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



Indian
Institute of
Technology
Mandi

# MINUTES OF 31ST BOARD OF ACADEMICS MEETING

VENUE       :    A-4 CONFERENCE ROOM, KAMAND

DATE        :    17th SEPTEMBER,  2019 (TUESDAY)

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 (B.Tech.-CSE) | Dr. Dileep A D |
| 7 | Course Coordinator (B.Tech.-EE) | Dr. Shubhajit Roy Chowdhury |
| 8 | Course Coordinator (B.Tech.-ME) | Dr. Arpan Gupta |
| 9 | Course Coordinator (M.Tech.- (Energy Engg. (Materials)) | Dr. Atul Dhar |
| 10 | Course Coordinator (M.Tech.-(Mechanical Engg. (Energy Systems)) | |
| 11 | Course Coordinator (M.Tech.-(Communication and Signal Processing)) | Dr. Samar Agnihotri |
| 12 | Course Coordinator (M.Tech.-(Power Electronics and Drives)) | Dr. Narsa Reddy Tummuru |
| 13 | Course Coordinator (M.Tech.-Biotechnology) | Dr. Shyam K Masakapalli |
| 14 | Course Coordinator (M.Sc.-Applied Maths) | Dr. Nitu Kumari |
| 15 | Course Coordinator (M.Sc.-Physics) + (I-Ph.D. (Physics)) | Dr. Ajay Soni |
| 16 | Nominee-1: School of Engineering | Dr. Rajesh Ghosh |
| 17 | Nominee-2: School of Engineering | Dr. Venkata Uday Kala |
| 18 | Nominee-2: School of Computing & Electrical Engineering | Dr. Aditya Nigam |
| 19 | Nominee-1: School of Basic Sciences | Dr. Syed Abbas |
| 20 | Nominee-1: School of Humanities & Social Sciences | Dr. Suman Sigroha |
| 21 | Academic Affairs Secretary | Mr. Anand Ramrakhyani |
| 22 | Research Affairs Secretary | Mr. Partha S. Nayak |
| 23 | 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 M.Sc. (Chemistry) | Dr. Chayan K Nandi | Member |
| 3 | Course Coordinator (MA Dev. Studies) + Nominee (SHSS) | Dr. Shyamasree Dasgupta | Member |
| 4 | Course Coordinator (B.Tech.-CE) | Dr. Deepak Swami | Member |
| 5 | Course Coordinator (M.Tech.-(VLSI)) | Dr. Hitesh Shrimali | Member |
| 6 | Nominee-2: School of Basic Sciences | Dr. Prosenjit Mondal | Member |
| 7 | Industry Member – 1 | Dr. Nadeem Akhtar | Member |

## Special Invitee

| Sl.No. | Name | |
|---|---|---|
| 1. | Dr. Satinder Sharma | Asso. Prof., SCEE |
| 2. | Dr. Kalpesh Haria | Asst. Prof., SBS |
| 3. | Dr. Sandip Saha | Asst. Prof., SE |

# PART-A

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

**31.1 Confirmation of the minutes of 30<sup>th</sup> meeting of Board of Academics:**

The minutes of the 30<sup>th</sup> Board of Academics meeting held on 14<sup>th</sup> June, 2019 were confirmed.

**31.2 To consider modification in course curriculum of M.Tech. (PED) programme:**

Dr. Narsa Reddy Tummuru, proposed modification in the course curriculum of M.Tech. (PED) programme. The proposed modification were based on suggestion received from the school review committee, which was held on May 2018. The revised structure gives students ᴏᴘᴘᴏʀᴛᴜɴɪᴛʏ to do final year project in industry/R&D organizations, because all the credit requirements of courses are completed by 2<sup>nd</sup> semester. The board deliberated and suggested few minor changes. The modified and final course curriculum is placed at **Annexure-A** and is recommended for consideration of the Senate for approval.

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

The Chairperson, Course Proposal Committee (CPC) presented five courses for consideration and approval of the BoA. After due deliberations, the BoA recommended the following courses for consideration by the Senate and its approval.

| Sl.No | Course No. | Course Name | Credits |
|-------|-----------|-------------|---------|
| 1 | HS 535 | Financial Inclusion in India | 3-0-0-3 |
| 2 | HS 537 | Post-Reform India: Polity, Society, Economy | 3-0-0-3 |
| 3 | HS 538 | Development Economics | 3-0-0-3 |
| 4 | HS 539 | Post-War Germany: Politics, Society and Culture | 3-0-0-3 |
| 5 | MA 612 | Operator Theory | 3-1-0-4 |

The final course descriptions after incorporating the suggested changes are placed at **Annexure – B**.

**31.4 One Time Approval (OTA) of the courses already taken by the graduating students through Semester Exchange:**

A list of courses taken by graduating students during the semester exchange requires one time approval (OTA) of the Senate. The BoA discussed on the course descriptions, etc. and recommended it to Chairman, Senate for approval. The list is placed as **Annexure – C.**

**31.5** **To consider award of Ph.D., M.S. (by Research), M.Tech., M.Sc., and B.Tech. Degrees on the registered students who have completed all the requirements of the programme:**

The Board recommended the following number of students, who have completed all the academic requirements for award of mentioned degrees during the 7th Convocation scheduled to be held on 05th October, 2019 (Saturday) at Kamand Campus for Senate approval. The detailed list is placed as **Annexure – D**. The award of the degree would be subject to clearance of all the dues and no pending disciplinary action against the student.

| Programme | No. of students |
|---|---|
| Ph.D. | 18 |
| M.S. (by Research) | 8 |
| M.Tech in MES | 9 |
| M.Tech in EEM | 10 |
| M.Tech in VLSI | 8 + 1 (2016 batch) |
| M.Tech in PED | 9 |
| M.Tech in SPCOM | 13 |
| M.Tech in BioTech | 10 |
| M.Sc. (Chem) | 22 |
| M.Sc. (Maths) | 14 |
| M.Sc. (Physics) | 16 + 1 (2016 batch) |
| B.Tech | 124 + 2 (2013 & 2014 batch) |

The BoA also noted that Thesis/Answer sheets of a few students are under evaluation. If the requirements for the programme are completed before the Senate meeting, their names may be included in the list of degree recipients.

**31.6** **To consider Flexibility in Internship requirements for the B.Tech. students:**
Academic Secretary briefed the Board on the proposal for flexibility in internship requirements for the B.Tech. students. BoA rejected the proposal after detailed discussion.

**31.7** **Any other item with the permission of the Chair.**
In addition to the circulated agenda points, with the permission of Chairman BoA, following items were also discussed:

(a) **Modification in B.Tech. CSE curriculum and Discipline Core (DC) courses:** Dr. Dileep A.D., Course Coordinator (CSE), briefed the BoA regarding modification in B.Tech. (CSE) curriculum and Discipline Core courses. The board deliberated and suggested minor changes. He was requested to modify the curriculum accordingly. The modified and final B.Tech. CSE curriculum and DC courses placed at **Annexure-E** is recommended for consideration of the Senate and approval.

(b) **Proposal on Independent Study Courses:** Dr. Sandip Saha presented proposal on Independent Study Course. The board deliberated and suggested some minor changes. After incorporating the suggested changes, the modified proposal placed at **Annexure-F** is recommended for consideration of the Senate and approval.

(c) **Issues raised by Associate Dean (Research):** The Associate Dean (Research) raised the following issues during the meeting:
  (i)     Policy for retention of M.Tech. students once they join a job while studying.
  (ii)    Introduction of credits for MS/PhD Thesis.
  (iii)   Policy for change of MS/PG/PhD guide.
  (iv)    Issues related to scholarship of MS/PG/PhD scholars due to exceptional or inadequate TA duty or Research performance
  (v)     Regulations / Guidelines for I-PhD, Dual Degree, MA and other programmes.

  The BoA briefly discussed on the above issues and authorized Dean (Academics) to constitute committees to discuss and submit the recommendations.
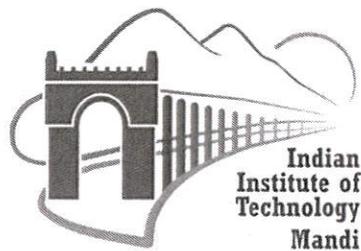
The meeting ended with a vote of thanks to the Chair.

26/9/19

**Secretary, Board of Academics**


**Chairman, Board of Academics**

# Master of Technology in Power Electronics and Drives (Modified)



**Indian Institute of Technology Mandi**

School of Computing and Electrical Engineering,
Indian Institute of Technology Mandi,
Himachal Pradesh, India

**MODIFIED STRUCTURE:**

**1st Semester**

| Course No. | Title of the course | L-T-P-C |
|---|---|---|
| EE 508 | Fundamentals of Electrical Drives | 3-0-0-3 |
| EE 508P | Practicum on Electrical Drives | 0-0-3-2 |
| EE 527 | Analysis and Design of Power Electronic Converters | 3-0-0-3 |
| EE 527P | Practicum on Analysis and Design of Power Electronic Converters | 0-0-3-2 |
| EE 528 | Modeling and Analysis of Electrical Machines | 2-0-2-3 |
| EE 509 | Linear Dynamical Systems | 3-0-0-3 |
| HS 541 | Technical Communication | 1-0-0-1 |
| EE 504 | Switched Mode Power Conversion | 2.5-0.5-0-3 |
| | **Total** | **20** |

**2nd Semester**

| Course No. | Title of the course | L-T-P-C |
|---|---|---|
| EE 604 | Advanced Electrical Drives | 2.5-0.5-0-3 |
| EE 604P | Practicum on Advanced Electrical Drives | 0-0-2-1 |
| | Discipline Elective-I | 3 credits |
| EE 623P | Practicum on Digital Control of Power Electronics and drives | 1-0-4-3 |
| | Discipline Elective-II | 3 credits |
| | *Open Elective - I | 3 credits |
| | *Open Elective - II | 3 credits |
| | **Total** | **19** |

**3rd Semester**

| Course No. | Title of the course | L-T-P-C |
|---|---|---|
| EE 624P | Post-Graduate Project-I | 0-0-30-15 |
| | **Total** | **15** |

**4th Semester**

| Course No. | Title of the course | L-T-P-C |
|---|---|---|
| EE 625P | Post-Graduate Project-II | 0-0-32-16 |
| | **Total** | **16** |

*Open Elective: **Open electives from outside the discipline of program**

## List of Discipline Electives (DEs)
- **EE 513 - Special Electrical machines**
- **EE 515 -Nonlinear Stability and Control**
- **EE506- Solar Photovoltaic Energy Systems**
- Power Quality and Custom Power Devices
- Flexible AC Transmission Systems and HVDC
- Power Electronics Application to Power Systems
- Hybrid and Electric Vehicles
- Smart Grid Technology
- Power Electronics for Renewable Energy System
- Computer Aided Design of Power Electronic systems and Electrical Drives
- Condition Monitoring of Electrical machines

A few more electives will be added as DEs in due course of time.

## OLD STRUCTURE:

### Semester-I

| Course No. | Title of the course | L-T-P-C | Remarks |
|---|---|---|---|
| EE 508 | Fundamentals of Electrical Drives | 3-0-0-3 | DC |
| EE 508P | Practicum on Electrical Drives | 0-0-3-2 | DC |
| EE 527 | Analysis and Design of Power Electronic Converters | 3-0-0-3 | DC |
| EE 527P | Practicum on Analysis and Design of Power Electronic Converters | 0-0-3-2 | DC |
| EE 528 | Modeling and Analysis of Electrical Machines | 3-0-0-3 | DC |
| EE 509 | Linear Dynamical Systems | 3-0-0-3 | DC |
| HS 541 | Technical Communication | 1-0-0-1 | TC |
| | **Total Credits** | **17** | |

### Semester-II

| Course No. | Title of the course | L-T-P-C | Remarks |
|---|---|---|---|
| EE 504 | Switched Mode Power Conversion | 2.5-0.5-0-3 | DC |
| EE 601 | Advanced Electrical Drives | 2.5-0.5-0-3 | DC |
| EE 604P | Practicum on Advanced Electrical Drives | 0-0-2-1 | DC |
| EE 623P | Practicum on Digital Control of Electrical Drives | 1-0-3-3 | DC |
| | Mathematics Elective | 3~4 credits | MaE |
| | Discipline Elective I | 3 credits | DE |
| | Open Elective - I | 3 credits | OE |
| | **Total Credits** | **19** | |

### Semester-III

| Title of the course | L-T-P-C | Remarks |
|---|---|---|
| Discipline Elective II: | 3 credits | DE |
| Discipline Elective III: | 3 credits | DE |
| Open Elective II: | 3 credits | OE |
| PGP- I | 8 credits | |
| **Total Credits** | **17** | |

### Semester-IV

| Title of the course | L-T-P-C |
|---|---|
| PGP- II | 17 credits |
| **Total Credits** | **17** |

**IIT Mandi**
**Proposal for a New Course**

| | |
|---|---|
| **Course Number** | : HS535 |
| **Course Name** | : Financial Inclusion in India |
| **Credits** | : 3-0-0-3 |
| **Prerequisites** | : None |
| **Intended for** | : Ph.D./Masters/B.Tech. (3rd and 4th year) |
| **Distribution** | : Discipline Elective for M.A. Development Studies, HSS Free Elective for B. Tech. and Free Elective for others |
| **Semester** | : Odd/Even |

1. **Preamble:**

   Last mile delivery of financial services is a major challenge facing financial inclusion interventions in India which is home to a large unbanked population living in remote and rural areas. Lack of access to financial services causes poverty. On the other hand, access to financial services helps earn more, creates assets and cushions against external shocks due to investing in better nutrition, housing, health, and education. In other words, financial inclusion is imperative for inclusive development & growth. In this context, the course aims to provide avenues for an in-depth understanding of demand and supply side issues relating to financial inclusion ranging from user awareness to technological developments.

2. **Course Modules:**

   **Module I: Introduction Financial Inclusion    (6 hours)**
   Introduction of Indian financial system, evolution, growth and developments in the Indian financial system over the years. Meaning and scope of financial inclusion, breadth and depth of financial inclusion in India, Economic and social causes of financial exclusion, Financial inclusion Indices, Status of financial inclusion in India, Barriers to financial inclusion in India.

   **Module II: Demand Side Issues    (9 hours)**
   Nature and characteristics of clientele, economic status of rural folks, need for tailor made products and services: savings, investments, micro credit, micro insurance, remittances, pension, etc. Client vulnerability and credit risks, women empowerment, livelihood creation.

   **Module III: Supply Side Issues    (9 hours)**
   Informal and formal sources of finance, Transaction cost, Institutional interventions: Microfinance institutions, Joint liability groups, Self Help Groups, Branchless banking models, Collateral issues, Business correspondent model of banking, Issues relating to interoperability, Convergence of digital identity and financial services, Impact on poverty reduction and employment generation.

   **Module IV: Emerging Trends and Innovations    (10 hours)**
   Recent Trends and Innovations: Mobile banking, Digital Identity – Aadhaar, Innovations in Fintech, International case studies: Kenya and M-Pesa, Philippines and smart money, Bangladesh and bKash, and/or similar case studies.

   **Module V: Challenges for Future    (8 hours)**

Inclusive growth: Scaling financial inclusion – Role of banks, Jan-dhan yojna – trends & progress, non-banking finance companies, and technology, Rural Banking Infrastructure, Institutional changes required for financial inclusion, Client Trust, Financial Literacy, Financial Awareness, Privacy and Security concerns.

3. **Textbooks:**

Mani, N. (2015). Financial Inclusion in India: policies and Programmes. New Century Publications.

4. **Reference:**

Barua, A., Kathuria, R., & Malik, N. (2016). The Status of Financial Inclusion, Regulation, and Education in India. *ADBI Working Paper Series*, (568), 1–24. https://doi.org/10.1017/S0020818300006032

CRISIL. (2018). *CRISIL Inclusix: Financial inclusion surges, driven by Jan-Dhan Yojana* (Vol. 4). Retrieved from https://www.crisil.com/content/dam/crisil/our-analysis/reports/Research/documents/2018/march/crisil-inclusix-financial-inclusion-surges-driven-by-Jan-Dhan-yojana.pdf

Deepak Mohanty. (2015). *Report of the Committee on Medium-term Path on Financial Inclusion*.

Garcia Arebehety, P., Chen, G., Cook, W., & McKay, C. (2016). Digital Finance Interoperability & Financial Inclusion. *Cgap*, (December), 16. Retrieved from http://www.cgap.org/publications/digital-finance-interoperability-financial-inclusion

Gardeva, A., & Rhyne, E. (2011). *Opportunities and Obstacles to Financial Inclusion*. Retrieved from https://centerforfinancialinclusionblog.files.wordpress.com/2011/07/opportunities-and-obstacles-to-financial-inclusion_110708_final.pdf%0A

Gupta, S. K. (2011). Financial Inclusion - IT as enabler. *Reserve Bank of India Occasional Papers*, *32*(2).

Holloway, K., Naizi, Z., & Rouse, R. (2017). *Women 's Economic Empowerment Through Financial Inclusion A Review of Existing Evidence and Remaining Knowledge Gaps.* (March).

Karmakar, K. G., Banerjee, G. D., Mohapatra, N. P. (2011). Towards Financial Inclusion in India. Sage Publications

Ng'weno, A., Oldja, L., Hassan, M. and, & Kapoor, P. (2018). Demand-side review of Financial Inclusion for Women in entrepreneurship and smallholder agriculture. *International Development Research Centre*. Retrieved from www.idrc.ca

Pradhan, N. C. (2013). Persistence of Informal Credit in Rural India: Evidence from 'All-India Debt and Investment Survey' and Beyond'. *RBI Working Paper*, 1–23.

Realini, C., & Mehta, K. (2015). Financial Inclusion at the Bottom of the Pyramid. Friesen Press.

Sriram, M.S. (2017). Talking Financial Inclusion in Liberalised India: Conversations with Governors of The Reserve Bank of India. Routledge.

Singh, A. S., Venkataramani, B., & Ambarkhane, D. (2014). Role of Mobile Banking in Financial Inclusion. *SSRN Electronic Journal*, (February). https://doi.org/10.2139/ssrn.2485777

Singh, C., & Naik, G. (2017). Financial Inclusion in India: A Case Study of Gubbi. *SSRN Electronic Journal*, (May), 1–69. https://doi.org/10.2139/ssrn.2973741

Sethy, S.K. (2017). Financial Inclusion An Overview: A Road Map For Inclusive Growth. Bharti Publications.

Ujjawal, A., Champatiray, A. K., Sadhu, S., & Mendiratta, T. (2012). *Business Correspondent Model: An Analysis of the Financial Viability of Customer Service Providers and Client Satisfaction.*

World Bank. 2014. Global Financial Development Report 2014 : Financial Inclusion. Washington, DC. World Bank. https://openknowledge.worldbank.org/handle/10986/16238 License: CC BY 3.0 IGO

### 5. Similarity Content Declaration with Existing Courses

| S.N. | Course Code | Similarity Content | Approx. % of Content |
|---|---|---|---|
| | **HS528: Information Technology and Development** | **Module 4: Networking, access, mobile technologies, and development** Access to hardware, software, information and services; WiMax and Internet backbone; role of TCP/IP and other protocols; (Certain example cases could include the case of the last 10km in Rwanda; case of microwave in rural Alaska; role of cellular – voice and data; case of M-PESA in India and Kenya.) | 2% |

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

**Approvals:**

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

**Proposed by: Puran Singh**          **School: SHSS**

**Signature:** _____          **Date:** _____

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

-------------------------------------------------          **Date:** _____
**Chairman, CPC**

*Approved/Not Approved*

-------------------------------------------------          **Date:** _____
**Chairman, Senate**

**Reviewers' Comments**

1. **Changes made in the course throughout:**

   1. Preamble:

Last mile delivery of financial services is a major challenge facing financial inclusion interventions in India which is home to a large unbanked population living in remote and rural areas. Lack of access to financial services causes poverty. On the other hand, access to financial services helps earn more, create assets and cushion against external shocks due to investing in better nutrition, housing, health, and education. In other words, financial inclusion is imperative for inclusive development & growth. In this context, the course aims to provide avenues for in-depth understanding of demand and supply side issues relating to financial inclusion ranging from user awareness to technological developments.

   2. Course Modules:

Module I: Introduction Financial Inclusion     [6 hours]
Introduction of Indian financial system, evolution, growth and developments in the Indian financial system over the years. Meaning and scope of financial inclusion, breadth and depth of financial inclusion in India, Economic and social causes of financial exclusion, Financial inclusion Indices, Status of financial inclusion in India, Barriers to financial inclusion in India.

Module II: Demand Side Issues [9 hours]
Nature and characteristics of clientele, economic status of rural folks, need for tailor made products and services: savings, investments, micro credit, micro insurance, remittances, pension etc. Client vulnerability and credit risks, Women empowerment, livelihood creation

Module III: Supply Side Issues [9 hours]
Informal and formal sources of finance, Transaction cost, Institutional interventions: Microfinance institutions, Joint liability groups, Self Help Groups, Branchless banking models, Collateral issues Business correspondent model of banking, Issues relating to interoperability, Convergence of digital identity and financial services, Impact on poverty reduction and employment generation

Module IV: Emerging Trends and Innovations    [10 hours]
Recent Trends and Innovations: Mobile banking, Digital Identity - Adhaar, Innovations in Fintech, International case studies: Kenya and M-Pesa, Philippines and smart money, Bangladesh and bKash and/or Similar case studies.

Module V: Challenges for Future     [8 hours]
Inclusive growth: Scaling financial inclusion - Role of banks, Jan-dhan yojna - trends & progress, non-banking finance companies, and technology, Rural Banking Infrastructure, Institutional changes required for financial inclusion, Client Trust, Financial Literacy, Financial Awareness, Privacy and Security concerns.

   3. Textbooks:

Financial Inclusion, Sameer Kochhar, R. Chandrashekhar, K.C. Chakrabarty, Deepak B. Pathak, Academic Foundation, 2009

4. Reference:

Towards Financial Inclusion in India, K. G. Karmakar, G. D. Banerjee, N. P. Mohapatra, Sage Publications, 2011

Financial Inclusion at the Bottom of the Pyramid, Carol Realini, Karl Mehta, 2015, Friesen Press

Talking Financial Inclusion in Liberalised India: Conversations with Governors of the Reserve Bank of India, M.S. Sriram, Routledge, 2017

Financial Inclusion - Global Financial Development Report, 2014, World Bank Group

**2. The contents are Ok. They provide a good coverage of issues. It would be a good idea to search for more references and list as reading resources, other than the two books that have been listed.**

**3. Course coverage looks fine to me. Only two suggestions:**

**1. Do not make everything only India specific. Draw a contrast with international data and examples.**

**2. I would suggest that reference list be made more exhaustive. Financial inclusion is an emerging research area and only books may not be sufficient to understand the nuances. The instructor should include more research papers in reference list.**

**Responses to the comments from reviewers are as follows:**

1. The contents are Ok. They provide a good coverage of issues. It would be a good idea to search for more references and list as reading resources, other than the two books that have been listed.

*Response: A range of references have been included.*

2. Second reviewer edited the course content.

*Response: I am fine with the changes that he has made at various places in course content.*

3. Third reviewer has two comments:

a. Do not make everything only India specific. Draw a contrast with international data and examples.

*Response: Since the course is called Financial Inclusion in India, most content has to be India specific. However, fair bit of international case studies have been included in Unit IV on Emerging Trends.*

b. I would suggest that reference list be made more exhaustive. Financial inclusion is an emerging research area and only books may not be sufficient to understand the nuances. The instructor should include more research papers in reference list.

*Response: A number of research papers are now included.*

**1. Prof. Anil Kumar Sharma**
Professor, Finance
IIT Roorkee

**2. Prof. SS Yadav**
Professor, Finance
IIT Delhi

**3. Prof. Ashay Kadam**
Research Director, DIRI, Indian School of Business, Hyderabad
Previously, Professor, IRMA and IIM Udaypur

# IIT Mandi
## Proposal for a New Course

| | |
|---|---|
| **Course Number:** | HS537 |
| **Course Name:** | Post-Reform India: Polity, Society and Economy |
| **Credits:** | 3-0-0-3 |
| **Prerequisites:** | None |
| **Intended for:** | Ph.D./Masters/ B. Tech. (3rd and 4th Year) |
| **Distribution:** | Discipline Elective for M.A. Development Studies, HSS Free Elective for B.Tech. and Free Elective for others |
| **Semester:** | Odd/Even |

1. **Preamble:** We all say, "India of 21st century is a new India". This course stimulates and encourages students to explore and ask: What is this new India of 21st Century? Who constitutes it and what is it constituted of? Is it a globalising and urbanising India whose economy and polity are shaped in cities and private enclaves? Is it an India of the new middle class that has an insatiable propensity to consume? Is it an India of toiling population groups and their impoverished everyday contestations with the State agents and market processes? Is it a turbulent India defined by contestations around religious, regional, linguistic or caste affiliations? Is it a confident and connected India exposed to the world through new media equipments and networks? The India of the new millennium is one 'of contradictions', 'poverty amidst plenty' and 'polarised maximums' produced by a variety of events, processes, institutions, agents, networks, technologies, discourses and rhetoric. Exploring these contradictions, this course moves around the interplay among the triad: economy, polity and society; and how specific events and processes of the 1980s and 1990s – local and global – have shaped political economy of this new India. The course locates discourses of empowerment, development, citizenship, mobility and marginalization; and how these are shaped around mobilisation and contestations of gender, caste, class, religion and region. The course helps students identify and establish interconnections among multiple events and processes that lead to the emergence of new strands in political economy and gave rise to new actors, sites and methods that define India of the new millennium. The course identifies events and processes of the late 1980s and early 1990s, and then goes on to explore continuities and changes in institutions, processes and sites that rotate around and shape political economy in the post-reform period in India. The course exposes students to nature of events, key agents and processes leading to various transformations in economy, polity and social structure. It equips students with contemporary debates of development, and help analyse and develop critical visions to understand the nature of transformations in post-reform India.

2. **Course Modules:**

**Module I. Before and After the 1990 (10 hours)**
    a. **Market**: Structural Adjustment Program and economic liberalisation
    b. **Mandir-Masjid**: Hindutva movement and idea of 'secular' State
    c. **Mandal**: Other Backward Classes and politics of/over reservation
    d. **Media**: Expansion and deepening of media
    e. **Mobilisation**: Politics and assertions

**Module II. State, Governance and Management of Development (10 hours)**
    a. Paradox of Development: India vs. Bharat
    b. Policies and politics of governance
    c. Bureaucracy and Governmentality
    d. International Conventions and new legal mechanisms

**Module III. Nature of Conflicts (8 hours)**
    a. Sectarian conflicts and Ethnic Violence
    b. Reconfiguration of histories
    c. Old and New contestant: NRIs and Indian Middle Class
    d. Conflict over Development: unions, projects, acquisition and beneficiaries

**Module IV. Legal Frameworks and Development Goals (8 hours)**
    a. Environment and ecology: international conventions and national policies
    b. Right to Education: from NEP to RTE
    c. Employment: as guarantee; contractual jobs and entrepreneurship
    d. Women's Health, Security and Development

**Module V. Arenas of empowerment and enfeeblement  (6 hours)**
    a. Instruments, Institutions and National Commissions
    b. Vocabularies and Dimensions of: inequalities, discriminations, deprivations
    c. Assessing ideas of Democracy, Citizenship and Mobilities in post-reform period

**3. Textbooks:**
1. John, Mary M, Praveen Kumar Jha and Surinder Singh Jodhka (eds.). 2006. *Contested Transformations: Changing Economies and Identities in Contemporary India.* New Delhi: Tulika Books.
2. Ruparelia, Sanjay et. al. 2011. *Understanding India'a New Political Economy: A Great Transformation?.* London: Routledge.
3. Corbridge, Stuart, John Harris and Craig Jeffrey (2012). *India Today: Economy, Politics and Society.* Cambridge: Polity Press.

**4. References:**
1. Thapar, Romila (ed.). 2000. India: Another Millennium. Delhi: Penguin

2. Deshpande, Satish. 2004. Contemporary India: A Sociological View. Delhi: Penguin

3. Gupta, Akhil and K. Sivaramakrishnan (eds.). 2012. The State in India after Liberalization.

New York: Routledge

4. Reddy, Ram Manohar. *How is India Doing.* Guhan Memorial Lecture

5. Dreze, Jean and Amartya Sen. 1995. *India: economic development and social opportunity.* New Delhi: Oxford University Press

6. Corbridge, Stuart and John Harriss. 2000. *Reinventing India: liberalization, Hindu nationalism and popular democracy.* Cambridge: Polity Press

7. Bhargava, Rajiv. 2013. Reimagining Secularism: respect, domination and principled distance. *Economic and Political Weekly.* Pp 79-92

8. Ram, Nandu (ed.). 2008. *Dalits in contemporary India: discrimination and discontent.* New Delhi: Siddhant Publications. pp 37-64

9. Kohli, Atul. 2009. *Democracy and Development in India: From Socialism to Pro-Business.* New Delhi: Oxford University Press

10. Jaffrelot, Christophe. 2000. 'The rise of the other backward classes in the Hindi belt'. *The Journal of Asian Studies,* Vol. 59(1):86-108

11. Saeed, Saima (2013) Screening the Public Sphere: Media and Democracy in India, New Delhi: Routledge.

12. Ganguly-Scrase, R and T.J. Scrase (2009) Globalization and the Middle Classes in India: The Social and Cultural Impacts of Neo-liberal Reforms, London: Routledge

13. Aslany, M. (2019) "The Indian Middle Class, its Size, and Urban-Rural Variations," Contemporary South Asia, Vol. 27 (2), pp.196-213.

14. Sharma, Aradhana (2006) "Crossbreeding Institutions, Breeding Struggle: Women's Empowerment, Neoliberal Governmentality, and State (Re)Formation in India," Cultural Anthropology, Vol.21 (1), pp.60-95.

15. Sharma, Aradhana (2008) Logics of Empowerment: Development, Gender and Governance in Neoliberal India, Minneapolis: University of Minnesota Press.

16. Levien, M. (2018) Dispossession without Development: Land Grabs in Neoliberal India, New Delhi: Oxford University Press.

17. Nielsen, Kenneth and Alf G. Nilsen (2016) Social Movements and the State in India: Deepening Democracy? London: Palgrave.

18. Gupta, Akhil (2012) Red Tape: Bureaucracy, Structural Violence and Poverty in India, Hyderabad: orient Blackswan.

19. Sahu, Geetanjoy (2014) Environmental Jurisprudence and the Supreme Court: Litigation,

Interpretation, Implementation, Hyderabad: Orient Blackswan.

20. Muenster, Daniel and Christian Struempell (2013) "The Anthropology of Neoliberal India: An Introduction," Contributions to Indian Sociology (Special Issue), Vol.48 (1), December, pp.1-16

21. Dreze, Jean and Amartya Sen. 2013. An Uncertain Glory: India and its Contradictions. New Jersey: Princeton University Press.

22. Kohli, Atul. 2012. Poverty amid Plenty in the New India: Politics, Economics and Inequality. Cambridge: Cambridge University Press.

5. Similarity Content Declaration with Existing

## 5. Similarity Content Declaration with Existing Courses:

| S. No. | Course Code | Similarlity Content | Approx. % of Content |
|---|---|---|---|
| 1 | HS471 | All submodules of Introduction (Module I); State and paradox of development (Module II) Reconfiguration of histories (Module III a) Sectarian and Ethnic Violence (Module III b) NRI and Indian Middle Class (Module 111 c) Inequalities, Deprivation and Discrimination (Module V b) | 50% |

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

This course is an upgradation of existing course (HS471 titled Contemporary India). It is conceived to advance more contents adding the legal aspects, international influences on policies; the debates on democracy, citizenship and mobilities, governance mechanisms, agents of the State and methods of governmentality. The major beneficiaries of this course would be students of MA Development as well as others who wish to learn in-depth about contemporary India. The course would facilitate further understanding and analysis of post-reform developments in India. The level of readings are also advanced including more new specifics debates and contents with regard to developmental issues in contemporary times.

**Other Faculty interested in teaching this course:** Dr. Manu V. Devadevan

**Proposed by:** Surya Prakash Upadhyay          **School**: SHSS

**Signature**_____**Date 9 May 2019**

Recommended/Not Recommended, with Comments:

_____        Date:_____

Chairman, CPC

*Approved / Not Approved*

.

_____        Date:_____

Chairman, Senate

*Instructions for Course Prosper:*

*1- In prerequisites please give course numbers and names.*

2- In distribution, please specify if the course is compulsory for students or elective. It may be compulsory for some students and elective for others. For example Compulsory for CSE; CS elective for EE and ME.

3- In preamble, please mention how it fits in with other related courses. Is it part of a sequence, one of a basket?

4- In Course outline, please mention what students will learn in the course.

5- In Module, detailed break-up of the course contents into half a dozen modules/units or so should be given. The lecture hours or lab hours required for each module/unit must be clearly mentioned, considering if it is x credit course there will be 14x hours only in the semester.

6- Please provide one or two most relevant text books, you can include references if you feel some of the topics are explained in details there and students can follow.

Reviewer's comments:

1. **Addition to the text book**:
   Corbridge, Stuart, John Harris and Craig Jeffrey (2012) *India Today: Economy, Politics and Society,* Cambridge: Polity Press.
   **Additions to the reference list:**
   Saeed, Saima (2013) *Screening the Public Sphere: Media and Democracy in India,* New Delhi: Routledge.

   Ganguly-Scrase, R and T.J. Scrase (2009) *Globalization and the Middle Classes in India: The Social and Cultural Impacts of Neo-liberal Reforms,* London: Routledge

   Aslany, M. (2019) "The Indian Middle Class, its Size, and Urban-Rural Variations," *Contemporary South Asia,* Vol. 27 (2), pp.196-213.

   Sharma, Aradhana (2006) "Crossbreeding Institutions, Breeding Struggle: Women's Empowerment, Neoliberal Governmentality, and State (Re)Formation in India," *Cultural Anthropology,* Vol.21 (1), pp.60-95.

   Sharma, Aradhana (2008) *Logics of Empowerment: Development, Gender and Governance in Neoliberal India,* Minneapolis: University of Minnesota Press.

   Levien, M. (2018) *Dispossession without Development: Land Grabs in Neoliberal India,* New Delhi: Oxford University Press.

   Nielsen, Kenneth and Alf G. Nilsen (2016) *Social Movements and the State in India: Deepening Democracy?* London: Palgrave.

   Gupta, Akhil (2012) *Red Tape: Bureaucracy, Structural Violence and Poverty in India,* Hyderabad: orient Blackswan.

   Sahu, Geetanjoy (2014) *Environmental Jurisprudence and the Supreme Court: Litigation, Interpretation, Implementation,* Hyderabad: Orient Blackswan.

   Muenster, Daniel and Christian Struempell (2013) "The Anthropology of Neoliberal India: An Introduction," *Contributions to Indian Sociology* (Special Issue), Vol.48 (1), December, pp.1-16.

2. **A few observations:**

   a. The course is well structured to delve into varied dimensions of 'Contemporary India.'

   b. The interdisciplinary nature of the course is apt to the students of engineering

sciences, life sciences, and social sciences.

c. The ideas included in the course worth imparting and suitable to the students at different levels.

d. In a personal capacity, I appreciate the course proposer for this unique course.

e. The course proposer may consider adding the following as additional readings:

Dreze, Jean and Amartya Sen. 2013. *An Uncertain Glory: India and its Contradictions*. New Jersey: Princeton University Press.

Kohli, Atul. 2012. *Poverty amid Plenty in the New India: Politics, Economics and Inequality*. Cambridge: Cambridge University Press.

**Reply:**

As per the instructions of the Senate, I kept readings only to a permissible limit. I can use these readings during lectures. May I request you to kindly forward the course with it original readings without making any changes.

1. **Dr. Sarbeshwar Sahoo**
   HuSS
   IIT Delhi
2. **Dr. Apparao Thamminaina**
   Department of Anthropology
   University of Hyderabad

Title changed as per the suggestion received from Prof. Rowena Robinson (Member, Senate, IIT Mandi).

| | |
|---|---|
| Course Name: | Development Economics |
| Course Number: | HS538 |
| Credits: | 3-0-0-3 |
| Prerequisites: | Consent of the course instructor |
| Students intended for: | Ph.D. (Excluding students in Economics and Finance)/Masters/B.Tech. |
| (3rd and 4th year) | |
| Elective or Compulsory: | Discipline Elective for M.A. Development Studies, HSS Free Elective for B. Tech. and Free Elective for others |
| Semester: | Odd/Even |

## 1. Preamble:

This course introduces students to a range of ideas and perspectives on the important economic theories, models and policies of growth and development, and some of the more common tools and techniques employed by the development practitioners. While this course mainly focuses on relevant economic theories, it also discusses the context of the emergence of the theory and its application in order to develop an understanding of the principles that enable critical assessment of alternative development policies and programs. The course aims to enable students to think critically about the theories and assumptions that underlie and justify development policy interventions and how these underpinnings influence the consideration and treatment of different types of economic and social problems during the policy-making process. The course covers relevant problems and policies in sustainable development.

## 2. Course Modules:

### Module I: Introduction (3 hours)

Distinction between growth and development; Paradigms of development; Development indicators to sustainable development indicators and comparison of countries with respect to sustainable development indicators; a brief journey from growth economics to sustainable development.

### Module II: Theories of Economic Growth and Development (18 hours)

Historical legacies, economic growth and development: A brief overview of Adam Smith's Theory, Richardian Theory, Malthusian Theory, Mill's Theory, Classical, Marxian and Schumpeterian theories of economic development, Stages of Growth: Rostow and Marx; The Big-push Theory; Critical Minimum Effort; Low Level Equilibrium Trap; Lewis and Ranis – Fei models of economic development, Harrod-Domar model; Kaldor model of growth; Model of Capital Accumulation; Nurkse's theory of disguised unemployment as a saving potential; Neoclassical growth models: Solow-Swan Model (problem of dynamic inefficiency), steady state equilibrium, transitional dynamics; Ramsey-Cass-Koopsman (infinite horizon optimal growth framework); Samuelson-Diamond model (overlapping generations framework); Technological

progress and total factor productivity growth; Introduction to sustainable development models, approaches and operational principles of sustainable development.

### Module III: Issues of Development (15 hours)

Poverty and Inequality; Demography; Migration; Human Capital and Economic Development; Sectoral development; Trade and development; Foreign investment, Aid, and Conflict.

### Module IV: Concepts and Tools in use for Developmental Project Evaluation (6 hours)

Project evaluation and cost benefit analysis; concepts of investment and cost benefit analysis for environmental projects; Input-Output Table; Investment criteria in economic development, concept of Capital-Output Ratio; Shadow prices; Introduction to model estimation.

### 3. Textbooks:

- Todaro, Michael P. and Stephen C. Smith, Economic Development, Pearson Education, 2015.
- Thirlwall, A.P., Growth and Development, Palgrave McMillan, 2011.
- Sachs, J., The Age of Sustainable Development. Chapter 14: Sustainable Development Goals. Columbia University Press, 2015.
- Hanley, N., Shogren, F and White, B. Environmental Economics: In Theory and Practice. Chapter 14: The Economics of Sustainable Development. Macmillan. 2008.

### 4. References:

- Meier, Gerald M. and James E. Rauch, Leading issues in Economic Development, Oxford University Press, 2005.
- Ray, D. Development Economics. Oxford University Press, 1998.
- Lipsey, R. G. and K. A. Chrystal, Economics. Oxford University Press, 2007.
- Basu, K. Analytical Development Economics: The Less Developed Economy Revisited. Oxford University Press, 2003.

### 5. Similarity Content Declaration with Existing Courses

| S.N. | Course Code | Similarity Content | Approx. % of Content |
|------|-------------|--------------------|----------------------|
| 1 | HS532, HS201 | Development indicators, concepts such as: sustainable development, income inequality- Lorenz curve and Gini Coefficient, Kuznets curve. | 5% |
| 2 | HS481 | Concepts of trade and foreign investment | 3% |
| 3 | HS525 | A brief overview of Adam Smith's Theory, Richardian Theory, Malthusian Theory, Mill's Theory, Classical, Marxian and Schumpeterian theories of economic development, Stages of Growth: Rostow and Marx. | 7% |

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

**Approvals:**

**Proposed by: Dr. Ramna Thakur**        **School: SHSS**

**Other Faculty interested in teaching this course: Dr. Shyamasree Dasgupta**

**Signature:** _____        **Date: 19.09.18**

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

-------------------------------------------------        **Date:** _____

**Chairman, CPC**

*Approved/Not Approved*

-------------------------------------------------        **Date:** _____

**Chairman, Senate**

**Reviewers' Comments:**

**1.** I feel now development economics need to cover sustainable development issues with mainstream development economics otherwise students will graduate without knowing (but will always encounter) sustainable development concept.

*Reply: We have incorporated the suggestion.*

Module I. If sustainable development is included here and not taught in any other courses then there is need for relatively more focus on SD compared to what is there now.

*Reply: We have modified the contents as per the suggestion.*

In that case I will suggest make it from development indicators to sustainable development indicators and comparison of countries with respect to sustainable development indicators. I feel this will make it interesting and practically useful for the students.

*Reply: Thanks for the suggestion. We have incorporated the same.*

Module III. I prefer to name them as challenges of economic development and policies and put conflict after poverty and inequality

*Reply: Thanks, we have modified the title accordingly.*

Module IV. I suggest here the name can be 'Tools and Concepts in use for developmental project evaluation' or in the similar line. Otherwise the current title is either misleading or not conveying the intended coverage/purpose To be consistent here you can bring in genuine investment concept and environmental cost-benefit assessment tools _just concepts- which are relevant for SD project evaluation.

*Reply: Thanks, included.*

Textbooks. It will be useful to add a book to cover SD dimensions

*Reply: Thanks, Added.*


**2.** Thanks for sharing the course outline. I think this is a very well designed course outline. The most important theory and applications are covered with emphasis on theoretical understanding.

I also feel that this is an appropriate course at the MA Development Studies level since students come from diverse backgrounds.

However, it looks slightly heavy for the B. tech. students and instead of doing too much theory for them weight on applications will interest them more.

At the Ph.D. level, it looks elementary unless not being offered to Ph.D. economics students. Someone doing Ph.D. in Development Studies (assuming they are coming from a different disciplinary background than Economics) might stand to gain.


   **1**  **Dr. Anamika Barua**
       Associate Professor
       Indian Institute of Technology Guwahati
   **2**  **Prof. Joyashree Roy**
       Asian Institute of Technology

## IIT Mandi
## Proposal for a New Course

| | |
|---|---|
| **Course Number** | : HS-539 |
| **Course Name** | : Post-War Germany: Politics, Society, and Culture |
| **Credits** | : 3-0-0-3 |
| **Prerequisites** | : Consent of the course instructor |
| **Intended for** | : Ph.D./Masters/B.Tech. (3rd and 4th year) |
| **Distribution** | : Outside Discipline Elective for MA in Development Studies, Free Elective for others |
| **Semester** | : Odd/Even |

### 1. Preamble:

The course will introduce the students to a brief social and cultural history of Germany during the second half of the twentieth century. The students will gain an insight into the political and economic situation prevalent at the time, beginning with the post-war period, which saw Germany being divided into the FRG and GDR, and ending with the reunification of the two in 1990. A brief overview of the history of the European Union is also given to facilitate an understanding of present-day Europe so that the students have a broad understanding of culture and diversity as a whole. In addition, students will examine contemporary issues that impact Europe like the current migrant crisis in Germany, the debate around Brexit, rise of Eurosceptic parties in addition to the far-right ones.

### 2. Course Modules:

**Module I:** (2 hours)

This module provides the students with a background on the events leading up to the Second World War, briefly outlining topics like the First World War, Weimar Republic, and National Socialism among others.

**Module II: Allied Occupation of Germany** (4 hours)
- Zero hour/*Stunde Null*
- Denazification
- Four occupation zones

**Module III: Germany-US relations** (2 hours)
- Bizone/Trizone
- Berlin Blockade
- European Recovery Program/Marshall Plan

**Module IV: East and West Germany** (12 hours)
- Formation of FRG and GDR
- Comparison of political and economic systems. Basic Law
- Democratisation of education
- NATO and Warsaw Pact
- Adenauer era

- Brandt's Ostpolitik

## Module V: Anti Government Protests      (2 hours)
- East German uprising
- Students' movement
- Green movement (anti-nuclear movement, environmentalism)

## Module VI: Migrants in Germany      (4 hours)
- Gastarbeiter/'Guest Worker'
- Debate over Multiculturalism
- Current migrant crisis
- Emergence of far-right parties like AfD

## Module VII: The reunification of Germany      (2 hours)
- Fall of the Berlin Wall
- Reunification
- Problems in the process of internal integration

## Module VIII: Post-War German Cinema/Literature    (6 hours)
The students will engage with selected works of German literature/cinema, which will offer them a historical as well as a cultural perspective of the German society as it existed during the postwar period. It will include dealing with themes like *Heimat* ('homeland'), *Vergangenheitsbewältigung* ('coming to terms with the past'), and *Wende* ('turn').

## Module IX: European Union as it exists today (8 hours)
- European Integration (ECSC, EEC)
- Expansion of the EU (1993 – today)
- Germany's role within the EU
- Euroscepticism
- Brexit

## 3. Textbooks:

- Judt, Tony: Postwar. *A History of Europe since 1945*, New York, Penguin Press, 2005
- Staab, Andreas: *The European Union Explained: Institutions, Actors, Global Impact*, Bloomington, Indiana University Press, 2008

## 4. Reference:

- Braunthal, G, *Right-Wing Extremism in Contemporary Germany*, Palgrave Macmillan UK, 2009
- Childs, David, *The Fall of the GDR: Germany's Road To Unity*, Longman, 2001
- Dennis, Mike, *The Rise and Fall of the German Democratic Republic 1945-1990*, London: Routledge, 2000
- Dinan, Desmond: *Europe Recast: A History of European Union*, Boulder, Lynne Rienner Publishers, 2014

- Fulbrook, Mary, *A History of Germany 1918-2014: The Divided Nation*, Wiley-Blackwell 2014
- Gilbert, Mark: *European Integration: A concise History*, Rowman & Littlefield, 2012
- Göktürk, Deniz, David Gramling and Anton Kaes (eds.), *Germany in Transit: Nation and Migration, 1955-2005*, California: University of California Press, 2007
- Hofmann, Arne, *The Emergence of Détente in Europe: Brandt, Kennedy and the Formation of Ostpolitik*, London, New York: Routledge: 2007.
- Jones, Erik, Anand Menon and Stephen Weatherill (eds.): *The Oxford Handbook of the European Union*, Oxford, Oxford University Press, 2012
- Kitchen, Martin: *A History of Modern Germany 1800-2000*, Malden, Blackwell, 2006
- Maier, C.S. and G. Bischof (eds.) *The Marshall Plan and Germany: West German Development within the Framework of the European Recovery Programme*, Oxford: Berg, 1991.
- McCormick, John: *Understanding the European Union*, New York, Palgrave, 2008
- Müller, Jan-Werner (ed.): *German ideologies since 1945; studies in the political thought and culture of the Bonn republic*, New York 2003
- Pulzer, Peter: *German Politics 1945-1995*, New York, Oxford University Press, 1996
- Smith, Helmut Walser (ed.): *The Oxford Handbook of Modern German History*, Oxford, 2011
- Vorländer, Hans, Maik Herold, Steven Schäller, *PEGIDA and New Right-Wing Populism in Germany*, Palgrave Macmillan, 2018.
- Warleigh-Lack, Alex: *European Union: The Basics*, London, Routledge, 2008
- Wilhelm, Cornelia (ed), *Migration, Memory and Diversity: From 1945 to the Present*, New York: Berghahn Books, 2016.

## 5. Similarity Content Declaration with Existing Courses

| S.N. | Course Code | Similarity Content | Approx. % of Content |
|------|-------------|--------------------|----------------------|
|      | **HS363: Post-war Germany: A Literary Perspective** | The course examines the trajectory of German history from the 'Stunde Null' or 'Zero Hour' in 1945 to the Fall of the Wall in 1989 through its literary reflexes. It focuses on advanced reading comprehension by a thorough study of select short stories and poems besides short excerpts from novels that dwell on major defining moments in post-war Germany. | 5% |

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

Other Faculty interested in teaching this course: Gokul Somasekharan

**Proposed by: Neha Kaushik, Gokul Somasekharan**          **School: SHSS**

**Signature:** _____          **Date:** _____

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

---------------------------------------------------          **Date:** _____

**Chairman, CPC**

*Approved/Not Approved*

---------------------------------------------------          **Date:** _____

**Chairman, Senate**

**Response to reviewer's comments – in bold**

**Reviewer 1:**

**References**

Anderson,Jeffery and Eric Langenbacher (eds.), *From the Bonn to the Berlin Republic: Germany at the Twentieth Anniversary of Unification*, Oxford, New York: Berghahn Books 2010.

Ash,Timothy Garton, *In Europe's Name: Germany and the Divided Continent,* New York: Vintage, Reprint edition, 2010.

Baylis, Thomas A., David H. Childs, David and Marilyn Rueschemeyer (eds.), *East Germany in Comparative Perspective*, London: Routledge, 1989.

Braunthal, G, *Right-Wing Extremism in Contemporary Germany*, Palgrave Macmillan UK, 2009.

Childs, David, *The Fall of the GDR: Germany's Road To Unity*, Longman, 2001.

_____, *The GDR: Moscow's German Ally*, (Second Edition 1988, First Edition 1983, George Allen & Unwin, London)

_____, *From Schumacher to Brandt: The Story of German Socialism Since 1945*, Pergamon, 1966.

Childs, David H. and Jeffrey Johnson, *West Germany: Politics And Society*, Croom Helm, 1982.

Childs, David (ed.), *Honecker's Germany*, Allen & Unwin, 1985.

Childs, David H. and Richard Popplewell, *The Stasi: East German Intelligence and Security Service*, Palgrave Macmillan, 1996, Revised paperback edition 1999.

Dennis, Mike, *Social and Economic Modernisation in Eastern Germany from Honecker to Kohl (The New Germany)*, New York: St. Martin's Press, 1993

Dennis, Mike, *Social and Economic Modernisation in Eastern Germany from Honecker to Kohl (The New Germany)*, New York: St. Martin's Press, 1993

_____, *The Rise and Fall of the German Democratic Republic 1945-1990*, London: Routledge, 2000.

Dennis,Mike and Norman LaPorte, *State and Minorities in Communist East Germany*, New York: Berghahn Books, 2013.

Dettke, Dettke (ed.), *The Spirit of the Berlin Republic*, Oxford, New York: Berghahn Books 2003

Fulbrook, Mary, *Anatomy of a Dictatorship: Inside the GDR, 1949-1989*, U.S.A.: Oxford University Press, 1995.

_____, *Interpretations of the Two Germanies 1945-1990*, London: Palgrave, (second edition) 2000.

Gehler, Michael, *Three Germanies: West Germany, East Germany and the Berlin Republic*, London: Reaktion Books, 2011.

Glees, Anthony, *Reinventing Germany: German Political Development since 1945*, Oxford: Berg Publishers, 1996.

Göktürk, Deniz, David Gramling and Anton Kaes (eds.), *Germany in Transit: Nation and Migration, 1955-2005*, California: University of California Press, 2007.

Grieder, Peter, *The German Democratic Republic*, London: Palgrave, 2012.

Grunbacher, Armin, *The Making of German Democracy: West Germany during the Adenauer Era, 1945-1965*, Manchester: Manchester University Press, 2010.

Habermas, Jurgen, *Berlin Republic: Writings on Germany*, Lincoln (NE): University of Nebraska Press, 1997.

Hofmann, Arne, *The Emergence of Détente in Europe: Brandt, Kennedy and the Formation of Ostpolitik*, London, New York: Routledge: 2007.

Loth, Wilfred (ed.), *Europe, Cold War and Coexistence, 1955-1965*, London: Frank Cass Publishers, 2004.

Maier, C.S. and G. Bischof (eds.) *The Marshall Plan and Germany: West German Development within the Framework of the European Recovery Programme*, Oxford: Berg, 1991.

Sarotte, M.E., *Dealing with the Devil: East Germany, Détente and Ostpolitik, 1969-1973*, Chapell Hill & London: University of North Carolina Press, 2001.

Vorländer, Hans, Maik Herold, Steven Schäller, *PEGIDA and New Right-Wing Populism in Germany*, Palgrave Macmillan, 2018.

Webber, Douglas, *New Europe, New Germany, Old Foreign Policy? : German Foreign Policy since Unification*, London: Routledge, 2001 (eBook 2014)

Wilhelm, Cornelia (ed), *Migration, Memory and Diversity: From 1945 to the Present*, New York: Berghahn Books, 2016.

**Mostly taken and added to the reference list**

**Reviewer 2:**

Reviewers' Comments:

1.

I have gone through the course content of the German Elective titled, Post War Germany: A Survey and have the following observations to make:

1. In Module I the counterpart of the FRG Zero Hour/Stunde Null, in the GDR has to be incorporated, in order to do justice to cultural developments that took in the GDR. Here, I am specifically referring to the fact that Post War literature and culture in the GDR was seen as a continuation of the fight against fascism and not as a break in the development of German Literature, as was done in the FRG.

2. I suggest that Module II should be clubbed together with Module I and so much time need not be devoted to it.Instead, Moidule II should trace the main markers in the post-war Indo German discourse.

3. In Module III the specificities of the German School and University System should be incorporated, particularly in relation to the democratisation of education in the FRG and the GDR.

4.Module VII should also include Post Wall ( Wende) literature, film and music.

5.The following books may be added to suggested readings for the course:

Dennis, Mike, German Democratic Republic: politics, economics, and society (London ; New York, Pinter Publishers, 1988)

Fritsch-Bournazel, Renata, Confronting the German Question: Germans on the East-West divide (Oxford ; New York, Berg, 1988)

Fulbrook, Mary, The divided nation: a history of Germany, 1918-1990 (New York, Oxford University Press, 1992)

Glatzer, Wolfgang et al, Recent social trends in West Germany, 1960-1990 (Frankfurt am Main, Campus Verlag, 1992)

Nicholls, Anthony James, The Bonn Republic: West German democracy, 1945-1990 (London; New York, Longman, 1997)

Pulzer, Peter G. J., German politics, 1945-1995 (New York, Oxford University Press, 1995)

Richie, Alexandra, Faust's metropolis: a history of Berlin (New York, Carroll & Graf, 1998)

Stern, Fritz Richard, Dreams and delusions: the drama of German history (New Haven, Yale University Press, 1999)

Turner, Henry Ashby, Germany from partition to reunification (New Haven, Yale University Press, 1992)

2.

I gladly recommend that the course proposed by Dr. Kaushik and Dr. Somashekharan be placed before the concerned statutory academic bodies. I do have the following observations which will help explain why I think this course can serve as a wonderful introduction to modern Germany, designed especially with tech students in mind:

- Every time I have had the opportunity to teach postwar German history, I have noticed that it takes a long time to get it off the ground. In our case this happens despite the fact that our students are familiar with German history before and during the war. By this I mean that it takes a rather long while to draw the connections between the new processes under way, the new ways of looking at political institutions, the safeguards that were put in place and what went before all this - these discussions require time, and one invariably has to say a great deal about the 1930s and early 40s. Give this, I feel it might be a good idea to give more time to the first module.

- How much prior knowledge even in the shape of journalistic reading can one assume? Every institution has to judge its students in this manner in order to streamline one's courses, and I have no doubt the proposers of the courses will have their criteria.

- Teaching 'cultural history' as separate is perhaps a remnant of a time in literary studies that held the text as central with all else pieced together as 'background'. It is just that equation, but inverted, that appears in this separation of these two deeply interconnected aspects of history today. While it makes sense to have a separate module on literature and cinema, if only simply for the sake of clarity, the actual teaching if it as separate dimensions of postwar life is not only difficult, but tends to foreground mainstream political history, with the result that cultural production takes a backseat, when in fact it can serve as a teaching route for a period like this. I find that us standing in front of a class and trying to describe the horrors of fascism and the war may not be as effective as a chosen literary or cinematic piece. With this in mind, I feel that the time given to this component/module is likely to prove insufficient and ultimately dissatisfying to the colleague teaching it. Also, I do feel that the purpose of a HumSoSci department in tech schools could be taken as an anchor.

- Just a note of caution: it might be difficult to pitch the course at such a large spectrum of students from undergraduates in their last two years to research students. In the teaching of it, while diversity makes for a positive and instructive challenge, there is a clarity to addressing a group that has their programme of study in common. I must say, colleagues may find it extremely difficult to address both audiences in the same class. The reasons are numerous, uncertainly about Vorwissen being one of them. In order to address both audiences, one may have to give up on certain nuances, and run the risk of giving lectures a monochrome linearity, where the ideologically disruptive potential of the course loses its punch.

Even so, I find the course well organised, and I think it covers all the ground on postwar German history. The above are merely observations, when considerations for the teaching of the course may not allow that they be taken on board.

I gladly recommend the course for consideration in the concerned academic and statutory bodies of the institution. I have no doubt that this is a course that can start off a lifelong learning process for anyone who is aware of the times she lives in.

**Mostly taken**

**Reviewer 3:**

**Review of Course No HS-5xx, Post-War Germany: A Survey**

*Course No HS-5xx, Post-War Germany: A Survey* to be offered as an elective to the 3rd and 4th B.Tech. students, Masters (primarily M.A. Development Studies students) and research scholars, is an extremely well thought out and structured course providing a fairly comprehensive overview of the political and socio-cultural developments from the period of post-war Germany till the present. In tracing the path to the evolution of the present day Federal Republic of Germany, it highlights milestone events whilst seeking to locate the country, its politics and society in the complex and changing international order and the relations between the so-called superpowers, culminating in a Germany integrated into the European Union, and the challenges confronting this latter entity currently. In addition, the course is structured holistically, including a module on post-war cinema and literature.

Within the scope and framework of the course, I would like to suggest that in module III instead of just focusing on the *Hallstein Doctrine*, it would be more appropriate to critically engage with the domestic and foreign policies of the Adenauer era, which would include the Hallstein doctrine as well. Again the *Ostpolitik* in module III should be reworded as *Brandt's Ostpolitik*. What appears to be missing in this module is a comparison of the economic and educational systems of the FRG and GDR, representing as they do two very different worldviews and ideologies. This should be added, particularly as the *Economic Miracle* can again be included as one outcome of the domestic policy pursued during the Adenauer era. Together with the *Political System and Parties*, a brief introduction to the Basic Law, which is the constitution of the FRG should also be provided.

Module VI should also briefly touch on selective problems in the process of internal integration of the two Germanies post the reunification of Germany. Finally in Module VIII, there should be some discussion on Germany's perceived role within the European Union.

It would also be a good idea to show some documentaries (including from youtube) on the issues covered in the course. Alternatively, given the fact the course is only for one semester, the links to these can be provided to students for them to view these on their own.

**Well taken and incorporated**

1. **Dr. Parnal Chirmuley**
   Associate Professor
   Centre of German Studies,
   School of Language, Literature and Culture Studies
   JNU
2. **Prof. Chitra Harshvardhan**
   Centre of German Studies,
   School of Language, Literature and Culture Studies
   JNU
3. **Prof. Jyoti Sabharwal**
   Department of Germanic and Romance Studies
   University of Delhi

## New Course Proposal, IIT Mandi

| | |
|---|---|
| Course Name | : Operator Theory |
| Course Number | : MA-612 |
| Credit | : 3-1-0-4 |
| Prerequisites | : MA 521 (Functional Analysis) |
| Students intended for | : M.Sc./B.Tech/M.S./M.Tech/Ph.D. |
| Elective or core | : Elective |
| Semester | : Odd/Even |

**Preamble:** The objective of this course is to introduce fundamental topics in operator theory. It is a field that has great importance for other areas of mathematics and physics, such as algebraic topology, differential geometry, and quantum mechanics. It assumes a basic knowledge in functional analysis but no prior acquaintance with operator theory is required.

In the first part of this course, we discuss the basic results of spectral theory. The most important of these are the non-emptiness of the spectrum, Beurling's spectral radius formula, and the Gelfand representation theory for commutative Banach algebras. We discuss compact and Fredholm operators and describes their elementary theory. Important concepts are the essential spectrum and the Fredholm index. The ground field for all vector spaces and algebras is the complex field **C**. A complete normed algebra is called a Banach algebra. A complete unital normed algebra is called a unital Banach algebra. One thinks of the spectrum as simultaneously a generalization of the range of a function and the set of eigenvalues of a finite square matrix. According to Gelfand theorem, if **a** is an element of a unital Banach algebra A, then the spectrum $\sigma(\mathbf{a})$ of **a** is nonempty. There are algebras in which not all elements have nonempty spectrum.

In the second part, we present a study of C*-algebras and of operators on Hilbert spaces. Hilbert spaces are very well-behaved compared with general Banach spaces, and the same is true of C*-algebras as compared with general Banach algebras. Here the main results of are a theorem of Gelfand, which asserts that up to isomorphism all abelian C*-algebras are of the form $C_0(\Omega)$, where $\Omega$ is a locally compact Hausdorff space, and the spectral theorem. The spectral theorem enables to synthesize a normal operator from linear combinations of projections where the coefficients lie in the spectrum. We also discuss a partial order relation on the Hermitian elements of a C*-algebra. The principal results are the existence of a unique positive square root for each positive element and the theorem, which asserts that elements of the form **a*a** are positive.

In the end, we prove that every C*-algebra can be realized as a C*-subalgebra of B (H) for some Hilbert space H. This is the Gelfand–Naimark theorem, and it is one of the fundamental results of

the theory of C*-algebras. A key step in its proof is the GNS construction that sets up a correspondence between the positive linear functionals and some of the representations of the algebra. There are also deep connections between the positive linear functionals and the closed ideals and closed left ideals of the algebra.

## Module 1: Elementary Spectral Theory                                    [18 Hours]

Banach Algebras, Examples of Banach Algebra, Spectrum and the Spectral Radius, Neumann Series, The Fundamental Theorem of Banach Algebra by Gelfand, Gelfand-Mazur Theorem, The Beurling Theorem for Spectral Radius, The Gelfand Representation, Compact and Fredholm Operators, Integral Operators, Kernels of the Integral Operators, Volterra Integral Operator, Transpose of the Bounded Linear Maps between Banach Spaces, Bounded Below Linear Maps between Banach Spaces, Ascent and Descent, Index of Bounded Linear Maps between Banach Spaces, The Fundamental Result of Fredholm Theory, Fredholm Alternative, Characterization of Fredholm Operators, Essential Spectrum in terms of Fredholm.

## Module 2: C*-Algebras and Hilbert Space Operators                       [18 Hours]

Involution on an Algebra, *-Algebra, *-Algebra Generated by a Subset of *-Algebra, *-homomorphism between *-Algberas, Banach *-Algebras, Unital Banach *-Algebras, C*-Algebras, Examples of C*-Algberas, Double Centralizer for a C*-Algebra, Multiplier Algebra, Complete Characterization of Abelian C*-Algebras using the Gelfand Representation, Spectral Mapping Theorem, Positive Elements of C*-Algebras, Operators and Sesquilinear Forms, Adjoint and its properties, Orthogonal Projections, Invariant Subspaces, Reducing Subspaces, Partial Isometries and their Characterizations, Polar Decomposition, Compact Hilbert Space Operators, Diagonalizable Operators, Diagonalizability of Compact Normal Operators on Hilbert Spaces, denseness of the set of finite-rank operators, Hilbert-Schmidt Operators, Trace-Class Operators, The Spectral Theorem for Normal Operators.

## Module 3: Gelfand–Naimark Theorem                                        [6 Hours]

Ideals in C*-algebras, Positive Linear Functionals, Gelfand-Naimark-Segal Represenatation.

**Text Books:**

1. Gerard J. Murphy, *C*-algebras and Operator Theory*, Academic Press, 2014.

2. Ronald G. Douglas, *Banach Algebra Techniques in Operator Theory*, Volume 179 of Graduate Texts in Mathematics, Springer, 2012.

**Reference Books:**

1. Kenneth R. Davidson, *C\*-algebras by Example*, American Mathematical Soc., 1996.

2. Kehe Zhu, *An Introduction to Operator Algebras*, Volume 9 of Studies in Advanced Mathematics, CRC Press, 2018.

3. John B. Conway, *A Course in Operator Theory*, American Mathematical Soc., 2000.

**Similarity content declaration with existing courses:**

| Sr. No. | Course | Similarity Content | Approximate % of Content |
|---------|--------|--------------------|--------------------------|
| 1. | MA 521 | Compact Operators | 2 % |

**Justification for new course proposal if cumulative similarity content is > 30%: Not Applicable**

**Approvals:**

Proposed by: Dr.Kalpesh Haria (SBS)

Signature_____*Kalpesh*_____Date _27/09/19_

---------------------------------------------------------------------------------------------

Recommended/Not Recommended, with Comments: _____

Date: _____ Chairman, CPC

Approved / Not Approved

| Sl.No. | Course Code | Credit | Course Title | University Name |
|---|---|---|---|---|
| 1 | 17WS05840(3.33) | 3.33 | Foundations of Entrepreneurship | RWTH Aachen University, Germany |
| 2 | 17WS30872(3.33) | 3.33 | Industrial Engineering, Ergonomics and Work Organisation | RWTH Aachen University, Germany |
| 3 | BSINF55107104(4) | 4 | Foundations of Data Science | RWTH Aachen University, Germany |
| 4 | MSBWL210(3.33) | 3.33 | Foundations of Entrepreneurship | RWTH Aachen University, Germany |
| 5 | MSINF147102(4) | 4 | Machine Learning | RWTH Aachen University, Germany |
| 6 | MSINF147302(4) | 4 | Parallel Programming | RWTH Aachen University, Germany |
| 7 | EI0432(4) | 4 | Satellite Navigation | Technical University Munich (TUM), Germany |
| 8 | EI0504(2) | 2 | Seminar Scientific Writing | Technical University Munich (TUM), Germany |
| 9 | EI7210(4) | 4 | Humanoid Robotic Systems | Technical University Munich (TUM), Germany |
| 10 | WI001056(4) | 4 | Principles of Economics | Technical University Munich (TUM), Germany |
| 11 | C3140(3.33) | 3.33 | Operating Systems | Aalto University (AU), Finland |
| 12 | C3160(3.33) | 3.33 | Data Science | Aalto University (AU), Finland |
| 13 | E3210(3.33) | 3.33 | Machine Learning: Basic Principles | Aalto University (AU), Finland |
| 14 | E4100(3.33) | 3.33 | Mobile Cloud Computing | Aalto University (AU), Finland |
| 15 | E4600(3.33) | 3.33 | Algorithmic Methods of Data Mining | Aalto University (AU), Finland |
| 16 | A4930(2) | 2 | Astronomical View of the World | Aalto University (AU), Finland |
| 17 | C3150(3.33) | 3.33 | Software Engineering | Aalto University (AU), Finland |
| 18 | E4070(2) | 2 | Special Course in Machine Learning and Data Science | Aalto University (AU), Finland |
| 19 | E4580(3.33) | 3.33 | Programming Parallel Computers | Aalto University (AU), Finland |
| 20 | E4610(3.33) | 3.33 | Modern Database Systems | Aalto University (AU), Finland |
| 21 | E4800(3.33) | 3.33 | Artificial Intelligence | Aalto University (AU), Finland |
| 22 | E4840(3.33) | 3.33 | Information Visualization | Aalto University (AU), Finland |

1. **Foundations of Entrepreneurship (17WS05840) (3.33 credits)**

   Content: The aim of this course is to provide an overview about Entrepreneurs' way of thinking and how they deal with uncertainties to become success. It includes –

   - Unfolding Entrepreneurial Mindset
   - Evaluating Your Business Idea and its Potential
   - Building Team and partnerships
   - Watching for obstacles and overcoming pitfalls

2. **Industrial Engineering, Ergonomics and Work Organisation (17WS30872) (3.33 credits)**

   **Content:** The aim of this course is to provide overview of industrial engineering, what is ergonomics and how to organize work. Student will learn –

   - Work Organisation and finding critical path
   - Modelling and Optimizing Work Processes
   - Analysis of Time structure of working process
   - Manual work process with MTM
   - Occupational risk prevention
   - Work Ecology
   - Production Ergonomics
   - Ergonomic Design

# Foundations of Data Science    BS INF 5510 7104 (4 credits)

## Introduction

In the age of "big data" and "advanced analytics", data processing faces new challenges. Queries become more complex and often involve data mining and machine learning tasks, and the scale of the datasets requires new algorithmic approaches.

This course will cover the *theoretical foundations* of modern data processing and analytics. This includes topic: from database theory, such as data models, the analysis of query languages, and basic algorithmic and complexity theoretic questions related to query processing. It also includes topics from algorithmic learning theory, such as basic machine learning algorithms, support vector machines, the PAC model, and VC-Dimension. Furthermore, it includes new models of computation on massive datasets, such as the streaming model and the map-reduce paradigm, and algorithms for these models.

We will focus on *computational aspects* of the theory. Statistics, though undoubtedly one of the foundations of data science, will not play a central role in this course.

Lectures and exercises will be in English.

## Lectures

### Time and Place

Tuesday, 8:30 - 10:00 am in 2350|111 (AH II)

Thursday, 3:15 - 4:45 pm in 2350|314.1 (AH III)

### Lecturer

Martin Grohe

## Tutorials

Monday, 4:15 - 5:45 pm in 2356|056 (5056), held by Marlin Frickenschmidt

## Exercises

There will be weekly exercise sets. Completing these successfully (at least 50% of possible points) is necessary for admittance to the examination.

A new exercise sheet will be released every Thursday in our L2P room. Each sheet has to be handed in before the Thursday lecture a week later, or in our box in E1, first floor before 15:15.

## Exams

The modalities will be announced later. The planned exam dates are:

25.02.2016, 11:30 am, 2350|111 (AH II)

31.03.2016, 11.30 am, 2350|009 (AH I)

## References

S. Abiteboul, R. Hull, V. Vianu. Foundations of Databases. Addison Wesley 1995.

J. Hopcroft, R. Kannan. Foundations of Data Science. Unpublished, draft available online.

M. Kearns, U. Vazirani. An Introduction to Computational Learning Theory. MIT Press 1994.

# Foundations of Entrepreneurship  MSBWL210 (3.33 credits)

**Study path:**

Master in Management, Business and Economics

**Semester:**

3

**Course Type:**

Lecture

**Language:**

English

**Cycle:**

Winter term

**Scheduling:**

Entire semester

**Course Units:**

4.0

**Credits:**

5.0

**Erasmus Capacity:**

30

**Compulsory Attendance:**

No

## Lecturer

- Univ.-Prof. Dr.rer.pol. Malte Brettel

The following details taken from the examination regulations MSWIWI/14, MPO 2. Änderungsordnung (2016) are for information purposes only and not legally binding. For legally binding information, please refer to the corresponding official examination regulations of the program Master in Management, Business and Economics.

## Syllabus

This course provides an introduction into the topic of entrepreneurship. Central focus of this course is to explain how ideas are translated into marketable business opportunities. Theoretical core concepts such as innovation management and opportunity recognition are presented. These are complemented by guest lectures in order to connect theory and practice.

The practice session is closely connected to the lecture. Within this sesscion, participants develop new product ideas based on real technologies.

## Objectives

The objective of this course is to gain deeper understanding of entrepreneurship, both – as science and in practice. Next to basic theoretical insights related to this topic such as opportunity

recognition or innovation management, this course is closely connected to business practice. Course participants will develop an understanding for entrepreneurial thinking and acting. Further, participants will work on real business ideas for a presentation at the end of the course.

## Prerequisites

Formal: none

Content: Introduction to Business Administration (EBWL) or basic knowledge of business administration, interest in entrepreneurship topics

## Examination

Paper (20%, graded, 60min.) • Elaboration of an idea concept in a group (20% of final mark)
• Presentation of idea concept (20% of final mark)
• Written exam (60 minutes, 60% of final mark), Presentation (20%, graded), Examination (60%, graded)

## Further Information

This course is an open online course. That means the content of the course will be delivered in videos and in class we will discuss the content further.

## Literature

No information available in English at the moment.

# 1. <u>Machine Learning</u>  MSINF147102 (4credits)

**Semester:** SS 2015

**Type:** Lecture

**Lecturer:** <u>Prof. Dr. Bastian Leibe</u>
<u>M.Sc. Ishrat Badami</u>
<u>Dipl.-Inform. Michael Kramp</u>

**Credits:** V3 + Ü1 (6 ECTS credits)

**Links:** https://www3.elearning.rwth-aachen.de/ss15/15ss-29840/Dashboard.aspx

## Lecture Description

The goal of Machine Learning is to develop techniques that enable a machine to "learn" how to perform certain tasks from experience.

The important part here is the learning from experience. That is, we do not try to encode the knowledge ourselves, but the machine should learn it itself from training data. The tools for this are statistical learning and probabilistic inference techniques. Such techniques are used in many real-world applications. This lecture will teach the fundamental machine learning know-how that underlies such capabilities. In addition, we show current research developments and how they are applied to solve real-world tasks.

Example questions that could be addressed with the techniques from the lecture include

- Is this email important or spam?
- What is the likelihood that this credit card transaction is fraudulent?
- Does this image contain a face?

## Exercises

The class is accompanied by exercises that will allow you to collect hands-on experience with the algorithms introduced in the lecture.

There will be both pen&paper exercises and practical programming exercises based on Matlab (roughly 1 exercise sheet every 2 weeks). Please submit your hand written solutions of the exercises the day before the exercise class in the submission box at room 129, UMIC. Please submit your source code solutions through the L2P system.

We ask you to work in teams of 2-3 students.

## Literature

For most part, the lecture will follow the book by Bishop. Additional topics are covered in Duda & Hart's book *Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006* R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2nd Edition, Wiley-Interscience, 2000 Wherever research papers are necessary for a deeper understanding, we will make them available on this web page.

## Additional Resources

- C.E. Rasmussen, C.K.I. Williams Gaussian Processes for Machine Learning MIT Press, 2006 available available online.
- D.J. MacKay Information Theory, Inference, and Learning Algorithms Cambridge University Press, 2003 also available online.
- Lecture videos provided by the Fachschaft

## Matlab Resources

- Matlab Online Reference Documentation
- Getting started with Matlab
- Techniques for improving performance
- A useful Matlab Quick-reference card (in German).

# High-Performance and Automatic Computing

**RWTH** AACHEN
UNIVERSITY

# Parallel Programming MSINF 147302 (4 credits)

**When: Winter semester 2017-18**

**CAMPUS #: 17ws-23895**

**Contacts: <u>Prof. Paolo Bientinesi</u>, <u>Dr. William McDoniel</u>**

**Language: English**

## Office hours

- Prof. Bientinesi: Tuesdays, 11am-1pm, by appointment.
  **AICES R432** (Rogowski Building - Schinkelstrasse 2)

## Prerequisites

Knowledge of the C programming language. You are supposed to know

- the basic datatypes; how to define and use data structures (structs)
- how to operate on pointers and memory addresses
- how to allocate and free dynamic memory (malloc, free)
- how to declare and call (recursive) functions
- how to pass arguments to functions "by value" and "by address"
- how to use library functions; this means including headers, using the provided data structures, calling functions, ...

## Topics

- Principles of parallel performance
- Parallel architectures
- Patterns of parallel programming
- Processes and threads
- Open MP
  - Execution model
  - Work sharing
  - Loop-level parallelism
  - Synchronization
- Message Passing Interface
  - Collective communication
  - Point-to-Point communication
  - Derived data types

# Lectures & Exercises

- Mondays 12:15 - 13:00 (lecture) **1080|140 (R 140)**, Schinkelstraße 1, Templergraben 51
- Mondays 16:00 - 17:30 (exercises) **2090|120 (FT)**, Melatener Straße 23
- Wednesdays 12:15 - 13:45 (lecture) **1080|140 (R 140)**, Schinkelstraße 1, Templergraben 51

# Lectures

- 11.10 - **First lecture.** Presentation [PDF].
  Introduction to PP, overview of the semester [PDF].
  Architectures, pipelining, throughput [PDF].
- 16.10 - Dependencies [PDF].
- 18.10 - Timings [PDF] [code].
- 23.10 - OpenMP, part 1. Parallel regions [PDF] [code].
- 25.10 - Speedup, strong & weak scalability [PDF] [code].
- 30.10 - OpenMP, part 2 [PDF] [code]. [Exercise for Monday 06.11.17]
- 06.11 - Ahmdal's law [PDF] [code].
- 08.11 - OpenMP, part 3. [Synchronization] [Work Sharing 1] [code].
- 13.11 - OpenMP, part 4: Work-sharing & synchronization cont'd. [slides] [code].
- 15.11 - OpenMP, part 4: Work-sharing & synchronization cont'd. [slides] [code].
- 20.11 - OpenMP, part 5: Nested parallelism [slides] [code].
- 22.11 - Double buffering [Reference: Sec 4.1 & 4.2], Granularity [Reference: Sec 4.3] [NO slides!].
- 27.11 - OpenMP, part 6: Tasks [slides] [code].
- 29.11 - MPI, part 1: Introduction, "minimal MPI" [slides] [code].
- 04.12 - MPI, part 2: first program [code].
- 06.12 - OpenMP, part 7: Vectorization [slides] [code].
- 11.12 - MPI, part 3: Collective communication [slides] [code].
- 13.12 - Sample exam: performance, OpenMP
- 18.12 - TIS-100
- 20.12 - MPI, part 4: Collective communication [slides] [code].
- 08.01 - MPI, part 5: Collective communication [slides].
- 10.01 - MPI, part 6: Lower bounds [slides] - updated!.
- 15.01 - MPI, part 7: Point-to-point communication [slides] [code].
- 17.01 - MPI, part 8: Point-to-point communication [slides] [code].
- 22.01 - MPI, part 9: Send modes [slides] [code].
- 24.01 - MPI, part 10: Data types [slides] [code].
- 29.01 - MPI, part 11: Communicators [slides] [code].
- 31.01 - Exercises [code].

# Exercise sessions

- 23.10 - Intro to RWTH's cluster. OpenMP & MPI basics.
- 30.10 - Speedup, efficiency, strong & weak scalability.
- 06.11 - OpenMP [Exercise] [code].
- 13.11 - OpenMP [Exercise] [code].
- 20.11 - OpenMP Work-Sharing [Exercise] [code].
- 27.11 - OpenMP Nested Parallelism [Exercise] [code].
- 04.12 - OpenMP Wrap-Up [Exercise] [code].
- 11.12 - MPI Collectives - Part 1 [code].
- 18.12 - Test exam
- 08.01 - MPI Collectives - Part 2 [code].
- 15.01 - MPI: Matrix-vector multiply [slides].
- 22.01 - MPI: Point-to-point communication [slides] [code].

Module Description

# EI0432: Satellite Navigation   ( 4 credits)

## TUM Department of Electrical and Computer Engineering

| Module level: | Language: | Module duration: | Occurrence: |
|---|---|---|---|
| Master | English | one semester | winter semester |

| Credits*: | Total number of hours: | Self-study hours: | Contact hours: |
|---|---|---|---|
| | 180 | 120 | 60 |

The number of credits can vary depending on the corresponding SPO version. The valid number is always indicated on the Transcript of Records or the Performance Record.

## Description of achievement and assessment methods:

Students must participate in a written final exam (90 min) where they explain the functionality of sattelite navigation systems.

Furthermore, they might participate in a mid-term exam. The grade of the mid-term counts for 25% of the final score it this improves that score.

Students might bring up to 8 handwritten one-sided A4 pages to the exam and the midterm.

The exercises are provided one week. The students are expected to solve them at home. The solutions are provided in the following week (presentation by the assistant). The assistants do not correct the student's exercises, and they do also not check whether they solved them.

## Possibility of re-taking:

In the next semester: Yes
At the end of the semester:
No

## Recommended) requirements:

Mathematics, Signal description in time and frequency domain, Fundamentals of probability calculations and statistics

The following modules should have been successfully passed:
Höhere Mathematik 1-3
Signale und Systeme
Nachrichtentechnik 2

It is recommended to participate in the further modules:

## Contents:

Radio based determination of position, time and velocity
Satellite Orbits and Constellations
Navigation Services and Signals (Modulation and Codes)
Receivers: Signal Acquisition and Tracking
Propagation: Multipath, Ionosphere and Troposphere
Measures of Accuracy
GNSS Systems: Time - Relativistic Corrections; and Terrestrial Reference System

**Study goals:**

At the end of the lecture, the student
- will understand the functioning of a satellite navigation system
- will be able to evaluate important performance parameters
- will know the algorithms needed for designing a basic receiver.

**Teaching and learning methods:**

Learning method:

In addition to the lecture, students familiarize themselves with the material by studying their notes or a book, and by attending the mandatory exercises.

Teaching method:

Lectures are delivered in a front style manner. Questions are highly appreciated - they introduce a level of interaction, and mutual adaptation. The exercises are held in a student-centered way.

**Media formats:**

The following media are used:
Presentations (powerpoint slides, and blackboard for derivations).
Lecture notes (book).
Exercises with solutions as download.

**Literature:**

The following literature is recommended:
Misra, P., Enge, P., Global Positioning System: Signals, Measurements, and Performance, Ganga-Jamuna Press, 2nd ed. (2006)
Kaplan, E., Hegarty, C., Understanding GPS: Principles and Applications, Artech House, 2nd ed. (2006).

**Responsible for the module:**

Günther, Christoph; Prof. Dr.: christoph.guenther@tum.de

**Courses (Type, SH) Lecturer:**

20524108 Satellite Navigation (4SWS VI, WS 2019/20)
Günther C, Lülf M

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# Module Description

## EI0504: Scientific Writing Seminar (2 credits)

### TUM Department of Electrical and Computer Engineering

| Module level: | Language: | Module duration: | Occurrence: |
|---|---|---|---|
| Bachelor | English | one semester | winter semester |

| Credits*: | Total number of hours: | Self-study hours: | Contact hours: |
|---|---|---|---|
| | 90 | 60 | 30 |

The number of credits can vary depending on the corresponding SPO version. The valid number is always indicated on the Transcript of Records or the Performance Record.

**Description of achievement and assessment methods:**
Modulprüfung mit folgenden Bestandteilen: - schriftliche Hausaufgaben (50%) - schriftliche Abschlussaufgabe (50%)

**Possibility of re-taking:**
In the next semester: Yes
At the end of the semester:
No

**(Recommended) requirements:**
English language skills in writing and oral communication

**Contents:**
Scientific Writing, writing and reading, measuring clarity, structure and graces, grammatical exercises, composition; how to write mathematics, how to write a shitty first draft and how to revise it; the process of writing;

**Study goals:**
Write scientific subject matter with improved clarity and style; reconsider the writing process as integral part of scientific work B35

**Teaching and learning methods:**
The students have tp prepare the paper and presentation on their own initiative. They practise presentation and discussion in a group within the final seminar.

**Media formats:**
The following media is used:
presentations, slides
handbook

**Literature:**
The following literature is recommended:
W.J. Strunk, E.B. White. Elements of Style. Tandem Library; 1999.
J.M. Williams. Style: Toward Clarity and Grace. University Of Chicago Press, 1995.

**Responsible for the module:**
Diepold, Klaus; Prof. Dr.-Ing.: kldi@tum.de

**Courses (Type, SH) Lecturer:**

240861961 Seminar Scientific Writing (2SWS VO, WS 2019/20)

Module Description

# EI7210: Humanoid Robotic Systems (4 credits)

## TUM Department of Electrical and Computer Engineering

| Module level: | Language: | Module duration: | Occurrence: |
|---|---|---|---|
| Master | English | one semester | winter semester |

| Credits*: | Total number of hours: | Self-study hours: | Contact hours: |
|---|---|---|---|
|  | 180 | 120 | 60 |

The number of credits can vary depending on the corresponding SPO version. The valid number is always indicated on the Transcript of Records or the Performance Record.

**Description of achievement and assessment methods:**
presentation and laboratory assignments

**Possibility of re-taking:**
In the next semester: No
At the end of the semester:
No

**Recommended) requirements:**
C/C++ programming skills.

**Contents:**
Introduction
Humanoid Sensing;
Humanoid Perception & Action I-II;
Humanoid Locomotion I-II;
Humanoid Learning;

**Study goals:**
The lecture imparts the different aspects of humanod robotics.

**Teaching and learning methods:**
Lectures will be held ex cathedra. Laboratory work will provide a better understanding of the inner working of a cognitive architecture.

**Media formats:**
The following types of media are used:
Presentations
Lab experimentations

**Literature:**
Lecture work sheets
Behavor-Based Robotics, Arkin 1998. Autonomous Robots, Bekey, 2005.

**Responsible for the module:**
Cheng, Gordon; Prof. Dr.: gordon@tum.de

**Courses (Type, SH) Lecturer:**

TUM

Technische Universität München

# Module Description

## WI001056_1: Principles of Economics (4 credits)

### Chair of Public Finance and Industrial Organization (Prof. Frhr. von Weizsäcker)

| Module level: | Language: | Module duration: | Occurrence: |
|---|---|---|---|
| Master | English | one semester | winter semester |

| Credits*: | Total number of hours: | Self-study hours: | Contact hours: |
|---|---|---|---|
| 6 | 180 | 120 | 60 |

\* The number of credits can vary depending on the corresponding SPO version. The valid number is always indicated on the Transcript of Records or the Performance Record.

**Description of achievement and assessment methods:**
Students receive credit for the module by passing a multiple choice exam (written, 120 minutes). The exam is a means to measure the participants' understanding of fundamental micro- and macroeconomic concepts and methods. Moreover the exam assesses the students' ability to apply economic theory to concrete problems.
Hereby, participants demonstrate their capacity for abstraction (thinking in economic models) and concretization (interpreting and applying the results of the model).

**Possibility of re-taking:**
In the next semester: Yes
At the end of the
semester: No

**(Recommended) requirements:**
None

**Contents:**
This module provides an introduction to the basic concepts of economics. It is divided into two parts: micro- and macroeconomics.
Microeconomics deals with the behavior of individual agents, such as households, firms, and public institutions and with their interaction on markets. How can market demand be derived from the consumption choices of households? How can market supply be derived from the production decisions of firms? Which mechanisms give rise to an equalization of demand and supply? What are the consequences of market failure, and what can the state do about it?
Macroeconomics takes an aggregated perspective; it analyzes the economy as a whole. How can economic activity, inflation, and unemployment be measured? What are the factors that determine economic growth? Which mechanisms give rise to economic fluctuations, and how can these fluctuations be mitigated through fiscal and monetary policy?

**Study goals:**
At the end of the module the students will be able to understand and explain the basic principles of economics. On the micro level, this includes consumer behavior as well as firms' production decisions. The students will be able to analyze basic mechanisms that give rise to the equalization of supply and demand in competitive markets. Having attended the module, the students will be able to understand the interrelation between market power and social welfare and will be able to explain market failures. On the macro level, students will be able to identify and explain the main sources of growth, unemployment and inflation.
Moreover, they will be able to analyze the basic tools of monetary and fiscal policy.

## Teaching and learning methods:

The module consists of a lecture as well as an integrated exercise. The lecture content will be conveyed to the students by means of a verbal presentation. In the exercise participants apply the acquired knowledge by solving exercises and implementing case studies. The course aims at encouraging students to independently deliberate the economic problems, which are discussed in the lecture and in the relevant literature.

## Media formats:

text books, script

## Literature:

Baumol, William J. and Alan S. Blinder (2015): Economics - Principles and Policy. Boston: Cengage AND Krugman, Paul and Robin Wells (2015): Economics. New York: Worth AND
Mankiw, Gregory N. and Mark P. Taylor (2017): Economics. Boston: Cengage

## Responsible for the module:

Freiherr von Weizsäcker, Robert; Prof. Dr.: weizsaecker@tum.de

## Courses (Type, SH) Lecturer:

0000000767 Principles of Economics (WI001056_1) (MiM) (4SWS L, WS 2017/18)
Freiherr von Weizsäcker R [L], Feilcke C

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For further information about this module and its allocation to the curriculum see:
https://campus.tum.de/tumonline/wbModHb.wbShowMHBReadOnly?pKnotenNr=1175362

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## CS-C3140 Operating Systems, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-C3140 | **Validity** | 01.08.2016 - |
| **Name** | Operating Systems | **Abbreviation** | CS-C3140 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Intermediate Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**   Department of Computer Science

**Teachers in charge**

| Name |
|---|
| Vesa Hirvisalo |

**Description**

**Status of the Course**   Optional course of the Computer Science major and minor (Bachelor´s level).
Core course of the Computer Science major (Master's level).
Compulsory course of the CCIS programme's Software Systems and Technologies track and optional course in Signal, Speech and Language - Signal processing and data science (Master's level).

**Teaching Period**   I (Autumn)

**Learning Outcomes**   You understand the principles of operating system implementation.

**Content**   Operating system structure, processes, memory management, file system, concurrency and parallelism.

**Assessment Methods and Criteria**   Examination and exercises

**Workload**   Lectures 24 h, exercises 12 h

**Study Material**   William Stallings: Operating Systems: Internals and Design Principles, 7th edition, 2011. Corbet, Rubini, Kroah-Hartman. Linux Device Drivers, O'Reilly 3 ed., 2005.

**Substitutes for Courses**   Replaces the courses CSE-C3200 Operating Systems, T-106.4155.

**Prerequisites**   CS-A1120 / ICS-A1120 Programming 2 and CS-C2120 / CSE-C2120 Programming Studio 2: Project or equivalent knowledge.

**Grading Scale**   0-5

**Language of instruction and studies**   English

## CS-C3160 Data Science, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-C3160 | **Validity** | 01.08.2017 - |
| **Name** | Data Science | **Abbreviation** | CS-C3160 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Intermediate Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**  Department of Computer Science

**Teachers in charge**

**Name**

Jaakko Hollmen

**Description**

| | |
|---|---|
| **Status of the Course** | Compulsory course in Data Science major and minor, optional course of the Computer Science major and minor (Bachelor's level). Compulsory course of the Bioinformation Technology major (Bachelor's level). Optional course in CCIS programme's Signal, Speech and Language Processing - Signal Processing and Data Science (Master's level). |
| **Teaching Period** | II (Autumn) |
| **Learning Outcomes** | After the course, you can describe how natural data such as images, natural language, speech and time series measurements can be represented as data in digital form. You can apply elementary statistical and algorithmic methods to process the digital data to yield insights to the data generating phenomenon. You will understand what processes constitute the data science pipeline in the analysis, starting from natural data and ending with actionable results. |
| **Content** | The course serves as an introduction to the topic of data science and related topics such as machine learning. You will be introduced to data science methods and tools to find interesting information from data. Specific topics on the course include processing of digital signals such as speech and images, statistical estimation of parametric distributions, classification, prediction, clustering, pattern mining, and network analysis for developing search engines for hypertext collections such as the Web. |
| **Assessment Methods and Criteria** | Overall grade is determined by the exam grade. Attendance in the exercise sessions will earn the student extra exam points. |
| **Workload** | Lectures 20h, exercise sessions 20h, independent work 90h, examination 3h. |
| **Study Material** | Material will be announced on the course pages. |
| **Substitutes for Courses** | CS-C3110 Datasta tietoon (From Data to Knowledge). |
| **Prerequisites** | Skills needed on the course are taught on introductory courses in mathematics and statistics and programming. Specifically, matrix algebra, derivatives of functions, and statistical distributions will be needed on the course. |
| **Grading Scale** | 0-5. |
| **Language of instruction and studies** | English. |

## CS-E3210 Machine Learning: Basic Principles, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-E3210 | **Validity** | 01.08.2016 - |
| **Name** | Machine Learning: Basic Principles | **Abbreviation** | CS-E3210 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**  Department of Computer Science

### Teachers in charge

| Name |
|---|
| Juho Rousu |

### Description

| | |
|---|---|
| **Status of the Course** | Optional course in Data Science major and minor (Bachelor's level). Core course of the Computer Science major of CCIS Master's programme (Master's level). Compulsory course of the CCIS master's programme Game Design and Production; Machine Learning, Data Science and Artificial Intelligence;Signal, Speech and Language Processing majors, and Machine Learning, Data Science and Artificial Intelligence minor; ICT Innovation programme's Autonomous Systems, Data Science, and Human-Computer Interaction and Design majors, and in Life Science Technology programme's majors (Master's level). Optional course in CCIS Acoustics and Audio Technology, Communications Engineering, Security and Cloud Computing majors and in Analytics and Data Science minor (Master's level). The course is also offered through Open University. |
| **Teaching Period** | I-II (Autumn) Lectures only in Period I and independent project work in Period II. |
| **Learning Outcomes** | After the course, the student is able to apply the basic machine learning methods to data and to understand new models based on these principles. |
| **Content** | The course deals with basic principles needed to understand and apply machine learning models and methods. The topics include supervised and unsupervised learning, Bayesian decision theory, parametric methods, tuning model complexity, dimensionality reduction, clustering, nonparametric methods, decision trees, comparing and combining algorithms, as well as a few applications of these methods. |
| **Assessment Methods and Criteria** | The grading will be based on several multiple choice quizzes, the completion of home assignments, peer reviewing the home assignments of other students and completion of a data analysis project. There will be no written exam. |
| **Workload** | Lectures and exercises. |
| **Study Material** | To be specified in MyCourses at the start of the course. |
| **Substitutes for Courses** | Replaces courses T-61.3050 Machine Learning: Basic Principles and T-61.3030 Principles of Neural Computing. |
| **Prerequisites** | CS-C3160 Data Science, CS-C3110 Datasta tietoon or equivalent skills. |
| **Grading Scale** | 0-5 |
| **Language of instruction and studies** | English |

### Current and future teaching

| Functions | Name | Type | cr | Teacher | Schedule |
|---|---|---|---|---|---|
| Register | Machine Learning: Basic Principles | | | | |

## CS-E4100 Mobile Cloud Computing, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-E4100 | **Validity** | 01.08.2016 - |
| **Name** | Mobile Cloud Computing | **Abbreviation** | CS-E4100 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**   Department of Computer Science

**Teachers in charge**

| Name |
|---|
| Mario Di Francesco |

## Description

**Status of the Course**

Compulsory course of the CCIS programme's Software Systems and Technologies track and the Security and Cloud Computing tracks, Master's Programme in Security and Cloud Computing, and the ICT Innovation programme's Cloud Computing and Services, the Embedded Systems majors (Master's level).
Optional course in CCIS programme's Big Data and Large-Scale Computing, Web Technologies, applications and Science tracks, Game Design and Production major, CCIS minor on Security and Cloud Computing and Analytics and Data Science, ICT Innovation programme's Digital Media Technology, and Software and Service Architectures majors (Master's level).

**Level of the Course**

Master's level

**Teaching Period**   I - II (Autumn)

**Learning Outcomes**

After successful completion of the course, you will be able to: describe the distinctive features of mobile applications; explain how mobile applications can be supported by a cloud computing infrastructure; distinguish between different forms of virtualization; manage the resources offered by cloud computing platforms; write a mobile application that leverages cloud computing; evaluate the suitability of different cloud delivery models for specific application scenarios involving mobile computing.

**Content**

Principles of mobile computing. Distributed applications and services. Cloud computing and virtualization. Managing and using resources offered by cloud service providers. Computation offloading and thin-client computing. Application scenarios and selected use cases.

**Assessment Methods and Criteria**

Project work and assignments.

**Substitutes for Courses**

T-110.5121 Mobile Cloud Computing

**Prerequisites**

ELEC-C7241 / CSE-C2400 Computer Networks or equivalent skills. Basic mobile or web application programming skills.

**Grading Scale**   0-5

**Language of instruction and studies**

English

## CS-E4600 Algorithmic Methods of Data Mining, 5 cr _(3.33 credits)_

| | | | |
|---|---|---|---|
| **Code** | CS-E4600 | **Validity** | 01.08.2016 - |
| **Name** | Algorithmic Methods of Data Mining | **Abbreviation** | CS-E4600 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**  Department of Computer Science

### Teachers in charge

| Name |
|---|
| Aristides Gionis |

### Description

| | |
|---|---|
| **Status of the Course** | Compulsory course of the CCIS programme's Big Data and Large-Scale Computing tracks and Machine Learning, Data Mining and Artificial Intelligence tracks, and ICS Innovation programme's Data Science major (Master's level). Optional course in CCIS programme's Internet Technologies, Wireless Communication, Algorithms, Logic, and Computation, Software Systems and Technologies, Security and Cloud Computing, Signal Processing and Data Science tracks, Machine Learning, Data Science and Artificial Intelligence and Analytics and Data Science minor, ICT Innovation Human-Computer Interaction and Design major, and Master's Programme in Security and Cloud Computing, and Life Science Technologies Complex Systems major (Master's level). |
| **Level of the Course** | Master's level |
| **Teaching Period** | I - II (Autumn) |
| **Learning Outcomes** | The students will familiarize themselves with basic data-mining principles and methods. The course will cover different problem scenarios, such as, pattern discovery, clustering, and ordering, as well as, analysis of different types of data, such as, sets, graphs, and sequences. The students will develop their analytical tehniques to cope with challenging data-analysis problems. They will also develop their practical skills through programming assignments and experimentation with real data. |
| **Content** | The course covers general topics in data mining, such as pattern discovery, similarity search, data clustering, graph mining, ranking and ordering problems, stream computation, and distributed analysis of data, such as map-reduce. |
| **Assessment Methods and Criteria** | Take-home homeworks, programming assignments, and in-class final exam. |
| **Workload** | 24 + 12 (4 + 2) |
| **Study Material** | Lecture slides and online lecture notes. |
| **Substitutes for Courses** | T-61.5060 Algorithmic Methods of Data Mining |
| **Prerequisites** | Basic mathematics, statistics, and basic courses on algorithms design. |
| **Grading Scale** | 0-5 |
| **Language of instruction and studies** | English |

### Current and future teaching

| Functions | Name | Type | cr | Teacher | Schedule |
|---|---|---|---|---|---|
| Register | Algorithmic Methods of Data Mining | | | | |

## ELEC-A4930 Astronomical View of the World, 3 cr (2 credits)

| | | | |
|---|---|---|---|
| **Code** | ELEC-A4930 | **Validity** | 01.08.2013 - |
| **Name** | Astronomical View of the World | **Abbreviation** | ELEC-A4930 |
| **Credits** | 3 cr | **Date of expiry** | |
| **Type** | Basic Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**    Department of Electronics and Nanoengineering

### Teachers in charge

**Name**

Anne Lähteenmäki

Joni Tammi

### Description

| | |
|---|---|
| **Status of the Course** | Aalto course. |
| **Level of the Course** | Suitable for all students in Aalto University. |
| **Teaching Period** | III-IV 2018 - 2019 (spring)<br>III-IV 2019 - 2020 (spring) |
| **Learning Outcomes** | After the course the student can describe the physical background behind the basic celestial phenomena and knows how to take the movement of the Sun and the stars into account in engineering, design and architectural projects. The student recognises the astronomical nature of various historical and architecturally and otherwise significant constructions, ranging from the Stonehenge to sundials and modern observatories. She is able to describe the basics of the current scientific worldview and understands how it has been built over the millennia, and has basic knowledge of the interplay between astronomy and arts, as well as the influence on society and culture in general. |
| **Content** | Basic astronomical concepts; influence of astronomy and space sciences to history, civil engineering, architecture and art, and to science and culture in general. For further studies the course ELEC-E4530 Radio astronomy is recommended. |
| **Assessment Methods and Criteria** | Assessment methods: The course consists of lectures, homework, learning diaries, peer assessment, and excursion. |
| **Workload** | Lectures (30 h), assignments (32 h), and the learning diary (20 h). |
| **Study Material** | Online material provided during the course. |
| **Course Homepage** | https://mycourses.aalto.fi/course/search.php?search=ELEC-A4930 |
| **Grading Scale** | 0-5 |
| **Registration for Courses** | WebOodi |
| **Further Information** | language class 3: English |

## CS-C3150 Software Engineering, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-C3150 | **Validity** | 01.08.2016 - |
| **Name** | Software Engineering | **Abbreviation** | CS-C3150 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Intermediate Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**    Department of Computer Science

**Teachers in charge**

**Name**

Casper Lassenius

**Description**

**Status of the Course**    Optional course of the Computer Science major and minor (Bachelor's level). Common compulsory course of the CCIS Software and Service Engineering major and minor, and optional course in Signal, Speech and Language Prcessing - Signal processing and data science (Master's level). Compulsory course in the ICT in Business track (Master's level).

**Teaching Period**    I-II (Autumn) , III-IV (Spring)

**Learning Outcomes**    You can present and motivate the phases of software engineering (Requirements Engineering, Software Architecture, Software Design and Implementation, Software Testing, Software Evolution) and the main cross-cutting activities of software engineering (Software Processes, Agile Software Development, Configuration Management). You are able to read and understand software engineering literature, and motivate the importance of software engineering.

**Content**    The course provides a broad but practical view of industrial software development. Students learn the main problems, models and methods of software engineering, including traditional and agile/lean software development. The main software engineering activities, including software requirements engineering, design, implementation, testing and deployment are covered. Supporting workflows, e.g. configuration management and project management are also discussed. The course is delivered using moodle. Students pass the course by doing one moodle module each week, according to a fixed schedule. Each weekly module consists of a video lecture, a set of readings, a quiz, and a written assignment. After the course, students have a working understanding of software development in industry, and the necessary knowledge and skills to pursue further studies in software engineering.

**Assessment Methods and Criteria**    Exercises and possibly examination.

**Workload**    Lectures 30 h Exercises 60 h Independent study 45 h

**Study Material**    To be announced later.

**Substitutes for Courses**    Replaces former courses CSE-C3610 Software Engineering and T-76.3601 Introduction to Software Engineering.

**Prerequisites**    Basics in programming.

**Grading Scale**    0-5

**Language of instruction and studies**    English

## CS-E4070 Special Course in Machine Learning and Data Science, 3-10 cr *(2 credits)*

| | | | |
|---|---|---|---|
| **Code** | CS-E4070 | **Validity** | 01.08.2017 - |
| **Name** | Special Course in Machine Learning and Data Science | **Abbreviation** | CS-E4070 |
| **Credits** | 3-10 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

**Organisation**   Department of Computer Science

### Teachers in charge

| Name |
|---|
| Aristides Gionis |
| Alex Jung |
| Juha Karhunen |
| Samuel Kaski |
| Jouko Lampinen |
| Harri Lähdesmäki |
| Heikki Mannila |
| Juho Rousu |
| Aki Vehtari |

### Description

| | |
|---|---|
| **Status of the Course** | Compulsory course in CCIS programme's Speech and Language Processing track. Optional Course of the CCIS programme's Machine Learning, Data Science and Artificial Intelligence, and Signal Processing and Data Science tracks, and the ICT Innovation programme's Human Computer Interaction and Design majors (Master's level). |
| **Teaching Period** | Varies. |
| **Content** | Postgraduate level knowledge from one of the fields of computer and information science. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form. |
| **Assessment Methods and Criteria** | To be specified at the start of the course. |
| **Study Material** | Usually some new study book or collection of articles. |
| **Substitutes for Courses** | T-61.6010 Special Course in Computer and Information Science I, T-61.6020 Special Course in Computer and Information Science II, T-61.6030 Special Course in Computer and Information Science III, T-61.6040 Special Course in Computer and Information Science IV, T-61.6050 Special Course in Computer and Information Science V, T-61.6060 Special Course in Computer and Information Science IV, CS-E4010 Special Course in Machine Learning and Data Science I, CS-E4020 Special Course in Machine Learning and Data Science II, CS-E4030 Special Course in Machine Learning and Data Science III, CS-E4040 Special Course in Machine Learning and Data Science IV, CS-E4050 Special Course in Machine Learning and Data Science V, CS-E4060 Special Course in Machine Learning and Data Science VI. |
| **Grading Scale** | 0-5, may be graded with pass/fail |
| **Language of instruction and studies** | English |
| **Further Information** | The contents of the course vary. |

# CS-E4580 Programming Parallel Computers, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-E4580 | **Validity** | 01.08.2016 - |
| **Name** | Programming Parallel Computers | **Abbreviation** | CS-E4580 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Recommended timing** | | | |

| | |
|---|---|
| **Organisation** | Department of Computer Science |

## Teachers in charge

| Name |
|---|
| Jukka Suomela |

## Description

| | |
|---|---|
| **Status of the Course** | Optional course of the Computer Science and Data Science major and minor (Bachelor's level). Optional course of the CCIS programme's Algorithms, Logic and Computation, Big Data and Large-Scale Computing, and the Software Systems and Technologies tracks, Game Design and Production major, Analytics and Data Science minor, and ICT Innovation Data Science major, (Master's level). |
| **Level of the Course** | Master's level |
| **Teaching Period** | V (Spring) |
| **Learning Outcomes** | After this course, you will know how to write computationally intensive C or C++ code that makes an efficient use of dozens of CPU cores. You will learn how to partition large-scale computations between multiple processor cores, and how to choose the best memory layout for your data structures. You will also get hands-on experience of offloading computations from CPUs to GPUs. You will learn new kinds of algorithm design techniques that are relevant in the context of parallel computers, and you will also learn which of these techniques actually work in practice on modern multicore CPUs and GPUs. |
| **Content** | This is a practical hands-on course on algorithm engineering for modern parallel computers. The students will learn how to design programs that make the best possible use of the computing power of multicore CPUs and GPUs. The course projects will cover both numerical and combinatorial problems; the sole objective is to solve the task at hand in the shortest possible time. We will learn a whole range of techniques for speeding up computations, from bit manipulation hacks and special CPU instructions to high-level techniques such as choosing the right memory layout that makes the best possible use of the cache hierarchy. The main tools that we will use are C or C++, OpenMP or Intel TBB, and OpenCL or CUDA. |
| **Assessment Methods and Criteria** | Programming exercises. |
| **Study Material** | Available online. |
| **Substitutes for Courses** | ICS-E4020 Programming Parallel Computers |
| **Prerequisites** | No prior knowledge of parallel programming is needed. Students should have a good understanding of computer programming, algorithms and data structures, and a working knowledge of either C or C++ programming language. While this course is primarily targeted to Master students, advanced Bachelor students are welcome to join if they have sufficient background knowledge and programming skills. At the minimum, students should have completed all 1st year and 2nd year courses of their Bachelor degree. |
| **Grading Scale** | 0-5 |
| **Language of instruction and studies** | English |

# CS-E4610 - Modern Database Systems, (3.33 credits)
# 13.01.2017-31.03.2017

**Course home page**

- **Learning objectives**

Upon completion of the course, the students should be able to understand and cope successfully with various aspects of data management in modern database systems. Emphasis will be given in managing data that have complex structure, such as, text data, web data, social data, etc. Algorithms for approximate query answering and scalable data processing will be studied. The students will also have the opportunity to study platforms for managing big data, such as, map-reduce, platforms for data streams, and platforms for graph data.

**Course content**

- Structured data, relational databases, algorithms for query optimization.
- Semi-structured data, document-databases, semi-structured data abstraction, representation, and search.
- Unstructured text. IR systems, document retrieval and ranking.
- Platforms for Big Data, algorithms for Map-Reduce & Hadoop,
- Platforms for Big Graphs, algorithms for large graphs.

**Textbooks**

- Database management systems / Raghu Ramakrishnan, Johannes Gehrke / 3rd Edition / 0-07-246563-8 / 0-07-115110-9 (ISE)
  Learning Centre : 9 copies for borrowing and 1 for short loan
  Computer Science library 2 copies for borrowing and 1 for short loan

- Learning Spark: Lightning-Fast Big Data Analysis / Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia / O'Reilly Media; 1st edition / ISBN-13: 978-1449358624 / ISBN-10: 1449358624
  In Safari as an e-book with 3 users licence
  In EBSCO as an e-book with one user licence
  Learning Centre : 1 copy for short loan and 1 coursebook for borrowing
  Computer Science library : 1 copy for short loan and one coursebook for borrowing

- Data on the Web: From Relations to Semistructured Data and XML / Serge Abiteboul, Peter Buneman, Dan Suciu / 1st Edition / ISBN-13: 978-1558606227 / ISBN-10: 155860622X
  We have ordered 3 printed copies of the coursebook for borrowing

- Introduction to Information Retrieval / Christopher Manning, Prabhakar Raghavan, Hinrich Schutze / book and slides available online

**supplementary**

- Fundamentals of database systems / Ramez Elmasri, Shamkant B. Navathe / 6th edition / ISBN-13: 978-0136086208 / ISBN-10: 0136086209
  In Dawsonera as an e-book with one user licence
  Computer Science library: one coursebook for borrowing

- Advanced Analytics with Spark: Patterns for Learning from Data at Scale / Sandy Ryza, Uri Laserson, Sean Owen, Josh Wills / O'Reilly Media; 1st edition / ISBN-13: 978-1491912768 / ISBN-10: 1491912766
  In Safari as an e-book with 3 users licence.
  In Ebsco as an e-book with one user licence
  Computer Science library: one coursebook for borrowing

## Assessment methods

- 3 take-home homeworks, which will include pen-and-paper questions and programming assignments
- in-class final exam

### Grace Period for Assignments

Each student has a **grace period of 5 late days**, to distribute any way they want among the three assignments.

## Instructors

- Aristides Gionis
- Michael Mathioudakis

### Teaching Assistants

Frederick Ayala; frederick.ayala@aalto.fi
Karadahalli Nagesh Shreyas; shreyas.karadahallinagesh@aalto.fi
Phu Pham An; an.pham@aalto.fi

# CS-E4800 Artificial Intelligence, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-E4800 | **Validity** | 01.08.2016 - |
| **Name** | Artificial Intelligence | **Abbreviation** | CS-E4800 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Organisation** | Department of Computer Science | | |

**Teachers in charge**

| Name |
|---|
| Tomi Janhunen |
| Jussi Rintanen |

## Description

| | |
|---|---|
| **Status of the Course** | Compulsory course of the Data Science major and optional course in its minor (Bachelor's level)<br>Compulsory course of the CCIS programme's Algorithms, Logic and Computation track, and the Game Design and Production major (Master's level).<br>Optional course in the CCIS programme's Big Data and Large-Scale Computing, Software Systems and Technologies, Web Technologies, Applications and Science, Signal Processing and Data Science tracks, and Machine Learning, Data Science and Artificial Intelligence major, Analytics and Data Science minor, ICT Innovation programme's Data Science and Digital Media Technology, and Human-Computer Interaction and Design Majors, and Life Science Technology programme's Bioinformatics and Digital Health major (Master's level).<br>The course is also offered through Open University. |
| **Level of the Course** | Bachelor's and Master's level |
| **Teaching Period** | III - IV (Spring) |
| **Learning Outcomes** | Artificial intelligence (AI) tackles complex real-world problems, such as question answering, speech recognition, social network analysis, and task scheduling, with rigorous mathematical methods and tools. The goal of this course is to give an in-depth introduction to AI methodology while approaching the topic from the perspective of concrete application problems. Having completed the course, you have gained a comprehensive overview of AI and understand its fundamental principles related to machine learning and logical reasoning. You have excellent premises for solving real-world problems with modern AI techniques and building intelligent systems by implementing such techniques. |
| **Content** | The course presents a range of central AI techniques and provides the students with an extensive toolbox for solving problems in practice. For applications that require high degree of adaptation, specific techniques such as (deep) machine learning, reinforcement learning, and graphical models are included. These methods are instrumental for decision under uncertainty. For the purposes of knowledge representation and reasoning, different logical representations such as formulas and rules are covered. These representations establish the foundations for declarative problem solving and enable the use of state-of-the-art solver technology to search for solutions. The course also encourages the students to combine the logical and machine learning perspectives when solving future problems. |
| **Assessment Methods and Criteria** | Compulsory programming assignments, tutorial exercises, and exam. The overall course grade depends on the points earned from these sources. |
| **Workload** | Lectures, exercise sessions, independent work, and examination. |
| **Study Material** | Electronic material made available at MyCourses. |
| **Substitutes for Courses** | ICS-E4000 Artificial Intelligence |
| **Prerequisites** | Programming skills (CS-A1110 or equivalent), data structures and algorithms (CS-A1140 or equivalent), basics of probability theory (MS-A050* or equivalent) and linear algebra. |
| **Grading Scale** | 0-5 |
| **Language** | English |

## CS-E4840 Information Visualization, 5 cr (3.33 credits)

| | | | |
|---|---|---|---|
| **Code** | CS-E4840 | **Validity** | 01.08.2016 - |
| **Name** | Information Visualization | **Abbreviation** | CS-E4840 |
| **Credits** | 5 cr | **Date of expiry** | |
| **Type** | Advanced Studies | **Organisation** | |
| **Class** | Course | **Hours** | |
| **Study right** | | **Grading** | 1-5 · Courses |
| **Organisation** | Department of Computer Science | | |

### Teachers in charge

| Name |
|---|
| Kai Puolamäki |
| Tapio Takala |

### Description

| | |
|---|---|
| **Status of the Course** | Optional course in Data Science major and minor (Bachelor's level). Compulsory course of the CCIS programme's Human-Computer Interaction major and minor, Information Networks' programme's Media major, Life Science Technologies programme's Bioinformatics and Digital Health major (Master's level). Optional course in the CCIS programme's Communications Ecosystems, Big Data and Large-Scale Computation, Web Technologies, Applications and Science, Signal Processing and Data Science tracks, Game Design and Production and Machine Learning, Data Science and Artificial Intelligence majors, Machine Learning, Data Science and Artificial Intelligence, Analytics and Data Science minor, ICT Innovation programme's Data Science, Digital Media Technology, Human-Computer Interaction minor, and Life Science Technologies Complex Systems major and minor and Bioinformatics and Digital Health minor. |
| **Level of the Course** | Master's level |
| **Teaching Period** | IV (Spring) |
| **Learning Outcomes** | Information visualization offers instruments for reasoning about quantitative information, analyzing and communicating statistical information. The course overviews the main typologies of data graphics (data-maps, time-series, space-time narrative, relational diagrams, graphs and methods for dimensionality reduction) and provides a language for discussing data visualizations combined with a knowledge of the human perception of visual objects. |
| **Content** | The course teaches how to visualize information effectively by using the statistical methods, combined with knowledge of the human perception and the basics of data graphics. |
| **Assessment Methods and Criteria** | Examination and exercise work. |
| **Workload** | 24 + 12 (4 + 2) |
| **Study Material** | Lecture notes, and E. Tufte, The Visual Display of Quantitative Information, Graphics Press, 1983, and C. Ware, Information Visualization - Perception for Design, Morgan Kaufmann, 2004. |
| **Substitutes for Courses** | T-61.5010 Information Visualization |
| **Prerequisites** | Basic mathematics courses. |
| **Grading Scale** | 0-5 |
| **Language of instruction and studies** | English |

### Current and future teaching

| Functions | Name | Type | cr | Teacher | Schedule |
|---|---|---|---|---|---|
| Registration will start later | Information Visualization | Course | 5 | Tapio Takala | 24.02.20 -09.04.20 |

18 Ph.D., 08 M.S. (by Research), 60 M.Tech., 53 M.Sc. and 126 B.Tech. Students fulfill all the academic requirements for the award of the degree. The summary information with regard to the various degrees is as under:

**a) Doctor of Philosophy (Ph.D.)**

The following eighteen Ph.D. scholars have completed all the requirements for the award of the degree of "Doctor of Philosophy' including submission of the final approved thesis.

| Sl. No | Name & Roll No. | Date of Joining/ Date of Completion | Guide | Thesis Title | Viva- Voce Board | Thesis Examiners |
|---|---|---|---|---|---|---|
| 1 | Anna Varughese (D10002) | DoJ: 20-10-2010 DoC: 03-12-2018 (8 Years, 2 months) | Dr. Prasanth P Jose | A Molecular Dynamics Study of Glass Transition under Phase Separation in Pure and Glass Forming Binary Lennard-Jones Liquids | Dr. Hari Varma (Chair) Dr. Prasanth P Jose (Guide) Dr. A V Anil Kumar (Thesis Examiner) Prof. Abhik Basu (Subject Expert) | Dr. A V Anil Kumar (NISER Bhubaneswar) Prof. Richard K Bowles (University of Saskatchewan) |
| 2 | Jitendra Kumar Verma (D10017) | DoJ: 01-03-2011 DoC: 01-04-2019 (8 Years, 1 month) | Dr. Pradyumna K Pathak | Resonant Nonlinear Interaction of Light in Photonic Crystal Cavity-Quantum Dot Systems | Dr. Hari Varma (Chair) Dr. Pradyumna Pathak (Guide) Dr. Prasanta K Panigrahi (Thesis Examiner) Dr. Tarak Nath Dey (Subject Expert) | Prof. Prasanta K. Panigrahi (IISER Kolkata) Prof. Kishore Kapale (University Circle Macomb, USA) |
| 3 | Anand Kumar (D11042) | DoJ: 31-01-2012 DoC: 27-12-2018 (5 Years, 11 months) | Dr. Manoj Thakur | A New ACO Framework for Optimization with Application in Power System Problems | Dr. Sarita Azad (Chair) Dr. Manoj Thakur (Guide) Prof. Suresh Chandra (Thesis Examiner) Dr. Rajeev Kumar (Subject Expert) | Prof. Suresh Chandra (IIT Delhi) Prof. A.K. Verma (University of Applied Sciences, Haugesund), Norway |
| 4 | Amit Kumar (D12080) | DoJ: 31-07-2012 DoC: 31-01-2019 (6 Years, 6 months) | Dr. Vishal S Chauhan Dr. Rajeev Kumar (Co-guide) | Study of Electromagnetic Radiation from Cement and Cement Based Composites Under Impact Loading | Dr. Rahul Vaish (Chair) Dr. Vishal S Chauhan (Guide) Dr. Rajeev Kumar (Co-guide) Prof. Rajesh Prasad (Thesis Examiner) Prof. S.C. Jain (Subject Expert) | Prof. Rajesh Prasad (IIT Delhi) Prof. Dr. -Ing. Peter Wierach (Institute of Composite Structures and Adaptive Systems, Germany) |
| 5 | Somnath Acharya (D13005) | DoJ: 29-07-2013 DoC: 30-03-2019 (5 Years, 8 months) | Dr. Ajay Soni | Investigation of Physical Properties of Bulk Metal Chalcogenide Materials for Thermoelectric Applications | Dr. Suman K Pal (Chair) Dr. Ajay Soni (Guide) Prof. Ashish Garg (Thesis Examiner) Prof. Kuldeep K Sharma (Subject Expert) | Prof. Ashish Garg (IIT Kanpur) Prof. David J.S. (University of Missouri, Columbia) |
| 6 | Ashish Bahuguna (D13007) | DoJ: 29-07-2013 DoC: 11-01-2019 (5 Years, 6 months) | Dr. Venkata Krishnan | Carbon Support Based Heterogeneous Catalysts for Sustainable Synthesis of Indole Alkaloids and Chromenes | Dr. Pradeep Parameswaran (Chair) Dr. Venkata Krishnan (Guide) Dr. R. Boomi Shankar (Thesis Examiner) Dr. Jayamurugan Govindasamy (Subject Expert) | Dr. R. Boomi Shankar (IISER, Pune) Prof. Yoel Sassion (University of Jerusalem, Israel) |
| 7 | Mohit Kumar Sharma (D13013) | DoJ: 16-08-2013 DoC: 01-03-2019 (5 Years, 7 months) | Dr. Kaustav Mukherjee | Investigation of Physical Properties of Rare Earth and Transition Metal Based Oxides and Intermetallics Showing Significant Magnetocaloric Effect. | Dr. Hari Varma (Chair) Dr. Kaustav Mukherjee (Guide) Dr. R.Nirmala (Thesis Examiner) Dr. Kiran Singh (Subject Expert) | Dr. Menka Jain (University of Connecticut, United States of America) Dr. Nirmala R (IIT Madras) |

| 8 | Ashwani Kumar (D13017) | DoJ: 05-02-2014 DoC: 20-08-2019 (5 Years, 6 months) | Dr. Pradeep C Parameswaran | Aromatic Sulfonium Polyoxometalates as Photochromic Materials and Self-separating Catalysts | Dr. Syed Abbas (Chair) Dr. Pradeep C Parameswaran (Guide) Dr. Soumyajit Roy (Thesis Examiner) Dr. Boomi Shankar (Subject Expert) | Dr. Soumyajit Roy (IISER, Kolkata) Prof. Carsten Streb (Ulm University, Germany) |
|---|---|---|---|---|---|---|
| 9 | Mandeep Kumar (D13019) | DoJ: 10-02-2014 DoC: 03-05-2019 (5 Years, 3 months) | Dr. C.S.Yadav | Study of Electronic Transport Properties of Transition Metal Tellurides: CuxPdTe2(x=0,0.04), ZrTe3 and ZrTe5 | Dr. Syed Abbas (Chair) Dr. C.S. Yadav (Guide) Prof. Zakir Hussain (Thesis Examiner) Dr. Mukesh Kumar (Subject Expert) | Prof. Zakir Hussain (IIT Kanpur) Prof. Andre Strydom (University of Johannesberg, South Africa) |
| 10 | Mahesh Soni (D13023) | DoJ: 25-02-2014 DoC: 05-12-2018 (4 Years, 10 months) | Dr. Satinder K Sharma Dr. Ajay Soni (Co-guide) | Graphene and Derivatives Based Scaled Electronic and Memory Devices for Next Generation Technology | Dr. Ankush Bag (Chair) Dr. Satinder K Sharma (Guide) Dr. Ajay Soni (Co-guide) Prof. Pratima Agarwal (Thesis Examiner) Prof. Nagesh Thakur (Subject Expert) | Prof. Pratima Agarwal (IIT Guwahati) Prof. Subramanian S. Iyer (University of California, Los Angeles) |
| 11 | Mohammad Saquib (D14008) | DoJ: 01-08-2014 DoC: 16-07-2019 (4 Years, 11 months) | Dr. Aditi Halder | Rational Design of Carbon Supported Noble Metal Based Electrocatalysts for Renewable Energy Applications | Dr. Subrata Ghosh (Chair) Dr. Aditi Halder (Guide) Dr. Sudhanshu Sharma (Thesis Examiner) Dr. Ujjal K Gautam (Subject Expert) | Prof. Sudhanshu Sharma (IIT Gandhinagar) Prof. Prashant Deshlahra (Tufts University) |
| 12 | Suneel Kumar (D14013) | DoJ: 01-08-2014 DoC: 27-06-2019 (4 Years, 11 months) | Dr. Venkata Krishnan | Zinc Oxide Supported on Two Dimensional Materials as Heterogeneous Photocatalysts for Energy Conversion and Environmental Remediation Applications | Dr. Subrata Ghosh (Chair) Dr. Venkata Krishnan (Guide) Dr. Vivek Polshettiwar (Thesis Examiner) Dr. Atul Wankhade (Subject Expert) | Dr. Vivek Polshettiwar (TIFR, Mumbai) Prof. Matteo Cargnello (Stanford University, USA) |
| 13 | Davinder Singh (D14014) | DoJ: 11-08-2014 DoC: 22-04-2019 (4 Years, 8 months) | Dr. Viswanath Balakrishnan | Vapour Phase Growth and Nanomechanical Behaviour of $VO_2$ Microcrystals Across Phase Transition | Dr. Rajeev Kumar (Chair) Dr. Viswanath Balakrishnan (Guide) Dr. Navin Kumar (Thesis Examiner) Dr. Nitya Nand Gosvami (Subject Expert) | Dr. Navin Kumar (IIT Ropar) Prof. Shriram Ramanathan (Purdue University, USA) |
| 14 | Palvi Aggarwal (D14028) | DoJ: 19-01-2015 DoC: 30-11-2018 (3 Years, 10 months) | Dr. Varun Dutt | A Behavioral Game-Theoretic Analysis of Cyber- Security Scenarios Involving Deception and Intrusion Detection Systems | Dr. Dileep A.D. (Chair) Dr. Varun Dutt (Guide) Dr. Srinivasan Narayanan (Thesis Examiner) Dr. Anil Kumar Verma (Subject Expert) | Dr. Narayanan Srinivasan (University of Allahabad) Dr. David Peebles (University of Huddersfield, UK) |
| 15 | Anuruddh Kumar (D14032) | DoJ: 02-02-2015 DoC: 16-07-2019 (4 Years, 5 months) | Dr. Rajeev Kumar Prof. S.C. Jain (Co-guide) | Performance Enhancement of Piezoelectric Energy Harvesting | Dr. Manoj Thakur (Chair) Dr. Rajeev Kumar (Guide) Prof. S.C. Jain (Co-guide) Dr. P Thomas (Thesis Examiner) Dr. Mohit Pant (Subject Expert) | Prof. P.Thomas (CPRI, Bangalore) Prof. Christopher Rhys Bowen (University of Bath Claverton Down, UK) |
| 16 | Atendra Kumar (D14033) | DoJ: 04-02-2015 DoC: 26-12-2018 (3 Years, 10 months) | Dr. Rajendra K Ray | Unsteady Flow Separation from the Surface of Solid Cylinders in Laminar Shear Flow: A Structural Bifurcation Analysis | Dr. Syed Abbas (Chair) Dr. Rajendra K Ray (Guide) Dr. A.S. Vasudeva Murthy (Thesis Examiner) Dr. Subash Chandra Martha (Subject Expert) | Dr. A.S. Vasudeva Murthy, (TIFR, Deemed University, Bangalore) Prof. Kim Dan Nguyen, (Lab of Hydraulics Saint-Venant, Universite PARIS-EST, France) |

| Sl. No | Name & Roll No. | Date of Joining/ Date of Completion | Guide | Thesis Title | Academic Progress Committee | External Examiners |
|---|---|---|---|---|---|---|
| 17 | Supriya Ghosh (D15034) | DoJ: 27-07-2015 DoC: 08-02-2019 (3 Years, 7 months) | Dr. Suman K Pal | Photoinduced Processes in Organo Lead Halide Perovskite Bulk Crystals, Nanocrystals and Thin Films | Dr. Subrata Ghosh (Chair) Dr. Suman K Pal (Guide) Prof. Pradipta Purkayastha (Thesis Examiner) Dr. Rajiv Kr. Singh (Subject Expert) | Prof. Pradipta Purkayastha (IISER, Kolkata)<br><br>Dr. Andrey S. Mereshchenko (Saint Petersburg University, Russia) |
| 18 | Preeti Gulia (D15006) | DoJ: 27-07-2015 DoC: 16-09-2019 (4 Years, 2 months) | Dr. Arpan Gupta | Experimental and Numerical Investigation of Sonic Crystal and Acoustic Panel | Dr. Viswanath Balakrishnan (Chair) Dr. Arpan Gupta (Guide) Prof. Anand Parey (Thesis Examiner) Prof. S.C. Jain (Subject Expert) | Prof. Anand Parey (IIT Indore)<br><br>Dr. Densil Cabrera (University of Sydney, Australia) |

**b)      Master of Science (MS.(by Research))**

The following eight M.S. scholars have completed all the requirements for the award of the degree of Master of Science (M.S. (by Research)) including submission of the final approved thesis.

| Sl. No | Name & Roll No. | Date of Joining/ Date of Completion | Thesis Title | Guide | Academic Progress Committee | External Examiners |
|---|---|---|---|---|---|---|
| 1 | Gaurav Sharma (S15001) | DoJ: 20-07-2015 DoC:18-12-2018 (3 years 5 months) | Studies on HERIC (Highly Efficient Reliable Inverter Concept) Photovoltaic Inverter | Prof. Ramesh Oruganti<br><br>Dr. Bhakti Joshi (Co-guide) | Dr. Bharat Singh Rajpurohit (Chair) Prof. Ramesh Oruganti (Guide) Dr. Bhakti Joshi (Co-guide) Dr. Atul Dhar Dr. Kunal Ghosh | Prof. Narayanan G (IISC Banglore)<br><br>Prof. Shantanu Mishra (IIT Kanpur) |
| 2 | Abhay (S15004) | DoJ: 27-07-2015 DoC:20-11-2018 (3 years 4 months) | Solute Transport Modelling through Saturated Porous Media with Time-Dependent Dispersion | Dr. Deepak Swami<br><br>Dr. Dericks P Shukla (Co-guide) | Dr. Rajeev Kumar (Chair) Dr. Deepak Swami (Guide) Dr. Dericks P Shukla (Co-guide) Dr. Pradeep Kumar Dr. Manoj Thakur | Prof. Rajesh Srivastava (IIT Kanpur)<br><br>Prof. A. L. Ramanathan (Jawaharlal Nehru University, New Delhi) |
| 3 | Ankur Kaundal (S15008) | DoJ: 27-07-2015 DoC:19-06-2019 (3 years 11 months) | Improvement in Thermal Efficiency and Emission Control of Domestic Cook Stoves | Dr. Satvasheel Powar<br><br>Dr. Atul Dhar (Co-guide) | Dr. Rahul Vaish (Chair) Dr. Satvasheel Powar (Guide) Dr. Atul Dhar (Co-guide) Dr. P Anil Kishan Dr. Parmod Kumar Dr. Surya Prakash | Prof. Himanshu Tyagi (IIT Ropar)<br><br>Prof. Balkrishna Mehta (IIT Guwahati) |
| 4 | Abhilash Awasthi (S15013) | DoJ: 08-02-2016 DoC:19-12-2018 (2 years 10 months) | Mechanical Characterization of Mineralized Collagen Fibril using Multiscale Asymptotic Homogenization | Dr. Rajneesh Sharma<br><br>Dr. Rajesh Ghosh (co-guide) | Dr. Rajeev Kumar (Chair) Dr. Rajneesh Sharma (Guide) Dr. Rajesh Ghosh (co-guide) Dr. Venkata Uday Kala Dr. Kaustav Sarkar Dr. Syed Abbas | Prof. Kallol Khan (NIT Durgapur)<br><br>Prof. Sitikantha Roy (IIT Delhi) |

| 5 | Sharey Deep Guleria (S16003) | DoJ: 05-08-2016 DoC:02-09-2019 (3 years 1 month) | Visualization-Based Fluid Dynamics Experiments on Fluid-Particle Interactions | Dr. Atul Dhar<br><br>Dr. Dhiraj V Patil (Co-guide) | Dr. Viswanath Balakrishnan (Chair) Dr. Atul Dhar (Guide) Dr. Dhiraj V Patil (Co-guide) Dr. P Anil Kishan Dr. Pradeep Kumar Dr. Satvasheel Powar Dr. Hitesh Shrimali | Dr. Vinayak Kulkarni (IIT Guwahati)<br><br>Dr. Amit Gupta (IIT Delhi) |
|---|---|---|---|---|---|---|
| 6 | Gaurav Sharma (S16006) | DoJ: 05-08-2016 DoC:20-11-2018 2 years 3 months) | Analytical Solution and Experiments in Wave Propagation Problems | Dr. Arpan Gupta<br><br>Dr. Aniruddha Chakraborty (Co-guide) | Dr. Vishal Singh Chauhan (Chair) Dr. Arpan Gupta (Guide) Dr. Aniruddha Chakraborty (Co-guide) Dr. Rajesh Ghosh Dr. M.Talha Dr. Pradeep Kumar | Dr. Anand Parey (IIT Indore)<br><br>Dr. Jayanta Kumar Dutt (IIT Delhi) |
| 7 | Sivarathri Ashok Kumar (S16010) | DoJ: 01-02-2017 DoC:16-07-2019 (2 years 5 months) | Piezoelectricity Induced Electromagnetic Radiation: Probable Phenomenon for Wireless Sensing | Dr. Vishal Singh Chauhan<br><br>Dr. Rajeev Kumar (Co-guide) | Dr. Rahul Vaish (Chair) Dr. Vishal Singh Chauhan (Guide) Dr. Rajeev Kumar (Co-guide) Dr. Atul Dhar Dr. Narsa Reddy Tummuru Dr. V. Balakrishnan | Dr. P.Thomas (DMD, CPRI, Bangalore)<br><br>Dr. Satyendra Singh (JNU Delhi) |
| 8 | Ragini Sinha (S16013) | DoJ: 01-02-2017 DoC:27-08-2019 (2 years 6 months) | Signal Enhancement and Source Characterization for Processing Birdcalls | Dr. Padmanabhan Rajan | Dr. Arnav Bhavsar (Chair) Dr. Padmanabhan Rajan (Guide) Dr. Renu M R Dr. Arpan Gupta Dr. Srikant Srinivasan | Prof. S.R. Mahadeva Prasanna (IIT Dharwad)<br><br>Prof. K. Sreenivasa Rao (IIT Kharagpur) |

### c) Master of Science in Chemistry (M.Sc. (Chemistry))

The following twenty two students have completed all the requirements for the award of the degree of Master of Science (M.Sc. (Chemistry)). Their names and Roll Nos. are as given below:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | V17001 | GAYATRI BATRA |
| 2 | V17002 | NEERAJ SONI |
| 3 | V17003 | MEENU UPADHYAY |
| 4 | V17004 | SAKSHI TYAGI |
| 5 | V17005 | ANKIT KASHYAP |
| 6 | V17006 | MAHENDER SINGH |
| 7 | V17007 | MUKESH KUMAR |

| | | |
|---|---|---|
| 8 | V17008 | NISHKANT MALKOTI |
| 9 | V17009 | PANKAJ KUMAR |
| 10 | V17010 | ABHAY SHARMA |
| 11 | V17011 | AKASH KUMAR |
| 12 | V17012 | VISHAL THAKUR |
| 13 | V17013 | CHETAN SAINI |
| 14 | V17014 | RENUKA SHARMA |
| 15 | V17015 | JYOTI ROHILLA |
| 16 | V17016 | VEDASREE MOUTAM |
| 17 | V17017 | RITU |
| 18 | V17018 | SHWETA KAUSHAL |
| 19 | V17019 | SOMESH CHAMOLI |
| 20 | V17020 | SWARNIM PANDEY |
| 21 | V17021 | ANJU |
| 22 | V17022 | SOURABH KUMAR |

### d) Master of Science in Applied Mathematics (M.Sc. (Applied Mathematics))

The following Fourteen students have completed all the requirements for the award of the degree of Master of Science (M.Sc. (Applied Mathematics)). Their names and Roll Nos. are as given below:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | V17042 | DEEPAK KUMAR |
| 2 | V17044 | RISHABH SAXENA |
| 3 | V17045 | ANIL KUMAR |
| 4 | V17046 | SNEH |
| 5 | V17047 | JASVANT SINGH |
| 6 | V17048 | RAKESH KUMAR |
| 7 | V17049 | RAJNEESH KUMAR |
| 8 | V17050 | ASHWANI |
| 9 | V17051 | ARCHANA RANI |

| | 10 | V17052 | AFIFA FATMA |
|---|---|---|---|
| | 11 | V17053 | VIVEK KUMAR YADAV |
| | 12 | V17054 | ABHISHEK GARG |
| | 13 | V17055 | KM AYUSHI CHAUHAN |
| | 14 | V17056 | VISHNU PRATAP SINGH PARIHAR |

**e)** **Master of Science in Physics (M.Sc. (Physics)):**

The following seventeen students have completed all the requirements for the award of the degree of Master of Science (M.Sc. (Physics). Their names and Roll Nos. are as given below:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | V17081 | PRIYA YADAV |
| 2 | V17082 | ATMIKA BHARDWAJ |
| 3 | V17083 | RAJKUMAR JANGID |
| 4 | V17084 | AMIT KUMAR SHARMA |
| 5 | V17085 | RAVI KUMAR SHARMA |
| 6 | V17086 | HARIOM SAINI |
| 7 | V17087 | SUMIT KANT |
| 8 | V17089 | SURAJ SINGH |
| 9 | V17090 | RADHIKA |
| 10 | V17091 | MAYANK VASHISTHA |
| 11 | V17092 | RAHUL MITTAL |
| 12 | V17093 | KOUSHAL KISHOR GANGWAL |
| 13 | V17094 | AYUSH RASTOGI |
| 14 | V17095 | VAIBHAV RAJ SINGH PARMAR |
| 15 | V17096 | MUKESH KUMAR |
| 16 | V17097 | DEEKSHA KANTI |
| 17 | DI1606 | MOHIT KHANNA |

**f)      Master of Technology in Energy Engineering with specialization in Materials (EEM)**

The following ten students have completed all the requirements for the award of the degree of Master of Technology in Energy Engineering with specialization in Materials (EEM).  Their names and Roll Nos. are as given below:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | T17003 | SAUMYA  PANDEY |
| 2 | T17009 | TARUN  KUMAR |
| 3 | T17012 | ASHUTOSH  CHAUHAN |
| 4 | T17013 | KARANVEER  SINGH |
| 5 | T17015 | GOURAV  SARASWAT |
| 6 | T17016 | NIKHIL TANAJI DOIPHODE |
| 7 | T17017 | HANI  CHAUDHARY |
| 8 | T17018 | MINHAJ |
| 9 | T17019 | SANDEEP YADAV |
| 10 | T17021 | AAYUSH TRIVEDI |

**g)      Master of Technology in Mechanical Engineering with specialization in Energy System (MES)**

The following nine students have completed all the requirements for the award of the degree of Master of Technology in Mechanical Engineering with specialization in Energy System (MES).  Their names and Roll Nos. are as given below:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | T17001 | DIVESH  BHARTI |
| 2 | T17002 | ANAND  SINGH |
| 3 | T17004 | PRINCE  KAKRAN |
| 4 | T17005 | VIKAS  HOODA |
| 5 | T17006 | DIKSHITA  JOSHI |
| 6 | T17007 | APAKRITA VINAYAK TAYADE |
| 7 | T17008 | DIWAKAR  SINGH |

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 8 | T17011 | ROSHAN LAL |
| 9 | T17020 | SHASHANK PRABHAKAR |

**h)**  **Master of Technology in Electrical Engineering with specialization in VLSI:**

The following nine students have completed all the requirements for the award of the degree of Master of Technology in Electrical Engineering with specialization in VLSI.  Their names and Roll Nos. are as given below with specialization:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | T17041 | SHUBHAM SANJAY TELGOTE |
| 2 | T17043 | MOHAMMED SUHAIL ILLIKKAL |
| 3 | T17045 | MUNEEB SULTHAN P P |
| 4 | T17046 | SHIV KUMAR |
| 5 | T17047 | KARUNANIDHAN PANDEY |
| 6 | T17048 | VARTIKA VERMA |
| 7 | T17049 | RUPAL JAIN |
| 8 | T17050 | RAHUL PANWAR |
| 9 | T16048 | ALVENDRA SINGH |

**i)**  **Master of Technology in Power Electronics and Drives:**

The following nine students have completed all the requirements for the award of the degree of Master of Technology in Power Electronics and Drives.  Their names and Roll Nos. are as given below with specialization:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | T17101 | ZEN BICHAKSHYANA MOHANTY |
| 2 | T17102 | RITU RAI |
| 3 | T17103 | VIRENDRA SINGH |
| 4 | T17104 | PRIYANKA TIWARI |
| 5 | T17105 | GAURAV GAUTAM |
| 6 | T17107 | GITIKA PANDEY |
| 7 | T17108 | DEVENDRA KUMAR |

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 8 | T17109 | MOINUDEEN |
| 9 | T17110 | GADDALA RAVI KUMAR |

**j)      Master of Technology in Communications and Signal Processing:**

The following thirteen students have completed all the requirements for the award of the degree of Master of Technology in Communications and Signal Processing.  Their names and Roll Nos. are as given below with specialization:

| SL. NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | T17131 | OM KARWAL |
| 2 | T17132 | RAGHAV SHARMA |
| 3 | T17133 | VARTIKA SENGAR |
| 4 | T17134 | VIPUL AGGARWAL |
| 5 | T17135 | AKSHAY TIWARI |
| 6 | T17136 | ANUSHA ASWATH |
| 7 | T17137 | ANIL TIWARI |
| 8 | T17138 | MUHAMMAD UBADAH |
| 9 | T17139 | SARATHPRASAD K V |
| 10 | T17140 | CHANDRAKANT SONAWANE |
| 11 | T17141 | SHELADIYA NIRALI DHANJIBHAI |
| 12 | T17143 | SURBHI JAIN |
| 13 | T17144 | HITIKA TIWARI |

**k)      Master of Technology in Biotechnology:**

The following ten students have completed all the requirements for the award of the degree of Master of Technology in Biotechnology.  Their names and Roll Nos. are as given below:

| SL. NO. | ROLL NO. | STUDENT NAME | BRANCH |
|---|---|---|---|
| 1 | T17071 | ANUMA SINGH | BIOTECHNOLOGY |
| 2 | T17072 | PRIYA SINGH | BIOTECHNOLOGY |

| 3 | T17073 | SWACHHATOA GHOSH | BIOTECHNOLOGY |
|---|---|---|---|
| 4 | T17074 | SUCHETA GHOSH | M.TECH IN BIOTECHNOLOGY WITH SPECIALIZATION IN MEDICAL AND NANO-BIOTECHNOLOGY |
| 5 | T17075 | BHOOMIKA PATEL | BIOTECHNOLOGY |
| 6 | T17076 | SURBHI MISHRA | M.TECH IN BIOTECHNOLOGY WITH SPECIALIZATION IN MEDICAL AND NANO-BIOTECHNOLOGY |
| 7 | T17077 | PAWAN KUMAR PANDEY | M.TECH IN BIOTECHNOLOGY WITH SPECIALIZATION IN MEDICAL AND NANO-BIOTECHNOLOGY |
| 8 | T17078 | URVASHI SINGH | M.TECH IN BIOTECHNOLOGY WITH SPECIALIZATION IN MEDICAL AND NANO-BIOTECHNOLOGY |
| 9 | T17079 | SANDESH KUMAR PATEL | BIOTECHNOLOGY |
| 10 | T17080 | SHAHIDA SIDDIQUI | M.TECH IN BIOTECHNOLOGY WITH SPECIALIZATION IN MEDICAL AND NANO-BIOTECHNOLOGY |

l)      **Bachelor of Technology (B.Tech.) in Computer Science and Engineering**

**59** students have completed all the requirements for the award of 'Bachelor of Technology' degree in Computer Science and Engineering. Of these, **19** students have completed requirements for the award of degree with '**Minor in Management**'. **01** student has completed requirements for **B.Tech (Honours Degree).** Their names and Roll. Nos. are as given below:

| SL NO. | ROLL NO. | STUDENT NAME | SL NO. | ROLL NO. | STUDENT NAME |
|---|---|---|---|---|---|
| 1 | B15101 | AAYUSH MISHRA *(Minor in Management)* | 31 | B15137 | SWAPNIL SHARMA |
| 2 | B15102 | ABHIJEET SHARMA *(Minor in Management)* | 32 | B15138 | UTKRISHT DHANKAR |
| 3 | B15103 | ABHISHEK *(Minor in Management)* | 33 | B15139 | VAIBHAV AGARWAL *(Minor in Management)* |
| 4 | B15104 | ABHISHEK POONIA | 34 | B15201 | AAKASH DAGAR *(Minor in Management)* |
| 5 | B15105 | AKASH YADAV *(Minor in Management)* | 35 | B15206 | AKASH SHARMA |
| 6 | B15106 | AKSH GAUTAM | 36 | B15207 | AMAN SINGH |
| 7 | B15107 | ANKIT AMRIT RAJ | 37 | B15211 | AVINAV SANYAL |

| 8 | B15108 | ANSHU PURI | 38 | B15217 | KHANDAGALE SUJAY SANJAY |
|---|--------|------------|----|--------|--------------------------|
| 9 | B15109 | AVNISH KUMAR | 39 | B15219 | KISLAYA MISHRA |
| 10 | B15110 | BARPATI AVINASH KUMAR | 40 | B15225 | PANKAJ KUMAR SHEORAN |
| 11 | B15111 | CHEBATHINI SONITH | 41 | B15227 | PRANAV GUPTA *(Minor in Management)* |
| 12 | B15112 | DHAIRYA VERMA | 42 | B15228 | RAHUL JAIN *(Minor in Management)* |
| 13 | B15113 | GAINGAMSIN PAMEI *(Minor in Management)* | 43 | B15232 | RAMCHANDANI HITESH BHARAT |
| 14 | B15114 | GURMEET SINGH *(Minor in Management)* | 44 | B15233 | SAGAR GUPTA |
| 15 | B15116 | JONTY PURBIA *(Minor in Management)* | 45 | B15234 | SANIDHYA |
| 16 | B15117 | MAMTA RAJU BHAGIA | 46 | B15238 | ABHISHEK TIWARI |
| 17 | B15118 | MOHIT SHARMA *(Minor in Management)* | 47 | B15302 | ADNAAN NAZIR *(Minor in Management)* |
| 18 | B15120 | PARINAYA CHATURVEDI *(Minor in Management)* | 48 | B15303 | AKASH AGRAWAL *(Minor in Management)* |
| 19 | B15121 | PRAMOD JONWAL | 49 | B15305 | AKHIL SINGHAL |
| 20 | B15122 | PULKIT KUMAR SHARMA | 50 | B15311 | DEEPANSHU TYAGI |
| 21 | B15123 | PULKIT SAPRA | 51 | B15312 | DEEPESH GOEL *(Minor in Management)* |
| 22 | B15124 | PUNEET YADAV | 52 | B15317 | INDRESH KUMAR GUPTA |
| 23 | B15125 | RAHUL KUMAR RAJPOOT | 53 | B15319 | KUSHAGRA SINGHAL |
| 24 | B15126 | RAJANISH KUMAR UPADHYAY *B.Tech. (Honours Degree) and (Minor in Management)* | 54 | B15321 | MEHUL RAJ KUMAWAT |
| 25 | B15129 | SAHIL SINGLA *(Minor in Management)* | 55 | B15322 | NIJASURE ATHARVA |
| 26 | B15130 | SAHIL YADAV *(Minor in Management)* | 56 | B15329 | RIYANSH GOYAL |
| 27 | B15131 | SAI TARUN REDDY PALLA | 57 | B15331 | SAKHILE NAGA KOTI REDDY |
| 28 | B15132 | SANDESH JOSHI | 58 | B15405 | ARCHIT KUMAR |
| 29 | B15134 | SHREYAK KUMAR | 59 | B13122 | KUMARI SHUBHANGI |
| 30 | B15136 | SONAM KAG | | | |

## m) Bachelor of Technology (B.Tech.) in Electrical Engineering

**25** students have completed all the requirements for the award of 'Bachelor of Technology' degree in Electrical Engineering. Of these, **06** students have completed requirements for the award of degree with '**Minor in Management**'. Their names and Roll. Nos. are as given below:

| SL NO. | ROLL NO. | STUDENT NAME | SL NO. | ROLL NO. | STUDENT NAME |
|---|---|---|---|---|---|
| 1 | B15202 | AAYUSH SHARMA | 14 | B15220 | LOKESH BAIRWA |
| 2 | B15203 | ABHISHEK PAL | 15 | B15222 | MUKESH KUMAWAT *(Minor in Management)* |
| 3 | B15204 | ABHISHEK SONAL | 16 | B15223 | MUNISH |
| 4 | B15205 | ADITI MANN | 17 | B15224 | NEMANI SRI HARI |
| 5 | B15208 | AMIT GHANGHAS | 18 | B15226 | PIYUSH ANAND |
| 6 | B15209 | ANUKSHA JAIN *(Minor in Management)* | 19 | B15230 | RAHUL MEENA |
| 7 | B15210 | ASHUTOSH KUMAR | 20 | B15231 | RAHUL SINGH |
| 8 | B15212 | DHRUV PATEL *(Minor in Management)* | 21 | B15235 | SHRAWAN KUMAR |
| 9 | B15213 | GOURAV BHATT *(Minor in Management)* | 22 | B15237 | SUMIT PATIDAR |
| 10 | B15214 | HIMANSHU KUMAR *(Minor in Management)* | 23 | B15239 | VIPIN TOLIA |
| 11 | B15215 | HIMANSHU MEWARA | 24 | B15323 | PANKAJ UPADHYAY |
| 12 | B15216 | J RAGHUNATH | 25 | B14220 | MOHIT JAIN *(Minor in Management)* |
| 13 | B15218 | KISHORE KUMAR SINGH | | | |

## n) Bachelor of Technology (B.Tech.) in Mechanical Engineering

**24** students have completed all the requirements for the award of 'Bachelor of Technology' degree in Mechanical Engineering. Of these, **03** students have completed requirements for the award of degree with '**Minor in Management**' and **02** students have completed requirements for the award of degree with '**Minor in Intelligent Systems**'. **01** student has completed requirements for B.Tech (Honours Degree). Their names and Roll. Nos. are as given below:

| SL NO. | ROLL NO. | STUDENT NAME | SL NO. | ROLL NO. | STUDENT NAME |
|---|---|---|---|---|---|
| 1 | B15301 | ADITYA SHARMA *(Minor in Management)* | 13 | B15327 | PREETI M KANNAPAN |
| 2 | B15304 | AKASH MARMAT | 14 | B15328 | REVU SRI HARSHA |
| 3 | B15306 | AMAN CHOUDHARY | 15 | B15330 | RUSHIL SINGHAL *B.Tech (Honours Degree), Minor in Management & Minor in Intelligent Systems* |
| 4 | B15307 | ANAND MOHAN TIWARI | 16 | B15332 | SANJAY NETRIWAL |
| 5 | B15308 | ATUL YADAV | 17 | B15333 | SHEKHAR SHUBHAM |
| 6 | B15309 | AVINASH KUMAR | 18 | B15334 | SHOBHIT OLA |
| 7 | B15313 | DEVENDRA BAIRWA | 19 | B15337 | UDIT SONI |
| 8 | B15315 | DIVYA RANJAN | 20 | B15338 | UTKARSH KUNWAR *(Minor in Intelligent Systems)* |
| 9 | B15316 | DIVYANSH VERMA | 21 | B15339 | V SAI SUBBA RAO |
| 10 | B15318 | KANIKARAM SAI SANDEEP | 22 | B15341 | VISHVAJEET PATEL |
| 11 | B15320 | MANOJ KUMAR JANGID *(Minor in Management)* | 23 | B15342 | WASIM SALIH.T |
| 12 | B15326 | PRADEEP KUMAR | 24 | B15403 | AMIT KUMAR |

## I) Bachelor of Technology (B.Tech.) in Civil Engineering

**18** students have completed all the requirements for the award of 'Bachelor of Technology' degree in Civil Engineering. Of these, **04** students have completed requirements for the award of degree with '**Minor in Management**' and **01** student has completed requirements for the award of degree with '**Minor in Intelligent Systems**'. Their names and Roll. Nos. are as given below:

| SL NO. | ROLL NO. | STUDENT NAME |
|---|---|---|
| 1 | B15401 | ABHAY SINGH CHAUHAN |
| 2 | B15402 | AKSHIT KAUSHIK DEVGUN |
| 3 | B15404 | ANKIT DAHIYA *(Minor in Management)* |

| 4 | B15407 | BIPIN SHARMA |
|---|--------|--------------|
| 5 | B15408 | CHIRAG MAHAWAR |
| 6 | B15409 | DEVESHI SONI |
| 7 | B15410 | GANTAVYA GUPTA *(Minor in Management)* |
| 8 | B15411 | GAURAV PUROHIT *(Minor in Intelligent Systems)* |
| 9 | B15412 | LOKESH TUNGARIYA |
| 10 | B15414 | MAYURESH GUPTA |
| 11 | B15415 | NAVYA AGARWAL |
| 12 | B15416 | NIKHIL KUMAR *(Minor in Management)* |
| 13 | B15417 | PRASHANT SINGH |
| 14 | B15418 | PRIYANSHU MEENA |
| 15 | B15423 | TUSHAR AGGARWAL |
| 16 | B15424 | VIKAS *(Minor in Management)* |
| 17 | B15314 | DHEERAJ KUMAR MEENA |
| 18 | B15340 | VIJAY SHANKAR MEENA |

Board of Academics recommended the award of degrees for approval by the Senate.

# Modification in BTech CSE Curriculum and Discipline Core Courses

**The modifications are proposed based on decisions of IC CIG meeting held on July 17th, 2019 and School meeting held on July 23, 2019 and Aug 5, 2019**

**As per the IC CIG meeting held on July 17th, 2019:**

1) Three baskets were made (courses of 24 credits) namely: Science I, Science II and Engineering Science
2) A student must take one course from each basket. Here, CIG can make a course compulsory for specific discipline. This should be done by 26th July 2019.
3) Engineering thermodynamics course will be offered as 3 credit course.
4) 12 credits will be used as 3 (Discipline core) + 9 (Free Elective)

Course coordinator should take appropriate action to implement this recommendation from Aug 2019.

**In School meeting held on July 23, 2019 and August 5, 2019 IC CIG outcome as mentioned above was discussed and following modifications was agreed to be included in BTech CSE Curriculum and Discipline Core:**

1) CS304: Formal Languages and Automata Theory (3-0-0-3) will be introduced as a new core course for BTech CSE
2) CS304 will be offered in 4th semester
3) If approved by Senate, above mentioned changes should be made effective for intake batch of 2018 and onwards.
4) Corresponding placement of CSE discipline core semester wise is as follows:
   a. **III Semester**:
      i. CS202: Data Structure and Algorithms (3-0-2-4)
      ii. CS207P: Applied Database Practicum (0-0-3-2)
      iii. CS208: Mathematical Foundation for Computer Science (3-1-0-4)
   b. **IV Semester**:
      i. CS201: Computer Organization (3-0-0-3)
      ii. CS201P: Computer Organization Lab (0-0-2-1)
      iii. CS304: Formal Languages and Automata Theory (3-0-0-3)
      iv. CS309: Information System and Databases (3-0-2-4)
   c. **V Semester**:
      i. CS308P: Large Application Practicum (0-0-3-2)
      ii. CS310: Introduction to Communicating Distributed Processes (3-0-2-4)

   d. **VI Semester**:
      i. CS302: Paradigms of Programming (3-0-2-4)
      ii. CS307P: System Practicum (0-0-3-2)

## Proposal for Independent Study Course

**Preamble:** During the faculty meeting, held on 11 January 2019, a group of faculty members was assigned to deliberate the possibility of introducing an independent study course to IIT Mandi curriculum.

**Proposal Committee Members:**
- Dr. Astrid Kiehn
- Dr. Shubhajit Roy Chowdhury
- Dr. Rajesh Ghosh
- Dr. Sandip Kumar Saha (Co-Ordinator)

The committee members have deliberated on various aspects of the proposal on independent study course. Following information are compiled based on the discussion.

**Needs:**
- A student willing to learn a specific topic in greater depth, which otherwise is not covered in any other regular courses being offered at IIT Mandi.
- A student wishes to continue to work on their Design Practicum (DP)/ Interactive Socio-Technical Practicum (ISTP) projects to next level, and needs to know more in depth about relevant advanced theories and the working principles under expert supervision.

**Proposal:**
- Interested student(s) should initiate the proposal and approach suitable faculty (faculties) (here after called as supervisor(s)) for guidance.
- Once the topic and supervisor(s) are decided, a detailed proposal in a prescribed format (Annexure-I) is to be prepared.
- The proposal should be submitted at least six weeks before proposed start date of the course, so that the proposal can be reviewed, when required, and necessary approval can be obtained.

**Approval:**
- The proposal should be submitted by the student to the Dean Academies through Faculty Advisor and School Chair for formal approval.
- The Dean Academics may ask for reviewing the proposal by a committee (at least three-members), constituted by the Dean Academics. The same committee can also be engaged during final evaluation of the course, if required.

**Registration:**
- Once the approval process is completed, the course can be registered for credit.
- This course can be registered during regular semesters or during the summer/ winter term.
- Registration process (offline/online) can be decided by the academic office time to time.
- Not more than four students should generally be allowed to register for same topic as independent study course concurrently. The number of students may be allowed up to six

for study areas related to DP and ISTP.

## Evaluation:

- The supervisor(s) may choose her/his/their own evaluation policy and must mention that in the course proposal. However, one presentation at the end and at-least one written examination are compulsory. The committee, if any, formed during the proposal approval can also be engaged for evaluation.
- The evaluation will be done as per the alphabetical grades used for other regular courses at IIT Mandi.

## Course Code, Credits and Distribution:

- Course Code:
  - XX598I – Independent Study (To be used for 1st Instances).
  - XX599I – Independent Study (To be used for 2nd Instances).
  
  *XX as per most relevant branch/specialization for the study area.*
- Credit: 2 (0-0-4-2)
- No discipline/institute core course credits can be substituted by independent study course(s).
- A student can take maximum two independent study courses (total 4 credits) during the entire program.
- The distribution of the credits, whether under discipline elective or under open/outside-discipline elective, may be decided by approving authority on the recommendations of the supervisor and FA/the proposal review committee.
- If the credits earned through independent study is over and above the maximum permissible credit for CGPA calculation, then the credits for independent study will not be considered.

## Eligibility:

- B.Tech./Dual Degree students (4th semester completed), and M.A./M.Sc./M.Tech. students (1st semester completed) can register for an independent study course.
- Minimum CGPA should be 7.5 at the time of applying for independent study course.
- The independent study course should not be allowed to merely reduce the expected challenge, e.g. literature review, of the Major Technical Project (U.G.), Postgraduate Project (M.A./M.Sc./M.Tech.).
- No classroom teaching or tutorial is admissible, the student is expected to be in self-learning mode.
- No teaching load will be considered for the faculty member associated with the course.
- Class Committee Meeting (CCM) is not required for this course.
- This course, in general, is not to be recommended for M.S. or Ph.D. students. An M.S. or Ph.D. student may take an independent study course which will reflect in the transcript, however the credits earned through independent study course will not be counted towards minimum course work requirements.
- Independent study course may be allowed for crediting in exceptional case for Ph.D. students of School of Humanities and Social Sciences.
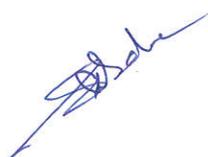
# **Proposal for Independent Study Course**
(to be submitted for each student separately, when same topic is taken by two students)

## **Details of The Student**
Name of the student:                              ID number:

Program registered for:                    Branch:              Current semester:

Total credits already completed (basket wise):

CGPA:

## **Details of The Supervisor(s)**
Name of the supervisor(s):

School(s):

## **Reason/Motivation for Opting Independence Study Course:**

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**Course Code:** XX598I/ XX599I (Use XX for most relevant branch code in consultation with the proposed faculty supervisor, use XX598I for $1^{st}$ occurrence and XX599I for $2^{nd}$ occurrence)

**Title:** Independent Study-I/ Independent Study-II

**Specific Topic for The Course:**

**Course Objectives:**

Learning objectives of the course are to be mentioned categorically.

**Course Plan:**

The course plan must include:

- Contents of the course
- Total duration of rigours involvement expected from the student, which is to be at par or more with respect to other regular courses at IIT Mandi.
- Frequency of meeting and discussion.
- Availability of course materials and other support required for the student to achieve the stated course objectives.
- Management of course diary, assignments, tests etc. with timeline.
- Expected date of the final evaluation.

**Deliverables:**

Expected deliverables (physical or scholastic) may be listed here.

**Evaluation:**

Detailed evaluation policy with weightage to different components must be enlisted here. At least one written exam and one presentation must be included in the evaluation process.

**Proposed by:**


Signature of the student(s)                        Signature of the supervisor(s)

**Has the course content been submitted to CPC as a regular course?** (Yes/No)
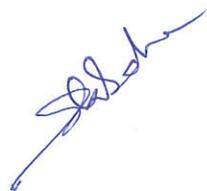**Date of submission of the course proposal to CPC** (If submitted):

**Forwarded by:**

Faculty Advisor

School Chair

**Approved by:**

Dean (Academics)