requirements, the committee proposes the following method to consider the credit and grade of the NPTEL courses towards the requirement of completion of degree.

The committee proposed the following:

(1) Maximum permissible number of courses:

S. No.	Program	No of course/ credit
1	UG/Dual degree	3 courses/(9 ± 1 credit)
2	MA/M.Sc/M.Tech/I-PhD	2 courses/(6±1 credit)
3	MS/PhD	1 course/(3±1 credit)

These courses will be considered towards credit requirements for a specific basket

(2) Process:

- Before start of the semester, student should take permission from both the faculty advisor and the course coordinator for categories 1 and 2 of the program. The consent from APC/DC committee is required for the category 3 program. Final approval will be made by AD course and record will be maintained in dean of academic office.
- These credits will be counted towards the number of course registered by student on successful completion of course by providing the completion certificate to Dean Office.
- Faculty advisor (FA) and course coordinator (CC) should assign the course basket (discipline elective or free elective) under which the credits for the online registered course(s) will be counted. If required, FA and CC may take inputs from the subject experts in this regard.
- It should be ensured that these courses are not in the list of courses regularly offered/taught in the institute.
- Students are allowed to take maximum one course from discipline elective basket and rest from free elective basket for category one, however two courses may be allowed for students adopting honours degree.

- No financial and logistics support will be extended to the student(s) for the execution of the courses/examination etc.
- These courses may not be allowed in the last semester of a programme.
- Maximum number of credits registered for course including NPTEL course in a semester will be according to the institute norm.

(1) **Mapping to IIT Mandi credit system:** The NPTEL certificate mentions the number of credit of a course and the credit definition. We have got the following information: Weekly video content is 2.5hrs and hence a 4 week course has 10hrs of video content and an assignment every week is about an hour of work and hence 4 assignments=4 Hrs. Hence for a 4 week course, total study time=14 Hrs and hence was recommended as 1 credit. And by the same token, an 8 week course was recommended 2 credits and 12 week course, 3 credits. Furthermore, If the time taken for discussion forum as 1 Hr more and additional reading material as 1 Hr then a 4 week course can be given 2 credits too. Also some courses have video content of 3 to 3.5 hrs per week. Also programming courses have 3 or 4 programming assignments per week which would consume more time. (Email responses from NPTEL office is attached with this proposal).

By this way, based on course duration which remain available on NPTEL website, we can assign number of credit of a NPTEL course.

(2) **Mapping with IIT Mandi grade system:** NPTEL portal provides all the statistics of the marks such as max, min, mean, standard deviation etc. In order to get any further data required for grading the students, Institute may nominate a person for the Local Chapter of NPTEL to access the data officially. Email responses from NPTEL office is attached with this proposal

The data related to every course offered is archived as statistics under the site npTEL.ac.in/noc. From here, total number enrolled, registered, certified, the highest and lowest marks etc can be found.”

If needed Institute may also sign a MOU with NPTEL for this purpose. After getting the required data, the grading policy of IIT Mandi can be applied to award the grade for NPTEL course.

The Faculty advisor/Research Guide has to work out the above details and present the final credit and grade in the CCM, and provide the grade to Dean Academic office. For such courses a special course code like XX591, XX592, XX593 or NPXXX can be used.

Supporting document:

Email from NPTEL office:



Proposal for **guidelines revision for comprehensive examination and JRF-SRF conversion of Ph.D. and I-PhD scholars**

Candidates who scored very good grades are ONLY eligible for JRF- SRF conversion. This is with reference to existing norms for JRF-SRF conversion. At present, there are three grades available as “not satisfactory”, “satisfactory” and “very good” for comprehensive examinations. In view of previous years various schools statistics, it has been noticed that there is skewed distribution of these grades among students. It has been observed that the most of the students have shown above average performance which cannot be accurately graded in present scheme. Hence, several students who were awarded satisfactory grades in comprehensive examinations have performed remarkable in the research as commented by respective Doctoral committees. In such situation, it is desirable to amend present guidelines for comprehensive examination and conversion from JRF to SRF under HTRA Fellowship. Inclusion of “**good**” grade may solve such issue.

The following amendments are proposed in the existing guidelines.

Revision in guidelines for Comprehensive Examination of Ph.D. and I-PhD scholars:

“The comprehensive examination consists of two parts: written and oral viva examinations. Both examinations focus on evaluation of preparedness of scholar on basics and advance knowledge of the chosen discipline. The performance in both written and oral examinations will be described separately using categorical adjectives: Very Good, Satisfactory and Not Satisfactory. These categorical attributes shall be derived from numeric values which may represent percentage of marks obtained in written and oral examinations. The relationship between numeric values and categorical values need to be specified explicitly.”

May be read as

The comprehensive examination consists of two parts: written and oral viva examinations. Both examinations focus on evaluation of preparedness of scholar on basics and advance knowledge of the chosen discipline. The performance in both written and oral examinations will be described separately using categorical adjectives: Very Good, **Good**, Satisfactory and Not Satisfactory. These categorical attributes shall be derived from numeric values which may represent percentage of marks obtained in written and oral examinations. The relationship between numeric values and categorical values need to be specified explicitly.

Revision in guidelines for JRF to SRF Conversion:

“The student has secured 'Very Good' grade in comprehensive examination. The student who secures 'Satisfactory' grade in comprehensive examination may also be considered eligible for this conversion if s/he takes additional two courses, after comprehensive examination, which are not related to her/his research area and secures minimum 'B' grade. These courses must have more than four students enrolled.”

may be read as

The student has secured 'Very Good'/'**Good**' grade in comprehensive examination. The student who secures 'Satisfactory' grade in comprehensive examination may also be considered eligible for this conversion if s/he takes additional two courses, after comprehensive examination, which are not related to her/his research area and secures minimum 'B' grade. These courses must have more than four students enrolled.

AD (Research)

Dean (Academics)

Chairman Senate



New Course Proposal, IIT Mandi

Course Name	: Real Analysis
Course Number	: MA-511
Credit	: 3-1-0-4
Prerequisites	: None
Students intended for	: M.Sc. /M.S./Ph.D. /B.Tech 3 rd and 4 th year
Elective or core	: Core for M.Sc. in applied Mathematics and Elective for other discipline.
Semester	: Odd/Even

Preamble: The objective of this course is to introduce real analysis. Real analysis is a backbone of mathematics (pure and applied both) for example we need to have a profound knowledge of real analysis to study partial differential equation, functional analysis, probability theory etc.

1. Introduction to real numbers, Construction, Dedekind cuts, Completeness property, Archimedean property, Countable and uncountable set. [4]
2. Open balls and open sets in Euclidean space, Definition of interior points, Closed sets, Adherent points, Accumulation points, Closure, Bolzano-Weirstrass Theorem, Cantor intersection theorem, Heine-Borel Theorem, Compactness. [6]
3. Metric spaces, Open sets, Closed sets, Dense sets, Metric subspaces, Compact subsets of a metric space, Boundary of a set, Totally boundedness, Completeness. [7]
4. Convergent sequences in a metric space, Cauchy sequences, Complete metric space, Limit of a function, Continuous functions, Continuity of composite functions, Continuity and inverse image of open and closed sets, Functions continuous on compact sets, Connectedness. [8]
5. Review of Riemann Integration, Riemann-Stieltjes integral : definition and examples, Properties of the integral. [4]
6. Uniform continuity, Fixed point theorem for contractions, Sequences of functions, Point wise convergence of sequences of functions, Uniform convergence of sequences of functions, Uniform convergence and continuity, Cauchy condition for uniform convergence, Uniform convergence of infinite series of functions, Cauchy condition for uniform convergence of series, Weirstrass M-test, Dirichlet's test for uniform convergence, Uniform convergence and differentiation, Uniform convergence and integration [10]
7. Metric space $C[a,b]$, Characterize compact subsets, i.e., Arzela-Ascoli theorem. [3]

Text Books

1. **W. Rudin**, Principles of Mathematical Analysis, 3rd ed., McGraw-Hill, 2013.
2. **T. Apostol**, Mathematical Analysis, 2nd ed., Narosa Publishers, 2002.

Reference Books

1. **Elias M. Stein and Rami Shakarchi**, Real Analysis, Princeton Lectures.
2. **Terrance Tao**, Analysis I and II, Trim, Hindustan book agency.

Approvals:

Other Faculty interested in teaching this course:

Proposed by:

School: SBS

Signature _____ Date _____

Recommended/Not Recommended, with Comments:

Chairman, CPC

Date: _____

Approved / Not Approved



IIT Mandi
Proposal for a New Course

Course No.: EE-511

Course Name: Computer Vision

Credits (L-T-P-C): 3-0-2-4

Prerequisites: Linear algebra, Probability and Statistics

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

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

Semester: Odd / Even

Preamble:

Computer vision is an important applied research area encompassing aspects from geometry, machine learning, probabilistic models, optimization etc. The course consists of various important aspects of computer vision namely geometry, motion, image features, and low-level and high-level image labeling. The course is designed such that some fundamental frameworks as well as some contemporary methods are covered. The course also has a lab component, which includes programming assignments related to many of the topics mentioned below.

Course modules:

Unit 1: Essential mathematical tools: Least squares, RANSAC, Eigen-analysis, PCA, SVD, clustering, gradient-based optimization methods
(4 hours)

Unit 2: Geometry, Camera models, Epipolar geometry, Stratified reconstruction, Applications: large scale reconstruction, single-view metrology
(8 hours)

Unit 3: Probabilistic graphical models: MRF, CRF, Combinatorial optimization methods
(5 hours)

Unit 4: Stereo disparity estimation, Optical flow (Lucas Kanade and Horn Schunk approaches, contemporary energy minimization methods)
(5 hours)

Unit 5: Features detection and tracking: Harris corner detector, KL tracking, SIFT, Overview of other contemporary descriptors.
(5 hours)



Unit 6: Segmentation: Low-level segmentation, energy minimization and clustering based methods, semantic segmentation
(5 hours)

Unit 7: High level vision: CNN overview, single image depth estimation, Flow-net, 3D scene understanding and segmentation.
(6 hours)

Unit 8: Synthesis: GAN overview, 3D shape synthesis, integrating viewpoint and texture, semantic image synthesis
(4 hours)

Text books:

D. Forsyth and J. Ponce, Computer vision – A modern approach, Second edition, Pearson, 2012.

References:

1. R. Hartley and A. Zisserman, Multiple view geometry in computer vision, Second edition, Cambridge univ. press, 2003
2. S. Prince, Computer vision – Models, learning and inference, Cambridge univ. press, 2012.
3. C. Bishop, Pattern Recognition and Machine learning, Springer, 2006.

Similarity Content Declaration with Existing Courses: NIL

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

Proposed by: Dr. Renu Rameshan, Arnav Bhavsar

School: 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 Number:EE533P

Course Name: Programming Practicum

Credits: 1-0-3-3

Prerequisites: Programming experience in any language (C/C++/Matlab/Python etc.)

Students intended for: MTech./M.S./Ph.D.

Elective or Core: Core for M.Tech. CSP, Elective for M.S./Ph.D.

Semester: Odd

Preamble:

Programming skills are essential for any engineer. This course builds upon previous programming courses done by students during their previous degrees. A modern programming language with a large set of libraries suitable for data analysis or machine learning (such as Python) will be used. Emphasis will be given on programming for problems relevant to data analysis and information processing from domains such as signal processing, machine learning and communications.

Suggested implementation: The course will have weekly lab evaluations (related to the topic covered in the lecture), followed by a 3-4 week mini project. It is desirable for the the mini project to have a pre-final evaluation and a final evaluation.

Learning outcome: After taking this course, students will become familiar in writing good code, using relevant libraries, using the right data structure, handling large data sets, plotting and visualizing information. They would have also become familiar with programming solutions to several problems in data analysis. They would also know how to do basic performance evaluation of programs.

Course Outline:

1 lecture per week, followed by 3 hours of lab.

Course Modules:

- 1. Review of general programming constructs (4 lectures)**
Loops, conditionals, recursion, file i/o, data structures: strings, tuples, lists, dictionaries
- 2. Introduction to scientific computing (1 lecture)**
Numerical precision in programs, IEEE 754 floating point representation, introduction to NumPy and Scipy
- 3. Data manipulation (1 lecture)**
Pandas, handling large data files
- 4. Data visualization (1 lecture)**
*Various types of plots: histograms, scatter plots, box plots etc.
Datasets can be provided and plots can be created from them*
- 5. Object oriented programming (1 lecture)**
Classes and objects, inheritance



6. Implementing well known programs (4 lectures)

Matrix factorizations, solving large order linear systems of equations, least squares approximations, simulating binary channels, signal denoising, K-means clustering, classification using Baye's rule etc.

7. Introduction to parallelization (1 lecture)

Cuda programming (conceptual level only)

8. Program analysis (1 lecture)

Performance tuning, profiling of programs, identifying performance bottlenecks

Text Books:

1. Python Programming for the Absolute Beginner, Michael Dawson, Third Edition
2. How to Think Like a Computer Scientist: Learning with Python, Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press (Chapter 1-9, Chapter 11)

Reference Books:

1. Python Data Science Handbook, Jake Vanderplas, O'Reilly
2. Introduction to machine learning with Python, Muller and Guido, O'Reilly

Proposed by: Padmanabhan Rajan
School: **SCEE, IIT Mandi**

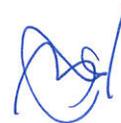
Signature:

Date: 8/3/2019

Approved / Not Approved

Chairman, Senate

Date: _____



New Course Proposal, IIT Mandi

Course Name	: Functional Analysis
Course Number	: MA-521
Credit	: 3-1-0-4
Prerequisites	: Real Analysis
Students intended for	: M.Sc./B.Tech/M.S./Ph.D.
Elective or core	: Core for M.Sc. in applied Mathematics and Elective for other discipline.
Semester	: Odd/Even

Preamble: The objective of this course is to introduce fundamental topics in Functional Analysis. The contents are designed in such a way that it will give foundation of Functional Analysis at a level and depth appropriate for someone aspiring to study higher level mathematics. Many of the concepts and results like Hahn Banach, open mapping, closed graph theorems etc are very useful in proving many results in fields like Differential Equations, Numerical Analysis etc.

Module 1: Normed spaces, Examples of Normed Spaces, Subspaces of Normed Spaces, Quotient Normed Spaces, Riesz Lemma, Finite-Dimensional Normed Spaces, Convex Subsets of Normed Spaces, Stronger and Equivalent Norms, Strictly Convex Normed Spaces. [5]

Module 2: Linear Maps Between Normed Spaces, Continuity of linear maps, Examples of Discontinuous Linear Maps on Infinite Dimensional Normed Spaces, Various Criterion for Continuity of Linear Maps, Linear Functionals, Examples of Continuous Linear Maps, Necessary Conditions for the Continuity of Transformations defined by Infinite Matrices, Operator Norm of Bounded Linear Maps, Operator Norm of Transformations defined by Finite Matrices. [5]

Module 3: Hahn-Banach Separation Theorem, Hahn-Banach Extension Theorem, Consequences of Hahn-Banach Extension Theorem, Uniqueness of the Hahn-Banach Extension, Banach Limits. [5]

Module 4: Banach Spaces, Subspaces of Banach Spaces, Quotient Banach Spaces, Product of Banach Spaces, Canonical Embedding of Normed Spaces, Schauder Basis, Uniform Bounded Principle and its Applications, Banach-Steinhaus Theorem. [8]

Module 5: Closed Maps, Closed graph theorem, Linear Projections, Open Maps, Quotient Maps, Open Mapping Theorem and its Applications, Bounded Inverse Theorem. [6]



Module 6: Spectrum of Bounded Operators, Resolvent Set, Eigen-spectrum, Approximate Eigen-spectrum, Spectrum of the Right Shift Operator, Compact Operators on Normed Spaces, Spectrum of Compact Operators. [5]

Module 7: Inner Product Spaces, Orthonormal Sets, Bessel's Inequality, Riesz-Fischer Theorem, Fourier Expansion, Parseval Formula, Projection and Riesz Representation Theorems, Bounded Operators and Adjoints, Normal, Unitary and Self-Adjoint Operators. [8]

Text Books:

1. B.V. Limaye, **Functional Analysis**, New Age International Private Limited, Revised Third Edition, New Delhi, x + 612 pp., 2017.
2. B.V. Limaye, **Linear Functional Analysis for Scientists and Engineers**, Springer, Singapore, xiv + 254 pp., 2016.
3. J.B. Conway, **A Course in Functional Analysis**, Springer, 2nd Edition, 1990.

Reference Books:

1. E. Kreyzig, **Introductory Functional Analysis with Applications**, John Wiley & Sons, New York, 1989.
2. K. Yoshida, **Functional Analysis**, Springer, 6th Edition, 1995.
3. C. Goffman and G. Pedrick, **A First Course in Functional Analysis**, Prentice-Hall, 1974.
4. A. Taylor and D. Lay, **Introduction to Functional Analysis**, Wiley, New York, 1980.

Approvals:

Other Faculty interested in teaching this course: Dr. Qaiser Jahan, Dr. Syed Abbas, Dr. Muslim Malik

Proposed by: Dr. Kalpesh Haria (SBS)

Signature _____ Date _____

Recommended/Not Recommended, with Comments: _____

Date: _____ Chairman, CPC

Approved / Not Approved



**Indian Institute of Technology -Mandi
School of Basic Sciences**

Proposal for a New Course

Course Name	: Modeling Population Dynamics
Course Number	: MA 604
Credit	: 3-0-0-3
Prerequisites	: MA 513 Ordinary Differential Equations
Students intended for	: M.Sc./B.Tech/M.S./M.Tech/Ph.D.
Elective or core	: Elective
Semester	: Odd/Even

Course Description:

The major goals of this course are to develop techniques of computational and differential equation modeling in ecology. This course is an introduction to synthesis of mathematical models and empirical ecology. Why do organisms become extremely abundant one year, and then apparently disappear a few years later? Why population outbreaks in certain species in certain locations happen more or less regularly, while in other locations such eruptions are irregular? This course will provide answers to such questions. This course will begin with a detailed examination of the dynamics of individual populations and go on to consider how interspecific interactions impact populations. While this course is strongly focused on the underlying theories of population ecology and the mathematical formulations that accompany these theories, the ultimate goal is always the better understanding of real populations. This course will introduce a number of modeling approaches that are widely used in applications to life sciences and age-structured model. From this course, students will gain a better understanding of population dynamics in general.

Course Content:

Module 1: Introduction:

Modeling Nature: History and General philosophy of the modeling approach. The demand for Reliable Prediction and Latest Development in Mathematical Modeling. Advantages and Demerits of Mathematical Modeling while Dealing with Real world's Problems. [2]

Module 2: Unstructured Population Models:

Population Dynamics from the first principle, Single-Species Models with Exponential and Logistic growth, Self Limitation, Consumer Resource Oscillation. Application of theory of Difference Equations to Population Growth models. Introduction to Discrete-time Models. Linear Models, Growth Models, Harvest Models: Bifurcation and Breakpoints. Delayed Differential models, Exogenous Drivers. [8]



Module 3: Introduction to Continuous Models:

Models for Single Species Populations: Malthus Model, Logistic Growth, Allee Effect. Predator-Prey System and the Lotka-Volterra Equations, Populations in Competition, Multiple-Species Communities and the Routh-Hurwitz Criteria, Qualitative Stability
Types of Models: Continuous-time, Discrete-time, Delayed Differential models, Exogenous Drivers. [10]

Module 4: Age and Stage-Structured Models In Ecology:

Discrete Time Models with Age and Stage classes, Leslie Matrices, Estimating the Transition Matrix From Empirical Data, fisheries and Insect Populations as Prototype Example. [6]

Module 5: Population Interactions:

Functional response, Aggregative response, Numerical Response, Competition Models, Mutualism Models, Lotka Volterra Model, Anatomy of Predator Prey Cycle, Grazing systems, pathogens and parasites, Tritrophic Models . [8]

Module 6: Empirical Approaches:

Analysis of Population fluctuations, Time Series Analysis, Fitting Models to Data, Fitting Mechanistic Models [8]

Text Books:

1. Introduction to Population Ecology, Larry L. Rockwood, Blackwell Publishing Limited, 2nd Edition, 2015.

Reference Books:

1. Mathematical Models, Richard Haberman, SIAM, 5th edition, 2013.
2. Mathematical Models in Biology, Leah Edelstein Keshet, SIAM, 2005
3. Complex Population Dynamics: A Theoretical Empirical Synthesis, Peter Turchin, Princeton University Press, 2003.
4. Environmental Modelling: An Introduction, Jo Smith and Pete Smith, Oxford University Press, 2007.
5. Elements Of Mathematical Ecology, Mark Kot, Cambridge University Press, 1st Edition, 2001.



Other faculty members interested in teaching this course: Not known

Proposed by: Dr. Nitu Kumari

School: Basic Sciences

Signature:

Date: July 24, 2012

The course proposal has been duly circulated and comments are attached/no comments were received.

_____ **(Dean (Academics))** **Date:** _____

Approved / Not Approved



New Course Proposal, IIT Mandi

Course Name	: Advanced Partial Differential Equations
Course Number	: MA 603
Credit	: 3-0-0-3
Prerequisites	: MA 522 Partial Differential Equation
Students intended for	: M.Sc./B.Tech/M.S./M.Tech/Ph.D.
Elective or core	: Elective
Semester	: Odd/Even

Preamble: This is a course intended to introduce the advanced concepts of partial differential equations. Through a detailed study of Greens function, students will learn the advanced analytical techniques available to solve nonlinear PDEs. Later they will be made to understand the role of Sobolev norms and compact embeddings to solve PDEs and find spectral decompositions.

Course Content:

Module 1: Green's Function: Green's functions, Green's functions and applications for Laplace, Poisson and Helmholtz equations Green's functions and applications for the heat equation Green's functions and applications for the wave equation. [4]

Module 2: Non Linear First Order PDE: Complete Integrals and New Solutions from Envelopes, Local Solution and Application. Equations that convert into linear PDE; some exactly solvable cases; Burgers' equation; dimensional analysis and similarity; travelling waves; nonlinear diffusion and dispersion. Introduction of Hamilton Jacobi Equations, Calculus of Variations, Hamilton's O.D.E., Boundary Conditions, Local Solutions and Applications. [6]

Module 3: Asymptotics, Singular perturbations, Turing Instability for Reaction Diffusion System, Laplace's Method, Homogenization, Power Series, Non Characteristic Surfaces, Real analytic Functions, Cauchy Kovalevskaya Theorem. [3]

Module 4: Sobolev Spaces: Introduction to Hilbert Spaces of Functions, Holder Spaces, Sobolev spaces; Definitions and Elementary Properties. Weak solution, Uniqueness and Properties of Weak derivatives. Definition & Properties of Sobolev Spaces, Inequalities, Compactness. Extensions, Sobolev. [12]

Module 5: Second Order Elliptic Equations: Weak Solutions of Elliptic Equation, Existence of weak solutions, Regularity, Maximum Principles, Eigen values & Eigen Functions of symmetric elliptic operators. [8]

Module 6: Reaction Diffusion System: Weak Solution of Diffusion Equation, Green's Function of Diffusion Equation, Formulation of Reaction Diffusion models and extensions to Include Chemotaxis terms; Application of Reaction Diffusion Systems to Population Dynamics, Pattern and Wave Phenomenon in the Life Sciences, Semi-arid vegetation and wound healing as Prototype Examples [9]

Similarity content declaration with existing courses:

Sl. No.	Course Code	Similarity Content	Approximate % of Content
1	MA 522	Green's Function	Less than 5%

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

Not Applicable

Text Book:

1. Evans, Lawrence C. *Partial Differential Equations*. Graduate Studies in Mathematics, vol. 19. Providence, RI: American Mathematical Society, 2010. ISBN: 9780821807729.
2. Brezis, H. And H. Brezis. 2011, 'Functional Analysis, Sobolev Spaces and Partial Differential Equations' Newyork: Springer.

Reference Books:

1. Debnath, Lokenath. *Nonlinear partial differential equations for scientists and engineers*. Springer Science & Business Media, 2011.
2. DiBenedetto, Emmanuele. *Partial Differential Equations*. Boston, MA: Birkhäuser, 1995. ISBN: 9780817637088.
3. Garabedian, Paul. *Partial Differential Equations*. Providence, RI: AMS Chelsea, 1998. ISBN: 9780821813775.
4. E.Kreyszig, *Advanced Engineering Mathematics*, Wiley, 2011.

Approvals:

Proposed by: Dr. Nitu Kumari School: SBS
 Signature ___Nitu_____ Date 20.11.18_____

Recommended/Not Recommended, with Comments:

_____ Date: _____

Chairman, CPC

Approved / Not Approved

Proposal for revision of CS 601

Course Number : EE 534

Course Name : Probability and Random Processes

Credits : 3-0-0-3 (L-T-P-C)

Prerequisites : Linear algebra (MA512 or IC 111) and IC 252 or equivalent of both (MA512 and IC252)

Intended for : UG /MS/MTech (CSP)/PhD/M.Sc(Maths)

Elective/Core : Core for Mtech (CSP), Elective for B.Tech. III/IV year, MS, Ph.D, M.Sc(Maths).

Semester : Odd

Preamble

Knowledge of random variables and random processes is essential in the following fields – signal processing, communications and machine learning. Starting with a review of basic concepts in probability the course aims to prepare a student to think in terms of random variables and processes. By the end of the course the student should be able to identify the type of process or variable involved and analyze a problem accordingly and obtain reasonable conclusions from the analysis. The course is oriented towards engineering applications rather than a mathematical one based on measure theory.

Course modules with Quantitative lecture hours:

Sigma field. Review of - axiomatic probability, conditional probability and independence. (2 lectures)

Recap of random variables and functions of random variables. (3 lectures)

Probability generating function, moment generating function and characteristic functions – properties and applications. (3 lectures)

Markov chains, classification of states and chains, stationary distribution and limit theorem, Poisson process. (5 lectures)

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

Concentration inequalities – Chernoff's bound, Hoeffding's inequality, Bennett's inequality, Bernstein's inequality and Efron-Stein inequality. (8 lectures)

Random vectors and covariance matrix. Random processes – stationarity, WSS. Autocorrelation, cross correlation, power spectral density. Filtering of WSS processes. Basic notion of ergodicity. Wiener processes, Markov processes. (10 lectures)

Queueing models - Little's law, M/M/1, M/M/m, M/M/m/m, M/G/1 queueing systems, priority queueing (6 lectures)

Textbook:

1. Probability and Random Processes, Grimmett and Stirzaker, Oxford University Press, 2001.

Reference books:

- (1) Erhan Cinlar, Introduction to Stochastic Processes, Dover Books on Mathematics, 2013
- (2) R. G. Gallager, Stochastic Processes: Theory for applications, Cambridge University Press; 1 edition (February 17, 2014)
- (3) S. M. Ross, Stochastic processes, 2nd Edition, 1996, John Wiley, New York
- (4) J. R. Norris, Markov chains, 1999, Cambridge University Press, Cambridge
- (5) Papoulis and Pillai, Probability, Random variables and Stochastic processes, McGraw-Hill Europe; 4th edition (January 1, 2002).

Similarity Content Declaration with Existing Courses:

Sr. No.	Course code and Title	Similarity content	Approx. % of content	Remarks
1	MA 524	Introductory material	5 lectures (12%)	
2	IC 252	Introductory material	5 lectures (12%)	
3	CS 601	Introduction and some parts of Random processes	At most 10 lectures (24%)	

Justification for new course proposal if cumulative similarity content is > 30%: This course is meant to replace CS 601 so the 24% similarity goes away. The remaining similarity is only due to the introductory material.

Approvals:

Other faculty interested in teaching this course: Satyajit Thakor, Arnav Bhavsar.

Proposed by: Renu Rameshan and Samar Agnihotri

School: SCEE

Signature:

Date: 31 Mar 2019

Recommended/Not Recommended, with comments

Chairperson, Course proposal committee (CPC)

Date:

Approved / Not Approved

Chairperson, Senate

Date:

