10, Institutional Area, Vasant Kunj,
New Delhi 110070

53rd MEETING OF THE ACADEMIC COUNCIL

MINUTES OF THE FIFTY THIRD MEETING OF THE ACADEMIC COUNCIL HELD ON 26 AUGUST 2022 AT 10.00 A.M.

PRESENT

The following members of the Academic Council attended the meeting:

Members	Special Invitee
Professor Prateek Sharma, Chairperson	Dr Shashi Bhushan Tripathi
Professor Ramakrishnan Sitaraman	Dr Kavita Sardana
Professor Anandita Singh	Dr Shruti Sharma Rana
Prof Shreekant Gupta	Dr Swarup Dutta
Professor Vinay Shankar Prasad Sinha	Dr Gopal Sarangi
Dr Sudipta Chatterjee	Dr L.N. Venkataraman
Dr Naqui Anwer	Dr Aviruch Bhatia
Dr Sukanya Das	Dr Abhijit Datey
Dr Chaithanya Madhurantakam	Dr Deepty Jain
Dr Anu Rani Sharma	
Dr Montu Bose	
Dr Chander Kumar Singh	
Dr Seema Sangita, Controller of Examination	
Mr Kamal Sharma, Secretary	

Professor Sagnik Dey, Mr Shubhashis Dey, Dr Sabhyata Bhatia, Professor Shaleen Singhal, Prof. P.S.N. Rao, Mr Manoj Chugh, Mr Rajesh Ayapilla, Mr Rahul Mittal and Professor Arun Kansal could not attend the meeting.

Prof Prateek Sharma welcomed all the Academic Council members. He introduced the new member to the AC, Prof. Shreekant Gupta. He said that the institution will essentially be benefitted from the experience of Prof Gupta.

Item No. 1: To confirm the minutes of the Fifty Second Meeting of the Academic Council held on 08 August 2022. The minutes of the Fifty Second Meeting of the Academic Council, held on 08 August 2022, were circulated to the members and comments received have been incorporated.

The Academic Council may, therefore, consider confirming the minutes, as circulated.

TS/AC/53.1.1 The Council resolved that the minutes of the 52nd Academic Council Meeting held on 08 August 2022 be confirmed.

Item No. 2. Inclusion of two cross-cutting courses across all Master's programmes.

Dean (Academic) informed the members that in consultation with all Master's Programme Coordinators and HoDs, it has been decided that the following two courses (already approved and being offered) will be embedded across all programmes and offered as audit, starting with the academic year 2022-23. Course delivery will take place in a modular form:

a. NRE 165 Introduction to sustainable development, Semester 1, 1 credit:

   This is to ensure that all incoming students gain perspectives on sustainable development that could inform their learning across their respective fields of study. (Previously approved course outline is provided as **Enclosure 1**).

b. PPM 179 Design Thinking, Semester 3, 2 credits:

   This is to enable students to acquire problem-solving skills and a systematic approach to problem-solving from ideation to implementation. (Previously approved course outline is provided as **Enclosure 2**).

The two courses will be compulsory audit courses except wherever offered for credit in accordance with the requirements of specific programmes. However, it will not be applicable to students of MA (Public Policy and Sustainable Development) programme due to difference in the Academic Calendar.

TS/AC/53.2.1 The Academic Council resolved to approve the inclusion of NRE 165 and PPM 179 as cross-cutting courses across all Master's programmes except to students of MA (Public Policy and Sustainable Development) programme as placed at **Enclosures 1 and 2**.

Item No. 3. Devising a university-wide system of open electives to facilitate multi-disciplinarity as envisaged in NEP 2020

Dean (Academic) informed the members that the courses taken by students enrolled in a given Master's degree programme will be classified as follows:

a. Core – Essential to the programme
b. Programme elective – Specific to the disciplinary and/or skill requirements of the programme
c. Open elective – A course that a student elects to enroll in, that is part of a different programme (wherein it may be a core or programme elective).

d. Open elective (mandatory) – As above, except that open electives for a certain number of credits are specifically recommended by a given programme

Enrolment and grading will be as follows:

a. Students will be permitted to opt for credit or audit in open electives at the time of registration, subject to course availability and scheduling.
b. Grades obtained in all non-mandatory open electives will be listed separately on the transcript and not count towards the final CGPA.
c. Mandatory open elective courses will count towards the total CGPA up to the credit limit specified by the guidelines of the degree programme the student is enrolled in.

Additionally, different Master's programmes have determined to offer some or all of their course offerings as 'open electives' to students enrolled in other programmes. The list of courses that are not available as open electives due to disciplinary pre-requisites is given in **Enclosure 3**. This list is subject to periodic updating and revision as courses and programmes undergo revisions and restructuring. He further stated that none of the courses in M.A. (Public Policy and Sustainable Development) will be available as open electives because the said programme follows a schedule that is entirely separate from that of the main academic calendar. Also, Minor/major projects, dissertations, master's thesis, field visit will not be available as open electives. Credit requirements to be fulfilled in the form of mandatory open electives (if any) will be specified by the degree programme the student is enrolled in.

TS/AC/53.3.1 The Academic Council resolved to approve classification of courses to facilitate multi-disciplinarity as envisaged in NEP 2020. The list of courses which are not available as open electives as placed in **Enclosure 3** is subject to periodic updation as per the programme requirement.

Item No. 4. To consider and approve the modified M.Sc (Geoinformatics) programme

Dr Anu Rani Sharma presented to the Academic Council the modified M.Sc (Geoinformatics) programme as placed at **Enclosure 4**. The members appreciated the modified programme structure and approved it.

TS/AC/53.4.1 The Academic Council resolved to approve the modified M.Sc (Geoinformatics) programme as placed at **Enclosure 4**.

Item No. 5. To consider and approve the revised programme structure and first semester course outlines of MBA (Sustainability Management), M.Sc. (Economics) and MA (Sustainable Development Practice) programme

Dr Montu Bose, Dr Kavita Sardana and Dr Swarup Dutta respectively presented to the Academic Council the revised programme structure and first semester course outlines of MBA (Sustainability Management), M.Sc. (Economics) and MA (Sustainable Development Practice) programme placed as **Enclosure 5**. After

detailed deliberation members suggested some minor modifications to be carried out in the course outlines and approved the programme structure and course outlines.

TS/AC/53.5.1 The Academic Council resolved to approve the revised programme structure and first semester course outlines of MBA (Sustainability Management), M.Sc. (Economics) and MA (Sustainable Development Practice) programme placed as **Enclosure 5**.

Item No. 6. To consider and approve the revised programme structure and first semester course outlines of M.Tech (Urban Development Management) and M.Tech (Renewable Energy Engineering and Management) programme.

Dr Deepty Jain and Dr Aviruch Bhatia respectively presented the revised programme structure and first semester course outlines of M.Tech (Urban Development Management) and M.Tech (Renewable Energy Engineering and Management) programme placed as **Enclosure 6**. Members suggested some minor corrections to the course outlines to be carried out and approved the programme structure and course outlines.

TS/AC/53.6.1 The Academic Council resolved to approve the revised programme structure and first semester course outlines of M.Tech (Urban Development Management) and M.Tech (Renewable Energy Engineering and Management) programme placed as **Enclosure 6**.

Item No. 7. Any other item with the permission of the Chair

Prof. Prateek Sharma presented the below mentioned two courses:-
(a) Entrepreneurship in Solid Waste Management **(Enclosure 7)**
(b) Air Pollution Monitoring and Control (**Enclosure 8**)

He stated that it is proposed to offer these two courses as open electives across programmes and requested the Academic Council's concurrence for the same.

TS/AC/53.7(a)(b) The Academic Council resolved to approve the abovementioned two courses as open electives across programmes placed as Enclosure 7 and 8.

There being no other items for discussion, the meeting was adjourned with a vote of thanks to the Chair at 1750 hours.

Sd/
Kamal Sharma
Registrar (Acting)

Enclosure:-
Enclosure 1. Course outline of NRE 165
Enclosure 2. Course outline of PPM 179
Enclosure 3. List of courses that are not available as open electives
Enclosure 4. Modified M.Sc (Geoinformatics) programme

Enclosure 5. Revised programme structure and first semester course outlines of MBA (Sustainability Management), M.Sc. (Economics) and MA (Sustainable Development Practice) programme
Enclosure 6. Revised programme structure and first semester course outlines of M.Tech (Urban Development Management) and M.Tech (Renewable Energy Engineering and Management) programme
Enclosure 7. Course outline of Entrepreneurship in Solid Waste Management
Enclosure 8. Course outline of Air Pollution Monitoring and Control

Distribution:-
Electronic Copy:
1. Vice Chancellor, TERI School of Advanced Studies
2. All members of Academic Council
3. Website

Printed Copy: Registrar Office

Enclosure 1

Course title: Introduction to Sustainable Development			
Course code: NRE 165	**No. of credits:** 1	**L-T-P:** 15-0-0	**Learning hours:** 15
Pre-requisite course code and title (if any):			
Department:			
Course coordinator:		**Course instructor:**	
Contact details:			
Course type: Core		**Course offered in:** Semester 1	

Course Description

The course seeks to build an inter-disciplinary perspective on understanding sustainable development concerns and challenges. This course familiarizes students with current debates and perspectives in analyzing constraints and opportunities for sustainable development. It also aims to provide students with a general introduction to the basic core competencies and practical skills required of a "generalist" development practitioner.

Course topics will be grounded in a practical, multi-disciplinary approach that will focus on theinter-relationship of each of the following core fields of study (Agriculture and Nutrition, Economics, Environment and Climate Science, Management, Policy, Anthropology and Social Studies, Public Health and Technology and Engineering), thereby exposing students to the complex relationships between social, economic and environmental processes.

Course objectives

1. The course seeks to build an inter-disciplinary perspective on understanding sustainabledevelopment concerns and challenges.
2. It also aims to provide students with a general introduction to the basic core competenciesand practical skills
3. This course familiarizes students with current debates and perspectives in analyzing constraints and opportunities for sustainable development.

Course content

S.No.	Topic	L	T	P
1.	Changing Perspectives • Definitions & Principles of Sustainable Development • Millennium Development Goals: Status (global and Indian),Inclusive Growth and Poverty Reduction, Impact on approach to development policy and practice in India, future directions	4		
2.	Challenges to Sustainable Development • Agriculture, Population & Food Security • Public Health and Nutrition • Education • Natural Resources (Forests, Energy, Water) • Climate Change	6		
3.	Responses to Sustainable Development Challenges • Public Policy (Community Participation and ParticipatoryLearning) • Gender and Human Rights • Technology and Engineering • Economics and Policy Coherence	5		
	Total	**15**		

Evaluation criteria

- Written Review: 60%
- Major Presentation: 40%

Learning outcomes

- The students will have a "generalist" development practitioner's perspective towardsenvironmental management.
- The students will have fairly good understanding of the current debates around concepts ofsustainable development and practices.

Pedagogical approach

Materials

Required text

1. Hazell P. and Diao X. (2005) *The Role of Agriculture and Small Farms in Economic Development*, Washington, D.C.: International Food Policy Research Institute.
2. Sachs J. (2006) *The End of Poverty: Economic Possibilities for Our Time*, Penguin (Chapters 1-4,8, 14-18).

Suggested readings

1. Cornwall A. and Brock K. (2005) What Do Buzzwords Do for Development Policy? A Critical Look at „Participation", „Empowerment" and „Poverty Reduction", *Third World Quarterly* 26(7), 1043–1060.
2. Human Development Reports
3. IPCC (2007) Summary for Policymakers of the Synthesis Report of the IPCC Fourth Assessment Report.
4. Johnson J.D. and Louka K. (2006) *Migration, Aid and Trade: Policy Coherence for Development*, OECD Development Centre Policy Brief No 28.
5. Laurence W.F. et al. (2001) The Future of the Brazilian Amazon, *Science*, Vol. 291 (5503), 438-439.
6. Luboobi L. and Mugisha J.T. (2005) *HIV/AIDS Pandemic in Africa: Trends and Challenges*, FondazioneEni Enrico Mattei.
7. Sachs D.J. and Wing T.W. (1994) *Structural Factors in the Economic Reforms of China, EasternEurope and the Former Soviet Union*, Economic Policy, 9 (18), pp. 101-145.
8. Sachs J. and Malaney P. (2002) The Economic and Social Burden of Malaria, *Nature*, 415 (7).
9. Sarah D. (2004) *Key Policy Coherence Issues in Agriculture and Migration*, OECD.
10. UN Millennium Project (2005) *Innovation: Applying Knowledge in Development*, Science,Technology and Innovation Task Force Report.
11. UN Millennium Project (2005) *Investing in Development: A Practical Plan to Achieve theMillennium Development Goals, Overview.*
12. World Bank (2006) *Enhancing Agricultural Innovation: How to Go beyond the Strengthening ofResearch Systems*, World Bank: Agriculture and Rural Development
13. World Commission on Environment and Development (1987) *Our Common Future*, Oxford, OUP.

Case studies

Websites

Journals

1. Development and Change
2. Economic and Political Weekly

Additional information (if any)

Student responsibilities

Attendance, feedback, discipline etc.

Enclosure 2

Course title: Design Thinking			
Course code: PPM 179	No. of credits: 2	L-T-P: 12-18-0	Learning hours: 30
Pre-requisite course code and title (if any): NA			
Department: Department of Business and Sustainability			
Course coordinator:		**Course instructor:**	
Contact details:			
Course type: Open Elective		**Course offered in**: Semester 3	

Course Description

This course will be an introduction to Design Thinking (DT). This course will let the learners understand the underpinnings of design thinking, and work with the DT framework and tools to help them understand design thinking as a creative problem-solving approach. We will also explore unique stories from organizations and teams that used design thinking to uncover compelling solutions.

Course objectives

The course aims to:
Instill the Design Thinking approach
Develop the understanding and implementation of Design Thinking framework Apply Design Thinking tools to solvea problem
Conceive and ideate persuasive solutions using Design Thinking approach.

Course Content

S No	Topic	L	T	P
1.	Problem Solving Visual problem solving Experience economy and the context of Digital	2	2	0
2.	Design Thinking Philosophy The three lenses of Innovation Why Design thinking Rudiments of Design Thinking	2	2	0
3.	Design Thinking Framework and Tools Five (5) phases of Design Thinking Framework Design Thinking Framework: Empathy, Define, Ideate, Test, Prototype Design Thinking Tools: Storyboarding, Build Measure Learn Feedback DIY: Design Thinking Tools	2	3	0
4.	Design Thinking Experience Problem identification in the context of the Design Thinking Framework.Problem Identification DIY – Design Thinking Process Empathy, Define, Ideate, Test, Prototype Blog: DT Phases to solve a problem.	3	4	0
5.	Design Thinking in Practice Design Thinking Solution Working as teams of four (4) they will work on aspects of using DT with appropriate tools to solve the problem. Design Thinking for Business Sustainability, Product, Service, Consultancy and Social Domains DIY – Design Thinking Process for the Proposed problem	2	3	0
6.	Design Thinking Unique Case Studies Group Presentation: Minimum Viable Product for the proposed problem The Way Forward	1	4	0

	Total	12	18	

Evaluation criteria

Test 1 Quiz (Module 1, 2 and 3): (30%) end of module 3

Test 1 will be a paper-based exam which with multiple option questions and descriptive questions. The exam will evaluate the student understanding on the Design Thinking Approach, Philosophy, Framework and Tools.

Assignment - Blog (Individual + Group) (Module 3 and 4):15% (assigned at the beginning of module 2 and will evolve of the course duration)

The Design Thinking blog component is equivalent to the assignment and will be evaluated by the course coordinator. The blog creation assignment will be. The blog will be based on application of Design Thinking Framework and Tool and will be document a DT experience; the blog will be evaluated on process, inferences, creativity, and clarity. This blog will be hosted in the blog website "Medium" and will remains as an artifact in the web domain for future evolution.

Test 2 Group Presentation: Problem in Context with DT Phases (Module 3 and 4): 20% will be conducted during module 4

The group presentation component will be evaluated by the course coordinator (40 %), an external faculty (40 %) from the department of business studies, and peer evaluated (20%).

Test 3 DT Use Case (Minimum viable Product Unique Case) (Module 5 and 6): 35% will be conducted during module 6.

Each team will create a present and submit a use case: a minimum viable product they developed for their problem using design thinking. The final presentation minimum viable product and report submission will be assessed by a three-member panel, course coordinator (50 %), internal observer and an external faculty (30 %) (course reviewer / industry domain expert). A peer contribution component will be a part of the individual assessments.

Learning outcomes:

By the end of the course, students will be able to:

1. Conceive and articulate the Design Thinking approach
2. Contextualize a complex problem in the purview of Design Thinking
3. Ideate solution based on the Design Thinking framework
4. Create and present a unique solution based on Design Thinking

Pedagogical Approach – The course will be delivered through lectures, Interactive and experiential learning will be enabled by brainstorming, Case studies, Group Discussion, Videos, and Audio. Visual problem solving is an important part in Design Thinking, the course will use, post it Notes (Mix Colour) methods to accomplish this.

Materials

Books

Required text: Liedtka, J. and Ogilvie, T. (2011). Designing for Growth – a Design Thinking Toolkit for Managers. Columbia Business School Publishing

Compulsory Readings

- Design Thinking for the Greater Good: Innovation in the Social Sector by Jeanne Liedtka (Columbia Business School Publishing) Hardcover – September 5, 2017
- The Back of the Napkin (Expanded Edition): Solving Problems and Selling Ideas with Pictures by Dan Roam Paperback – February 26, 2013
- Design Thinking 101, Sarah Gibbons, 2016, https://www.nngroup.com/articles/design-thinking/
- Brown Tim, (2008) Design Thinking, Harvard Business Review
- Liedtka Jane, The Essential Guide to Design Thinking - Generate new solutions with design thinking: a problem-solving process that combines creative and analytical thinking, E-Book, Darden Executive Education, University of Virginia.
- Cross Nigel, Design Thinking: Understanding How Designers Think and Work, Link: https://books.google.co.in/books?id=F4SUVT1XCCwC&lpg=PT5&ots=7PTAzYVs0j&dq=Design%20Thinking&lr&pg=PT22#v=onepage&q=Design%20Thinking&f=false

Weblinks

- Designit - https://www.designit.com/ - Mind Tools : https://www.mindtools.com/pages/article/design-thinking.htm
Additional information (if any) Recommended Audit of Course – Design Thinking for the Greater Good: Innovation in the Social Sector https://www.coursera.org/learn/uva-darden-design-thinking-social-sector/home/welcome
Student responsibilities The students are expected to submit assignments and all evaluation component within the timelines and come prepared with readings when provided. Attendance and Participation in Group Presentation sessions is mandatory, and course feedback is obligatory.

Prepared By:

Dr. Akash Sondhi

Course reviewers

1. Dr. Gerrit De Waal, Department of Management, RMIT University, Melbourne City Campus.
2. Mr. Shashank Deshpande, Chief Design Officer, Globant India, Pune
3. Mr. Praveen Bhond, Agile Consultant, Pune

Enclosure 3

Courses that are not available as open electives

NOTES:
1. The courses that are not available as open electives are listed below in a programme-wise manner.
2. These lists have been finalized in a decentralized manner at the level of each programme taking into account the views and teaching experiences of core faculty members teaching in the said programme.
3. In some cases, the courses listed do not have course codes or are listed as 'proposed courses' because approval from the Academic Council of programme and/or course revision and/or restructuring is pending.
4. The list provided below is current as of August 21, 2022.

1. **M.A. (Public Policy and Sustainable Development):** No course offered in this programme is available as an open elective because the academic calendar for this programme is different from that followed by all other programmes.

2. **M.B.A. (Sustainability Management):**

S. No.	Course code	Course	Credits
1		Financial Reporting and Analysis	4
2	PPM 196	Marketing Management	3
3	BSI 125	Accounting and Finance for Sustainability	3
4	PPM 191	International Financial Management	2
5	PPM 126	Security Analysis and Portfolio Management	2
6	PPM 195	Brand Management	2
7	PPM 104	Consumer Behaviour	2
8	PPM 109	Business to Business Marketing	2

3. **M.Sc. (Water Science and Governance)**

S. No.	Course code	Course	Credits
1	WSW 136	Irrigation water and drainage management	4
2	WSW 184	Water supply and sanitation	3
3	WSW 132	Industrial pollution control	3

4. **M.Tech (Water Resources Engineering and Management)**

S. No.	Course code	Course	Credits
1	WSW 178	Applied geo-informatics for water resources	4
2	WSW 186	Design of water supply and sanitation system	4
3	WSW 136	Irrigation water and drainage management	4
4	WSW 176	Water quality modelling and application	4

5. **M.Sc. (Environmental Studies and Resource Management)**

S. No.	Course Code	Course	Credits
1	NRE 121	Ecology	3
2	NRE 131	Environmental Chemistry and microbiology	3
3	NRE 155	Environmental law and policy	3
4	NRE 138	Environmental monitoring laboratory	3
5	NRE 170	Advanced Geosciences	3
6	NRE 162	Hydrology	3
7	NRE 112	Multivariate data analysis	3
8	NRE 173	Research methodology and thesis writing	2

9	NRE 130	Soil Science	2
10	NRE 171	Environmental modelling	4
11	NRE 175	Geoinformatics for resource management	4
12	NRE 136	Glacier hydrology	3
13	NRE 105	Independent study	3
14	NRE 167	Integrated watershed management	3
15	NRE 178	Satellite meterology	3
16	NRE 102	Seminar course in global change	3
17	NRE 174	Water and wastewater treatment processes and design	4

6. M.Sc. (Climate Science and Policy)

S. No.	Course Code	Course	Credits
1	NRC 131	Basics of climate science	3
2	NRC 143	Basics of economics	0
3	NRC 107	Climate Lab	2
4	NRC 136	Earth system sciences	3
5	NRC 139	Climate change and public health	3
6	NRC 122	Introduction to climate modelling	3
7	NRC 172	Advance climate modelling	3
8	NRC 186	Energy system modelling	3
9	NRC 133	Aerosol Science	3

7. M.Sc. (Geoinformatics):

S.No.	Course code	Existing course	Proposed course	Credits
1	NRG 172	Digital image processing and information extraction	Digital image processing and information extraction	4
2	NRG 170	Photogrammetry	Photogrammetry	3
3	NRG 108	Programming in Geoinformatics	Programming in Geoinformatics	3
4	NRG 163	Spatial data modelling and its applications	Spatial data modelling and its applications	4
5	NRG 179	Advances in GIS and current trends	Advances in GIS and current trends	4
6	NRG 181	Advances in remote sensing: Thermal, Hyperspectral, Microwave, LIDAR and UAV	Advances in remote sensing: Thermal, Hyperspectral, Microwave, LIDAR and UAV	4
7	NRG 166	Applications of geoinformatics for atmosphere	Applications of geoinformatics for atmosphere	3
8	NRG 164	Applications of geoinformatics for land resources	Applications of geoinformatics for land resources	3
9	NRG 165	Applications of geoinformatics for water resources	Applications of geoinformatics for water resources	3
10	NRG 167	Geocomputation	Geocomputation	3

8. M.Sc. (Biotechnology):

S.No.	Course code	Course	Credits

1	BBP 105	Biotechnology laboratory - Part 1	7
2	BBP 106	Biotechnology Laboratory - Part 2	7
3	BBP 131	Molecular Microbiology and Immunology	2
4		Biotechnology Laboratory - Part 3	7
5		Proteomics and Protein Engineering	3

9. M.Sc. (Economics)

S. No.	Course Code	Course	Credits
1	MPE 176	Methods of research in economics	4

10. M.A. (Sustainable Development Practice):

MA SDP programme is currently under restructuring process. The courses without code are first semester courses.

S. No.	Course No.	Course Title	Number of Credits
1		Current advances in environmental science	3
2		Global Classroom - Integrated approaches to sustainable development	2
3		Law, society and sustainable development	2
4		Themes and Perspectives on development	2
5		Principles of economics	3
6		Quantitative Approaches and Methods for Development Practice	3
7		Qualitative Methods for Development Practice	3
8	MPD 147	Development economics	3
9	MPD 106	Group practicum : community needs assessment	4
10	MPD 145	Integrated impact assessment	2
11	MPD 153	Management of development organizations	3
12	MPD 124	Population and health: Techniques of analysis policy perspectives	3
13	MPD 113	Application of quantitative data analysis in development practice	2
14	MPD 129	Project design and management for sustainable development practice	4
15	MPD 161	Public policy processes and institutions	3
16	MPD 104	Final project	16

11. M.Tech (Urban Development Practice):

S. No.	Course Code	Course	Credits	Semester
1	MEU-161	Theories of Urbanisation	3	1
2	NA*	Geoinformatics for Urban Development	3	1

3	MEU 152	City and Regional Planning and Management	3	2
4	MEU-184	Real Estate Development	3	2
5	NA*	Urban Systems Modelling	3	2
6	MEU-102	Major Project Part-1	12	3
7	MEU-104	Major Project Part-2	16	4

12. M.Tech (Renewable Energy Engineering and Management):

S. No.	Course Code	Course Title	(Proposed) Credits
1	NRE 106	Communication skills and technical writing	0
2	ENR 101	Energy lab - I (Power system lab and heat transfer lab)	2
3	ENR 119	Fundamentals of thermal and electrical engineering	0
4	ENR 135	Power system engineering	3
5	ENR 189	Heat transfer	3
6	NRE 165	Introduction to sustainable development	1
7	ENR 153	Wind, Biomass and other renewable technologies	3
8	ENR 157	Energy lab - II	3
9	ENR 103	Seminar on Field visits to RE plants/sites	1
10	ENR 107	Energy simulation laboratory	3
11	ENR 108	Dissertation - I/ Industrial Project	6
12		Elective 1	3
13		Elective 2	3
14	ENR 163	Biofuels and Decentralized Energy Systems	3
15	ENR 113	Wind power generation	3
16	ENR 145	Solar photovoltaic power generation	3
17	BSI 125	Accounting and Finance for Sustainability	3

13. LL.M. (Environment and Natural Resources Law / Infrastructure and Business Law)

S. No.	Course Code	Course	Credits
1	MPL 151	Comparative public law/systems of governance	3
2	MPL 103	Dissertation	2
3	MPL 155	Environmental law and policy	2
4	MPL 157	Infrastructure law and policy	2
5	MPL 165	Competition law and policy	2
6	MPL 104	Dissertation 2	3
7	MPL 159	Energy law	2
8	MPL 132	Water resources law	2
9	MPL 162	Biotechnology Law	2
10	MPL 134	Climate change and law	2
11	MPL 156	Environmental Aspects of Business Activities	2
12	MPL 158	Forest law and policy	2

13	MPL 182	Hazardous waste law	2
14	MPL 152	International environmental law	3
15	MPL 154	Mining and mineral laws	2
16	MPL 142	Business and taxation laws in infrastructure projects	3
17	MPL 144	Contracts Law and Management	2
18	MPL 163	Electricity law, reforms and practice	2
19	MPL 146	Infrastructure project finance law	2
20	MPL 148	Legal aspects of bidding and public private partnership	2
21	MPL 161	Telecommunication law	2
22	MPL 166	Urban Infrastructure Law and Management	2

Minor/major projects, dissertations, master's thesis, field trips will not be available as open electives.

Enclosure 4

MSc Geoinformatics program structure (2022-23 Academic Sessions)

Total Credits: 78

40 core taught credits + 22 (major + minor projects) + 12 program elective (PE) credits + 4 open elective (OE) credits

Semester 1 [Core: 12credits] + Open Elective (4 credits)

Sl No.	Proposed course(Course Name)	Credits	Core/Elective	NEP Open elective
1	Principles of Cartography	3	Core	Yes
2	Principles of GIS and GNSS	4	Core	Yes
3	Principles of Remote sensing	3	Core	Yes
5	Applied Mathematics	0	Core audit	ESRM course
6	Communication skills and technical writing	2	Elective	ESRM course
7	Fundamentals of computer and programming	2	Core	Yes

Semester 2 [Core: 20 credits] + Elective (3 credits)

Sl No.	Proposed structure (Course Name)	Credits	Core/Elective	NEP Open elective
1	Digital image processing and information extraction (NRG 172)	4	Core	No
2	Law and policy for maps and remote sensing (NRG 162)	2	Core	Yes
3	Environmental statistics (NRE 115)	4	Core	ESRM course
4	Photogrammetry (NRG 170)	3	Core	No
5	Programming in Geoinformatics (NRG 108)	3	Core	No

6	Project management (NRG 103)	3	Elective	Yes
7	Research methodology and thesis writing (NRE 173)	2	Elective	ESRM course
8	Spatial data modelling and its applications (NRG 163)	4	Core	No

Semester 3 [Core: 8 credits] + [Electives: 9 credits) + Minor project (6 credits)

Sl No.	**Proposed structure (Course Name)**	**Credits**	**Core/Elective**	**NEP Open elective**
1	Advances in GIS and current trends (NRG 179)	4	Core	No
2	Advances in remote sensing: Thermal, Hyperspectral, Microwave, LiDAR and Drone (NRG 181)	4	Core	No
3	Geoinformatics for atmosphere (NRG 166)	3	Elective	No
4	Geoinformatics for land resources(NRG 164)	3	Elective	No
5	Geoinformatics for water resources (NRG 165)	3	Elective	No
6	Geocomputation (NRG 167)	3	Elective	No
7	Multivariate data analysis (NRE 112)	3	Elective	ESRM Course
8	Integrated watershed management (NRE 167)	3	Elective	ESRM Course
9	Wildlife conservation and management (NRE 151)	3	Elective	ESRM course
10	Climate change and disaster risk reduction (NRC 162)	3	Elective	CSP course
11	Environmental modelling (NRE 171)	4	Elective	ESRM Course

12.	Integrated Impact assessment (NRE 145)	4	Elective	ESRM Course
13.	Spatiotemporal data analysis (NRC 142)	3	Elective	CSP course
14	Minor project (NRG 107)	6	Core	No

Semester 4 [Core: 16 credits]

Sl No.	**Proposed structure (Course Name)**	**Credits**	**Core/Elective**	**NEP Open elective**
1	Major Project (NRG 104)	16	Core	No

Enclosure 5

First semester course outlines of MBA (Sustainability Management)

Course title: Principles and Concepts of Sustainability			
Course code: MPP 163	**No. of credits:** 3	**L-T-P**: 31-14-00	**Learning hours:** 45
Pre-requisite course code and title (if any): None			
Department: Policy & Management Studies			
Course coordinator(s): Dr. Mala Narang Reddy		**Course instructor(s):** Dr. Mala Narang Reddy	
Contact details: malanarang@gmail.com			
Course Type: Core		**Course offered in:** Semester 1	

Course Description

The economic development and globalization have increased the production and consumption of the economics of the world over time. However, various economic and production and/or consumption activities are adversely impacting the environment and the society. Naturally, several questions are arising against the business community and its role in environmental sustainability and duties for the society.

Given the environmental and sustainability related challenges and issues faced by the business and the economies, understanding the concept of sustainability and practicing the concepts in real life is primarily important for every firm, organizations and communities. In addition to the basic understanding of the issues, employee with the ability to critically analyze different aspects of sustainability in production and consumption and the relation between sustainability and development is critically important. This course would try to discuss and sensitize students for various sustainability issues in business.

Course objectives

- To build an inter-disciplinary perspective on business sustainability.
- To enable students to discuss the concept of sustainability and be able to see how it translates into realities of organizations and communities.
- To empower students to critically analyze different, often competing, definitions of sustainability driven by perspectives and interests of societal stakeholders.
- It will help students understand the different challenges to sustainability, the role of business in addressing these challenges.

Course content

Module	Topic	L	T	P
1	**Sustainable development – evolution, approaches, interpretations** The students are requested to prepare and conduct two debates on the importance of environmental/social aspects of SD and on probabilities of various world scenarios. Changing Perspectives • Definitions & Principles of Sustainable Development • Millennium Development Goals: Status (global and Indian), Inclusive Growth and Poverty Reduction, Impact on approach to development policy and practice in India, future directions.	6	2	0
2	**Challenges to Sustainable Development** • Agriculture, Population & Food Security • Public Health and Nutrition • Education • Natural Resources (Forests, Energy, Water). • Climate Change **What drives business – issues and trends** What drives business; Social Role; Philanthropy; Corporate Social Responsibility; Creating Shared Values; Triple bottom line; Critical review of Base of the Pyramid Concept.	6	2	0
3	**Is the business of business, is business?** Through the group discussion and presentation, the students are requested to explorevarious forms of "corporations of the future". They will also work with analysis of a case of sustainable enterprise.	4	2	0

4	**Business (corporate) sustainability** The students are introduced to analyze a case relevant for understanding of stakeholder engagement and communication.	3	2	0
5	**Sustainable Production and Consumption** In addition to the discussion, the students will work with the study case of Rio Tinto focusing on the company's strategy in biodiversity and ecosystem serve	4	2	0
6	**Corporate Social Responsibility** The students will be requested to organize a debate on the role of CSR in the progress towards SD. **Responses to Sustainable Development Challenges** • Public Policy (Community Participation and Participatory Learning) • Gender and Human Rights • Technology and Engineering • Economics and Policy Coherence	6	2	0
7	**Pro-poor development** The students will work with developing principles of business engagement with poor communities	2	2	0
	TOTAL	**31**	**14**	**0**

Evaluation criteria:

- Test 1: Group Presentation - 50 %
- Test 2: Individual Presentation on a given topic - 20 %
- Major exam: Individual Assignment - Essay / Reaction Paper in 1000 words - 30%

Learning outcomes:

On successful completion of the course, the students would be able to:

- Understand and internalize the concept of sustainability and to ensure the concept pervades through the layers of organization.
- Critically analyze different, often competing, definitions of sustainability driven by perspectives and interests of societal stakeholders.
- Become familiar with the sustainability visions and practices relevant for the business community at the level of companies, supply chain, communities.

Pedagogical approach

Materials:

Dresner S. (2002) The Principles of Sustainability, Earthscan, London.
Robertson M. (2017) Sustainability Principles and Practice, Routledge, London & NY.
Materials:
Vanegas JA (2003) Road Map & Principles for Built Environment Sustainability, Environmental Science & Technology, Vol.37(23), pp. 5363-72.
Lindsey TC. (2011) Sustainable Principles: Common Values for Achieving Sustainability, Journal of Cleaner Production, Vol.19(5), pp. 561-65.

Additional information (If any): None

Student responsibilities: None

Prepared by: Dr. Shruti Sharma Rana

Course reviewers:

1. Dr. Kamna Sachdeva, Professor, Delhi Skill University
2. Dr. Archana Poonia, Associate Professor, O.P. Jindal Global University

Course title: Management concepts and Organizational Behavior			
Course code: PPM 118	**No. of credits:** 3	**L-T-P:** 35-08-04	**Learning hours:** 47
Pre-requisite course code and title (if any):			
Department: Policy and Management studies			
Course coordinator (s): Dr. Shruti Sharma Rana		**Course instructor (s):** Dr. Shruti Sharma Rana	
Contact details: shruti.rana@terisas.ac.in			
Course type: Core		**Course offered in:** Semester I	

Course description: In today's dynamic environment, organizational behaviour and leadership are critical differentiating factors for organizational success and excellence. There are continuous changes in social, political, cultural, global as well as economic environment, and an understanding of management concepts and organizational behaviour is essential for future managers to manage such changes through strategic choices anchored in the vision of the organization and its people. This course will cover management concepts and organizational behaviour theory, research in the context of current realities. The purpose is to impart state of art knowledge in the field of organisational behaviors and imbibe professional and broad humanistic values that leaders must possess for steering the teams and organizations to achieve excellence while safeguarding the interest of all stakeholders, including society and environment.

Course objectives:

- To impart knowledge about different forms of organizations, and changing roles and responsibilities of a manager ·
- To explain and discuss historical evolution of management thought and contemporary management approaches
- To explore managerial challenges in different organizations and discuss choices and appropriate strategies.
- To impart knowledge about classical and contemporary organisational behaviors theories and concepts
- To sensitize students about managing diversity among people and deal with behavioural issues in organizations**.**

Course content

Module	Topic	L	T	P
1.	Nature of Management; Social Responsibility of Business; Manager and Environment Levels in Management; Managerial Skills; Planning - Steps in Planning Process; Scope and Limitations; Short Range and Long-Range Planning; Flexibility in Planning; characteristics of a sound Plan; Management by Objectives (MBO); Policies and Strategies; Scope and Formulation; Decision Making; Techniques and Processes.	6	0	0
2.	Organising; Organisation Structure and Design; Authority and Responsibility Relationships; Delegation of Authority and Decentralisation; Interdepartmental Coordination; Emerging Trends in Corporate Structure, Strategy and Culture; Impact of Technology on Organisational design; Mechanistic vs Adoptive Structures; Formal and Informal Organisation.	6	2	2
3.	Perception and Learning; Personality and Individual Differences; Motivation and Job Performance; Values, Attitudes and Beliefs; Stress Management; Communication Types-Process; Barriers; Making; Communication Effective.	6	2	0
4.	Group Dynamics; Leadership – Styles; Approaches; Power and Politics; Organisational Structure; Organisational Climate and Culture; Organisational Change and Development.	6	1	0
5.	Comparative Management Styles and approaches; Japanese Management Practices Organisational Creativity and Innovation; Management of Innovation - Entrepreneurial Management – Benchmarking; Best Management Practices across the world - Select cases of Domestic & International Corporations - Management of Diversity.	6	2	0
6.	New generation organizations. Their challenges and Barriers. • Managing Workforce Diversity. • Improving Customer Service • Stimulating Innovation and Change	5	1	2

	• Improving People Skills. • Working in Networked organisation.			
	Total	**35**	**8**	**4**

Evaluation criteria
Test 1: Assignment-30%
Test 2: Presentation -30%
Major exam 3: End-Term Exam-40%

Test 1 (at the end of module 4)
Structure: The students will be required to identify an organization in consultation with the course instructor and submit a report based on analysis of primary and/or secondary data covering critical review of any one dimension like job satisfaction, values, leadership, organizational citizenship behavior, emotional intelligence, types of communication etc. Each report shall focus on one dimension to be decided in consultation with the course instructor. Parameters: Type of data; originality; timeliness, structure and formatting; logic of arguments and flow of thoughts; understanding of theoretical base will be the parameters for evaluation. All five components carry equal weightage.
Test 2 (at the end of module 8) Structure: The students will be required to select one book- an autobiography/biography/life-history of a leader, in consultation with the course instructor, and make a presentation covering (a) summary of the book and its salient features (b) reflection on the leadership qualities of the person (c) debate on whether leaders are born or made and (d) a critical evaluation of their own leadership ability. Parameters: The parameters for evaluation include structure and layout, originality, analytical ability, and presentation skills including audio-visual aids, body language, voice modulation etc. Each component carries weightage of 25 percent.
Major exam 3 (End-Term Exam; at the end of all modules) This will be an open book exam based on all the modules covered in the class.
Case Study discussion: A case may be studied keeping in mind the following:
1. a problem definition statement, which identifies the key issues facing management (not more than a few lines);
2. the objectives
3. alternative plan of action
4. an analysis section which synthesizes and integrates the answers to the key questions for the case, but does not repeat the facts themselves, and presents logical arguments in defense of both the problem definition and the recommended solution;

a set of detailed recommendations and suggestions for their implementation, including how to overcome any potential issues of implementation identified by the analysis.

Learning outcomes:
By the end of the course, the students should be able to:
- Demonstrate an understanding of organizations as complex and pluralistic places where both conflict and cooperation are normal occurrences (Test 1, 2 and 3)
- Ability to reflect on their personal leadership skills and ability to exhibit leadership qualities in organizations (Test 2)
- Ability to assimilate, and apply knowledge of basic theories and concepts to solve organizational behaviour problems (Test 1, 2 and 3)

Pedagogical approach
- Interactive Lectures
- Case discussions and presentations
- News crunching

Materials:

Textbook
- Robbins, SP, Organizational Behaviour, Pearson Education Suggested Books Bade, J, Bade, S, and Hilton, S, More Human (2015),
- Public Affairs Collins, J, Good to Great (2001),
- Willian Collins Horowitz, B, The Hard Thing about Hard Things (2014),
- Harper Business Sinek, S, Leaders Eat Last (2014),
- Penguin Books Slywotzky, A, and Weber, K (2011),
- Demand, HighBridge Wallace, A and Catmull, E (2014),
- Creativity Inc, Transworld Publishers Suggested Articles/Papers Amabile, T (1997).
- Motivating Creativity in Organizations.
- Available http://bear.warrington.ufl.edu/weitz/mar7786/articles/amabile%20ccal%20mgt%20review.pdf
- Available https://www.sciencedirect.com/science/article/pii/S0191308517300072.
- Giles, S (2016). The Most Important Leadership Competencies According to Leaders Around the World. Available https://hbr.org/2016/03/

- the-most-important-leadership-competencies-according-to-leaders- around-the-world
- Grant, A, Gino, F and Hoffman, D. Reversing the Extraverted Leadership Advantage: The Role Of Employee Proactivity. Available https://static1.squarespace.com/static/GrantGinoHofmann_Reversing.pdf
- Harvey, EO (2018). 5 Behaviours of Leaders Who Embrace Change. Available at https://hbr.org/2018/05/5-behaviors-of-leaders-who-embrace-change
- Houser, O (2017). Innovation with field experiments: Studying organizational behaviors in actual organizations.

Additional information (if any): None

Student responsibilities: Attendance, timeline adherence for assignments, come prepared with readings / cases according to the session plan and as and when provided

Prepared by: Dr**.** Shruti Sharma Rana

Course Reviewer:

1. Dr. Damini Saini, IIM Raipur.
2. Dr. Shyamli Satpathy, IILM, Lodhi Road

Course title: Business Mathematics & Statistics			
Course code: PPM 119	**No. of credits:** 4	**L-T-P**: 2.27-1.53-0.20	**Learning hours:** 63
Pre-requisite course code and title (if any): None			
Department: Policy & Management Studies			
Course coordinator(s): Dr. Montu Bose		**Course instructor(s):** Dr. Montu Bose	
Contact details: montu.bose@terisas.ac.in			
Course Type: Core		**Course offered in:** Semester 1	

Course Description

This course gives students an exhaustive introduction to statistical methods important in business and required basic mathematical exposure for it. For last few decades India's growth rate is impressive along with high competition in the economy. Economic growth, expansion of trade and business has forced to invest in infrastructure. Given this background, businessmen can no longer rely on the old system of hit-or-miss methods or leave their future on chances. They have now to proceed on scientific principles, prepare themselves for competitive markets and plan their business accordingly. The managers have therefore to depend on a variety of factors (like present labour condition, prices of raw materials etc.). All these factors are statistically taken account of before fixing the price of new commodity or services, so that it may find a suitable place in the market. This course would be offered to M.B.A. (Sustainability Management). The course would equip the students with necessary mathematical and statistical knowledge to be ready for various managerial decisions backed by scientific evidence.

Course objectives

In the course the students would be exposed to various examples of economics and business applications. The primary objective of this course is to motivate the use of statistical analysis and at the same time encourage students to go beyond the mathematical applications of technique and to develop critical judgment through statistical analysis. The specific objectives of the course are enabling student:

To increase students understanding of economic way of thinking and analyzing to business decision making problems

- to understand the role of mathematics in statistics
- to understand and use of statistical methods ranging from graphical presentation of data to descriptive statistical representation of data for economics & business-related studies;
- to analyse data for understanding the characteristics of the business & economy related factors, their association etc.
- apply statistical techniques to forecast the market situation and to take well informed decisions.

Course content

Module	Topic	L	T	P
1	**Mathematics for Business** Introduction to matrix algebra, determinants, system of equations and solutions, calculus – limits, continuity, derivatives, integration, Maximization & Minimization, permutation & combination.	7	3	0
2	**Introduction: Data and Statistics** Introduction to Statistics, Data: Concept & types of data; importance of data in business; Data sources: introduction to business-related data & sources.	2	0	0
3	**Descriptive Statistics** Summarizing data: how to handle data scientifically to make proper decisions; Exploration & representation of business-related data: tabulation, cross tabulation, variability checking, measuring the distribution and location statistically, association among inputs and outputs; Use of diagrams in business projects and reporting.	4	3	2
4	**Probability Distribution** Introduction to set theory and probability; Additive & multiplicative rules, conditional & unconditional probability, Bayes theorem, Discrete and continuous distributions; Random variables; Discrete & continuous probability distributions: theory and its applications in management (Binomial, Poission, Negative Binomial, Geometric, Hypergeometric, Uniform, Exponential, Normal).	5	4	0
5	**Sampling and Sampling Distributions** Statistical Inference: concepts & relevance in business; Methods of Sampling: purposive, random, stratified, systematic, multi-stage; Concepts and estimation of -	5	3	0

	Point Estimation, Sampling Distribution of Mean, Sampling distribution of p, sample size determination; Interval estimation, confidence interval; Determining sample size.			
6	**Hypothesis Testing** Null and alternative hypothesis; Test of significance; Type I and Type II errors; differences of means, proportions, difference of proportions, variances, ratio of variances, Practical issues, Standard normal, χ^2, t and F distributions.	3	2	0
7	**Analysis of Variance** Introduction to analysis of variance; Assumptions and analysis of one-way classified data; Multiple comparisons, Assumptions and analysis of two-way classified data.	3	2	0
8	**Correlation and Simple linear regression – Introduction** Correlation, coefficient of correlation, Simple regression model; Least square method; Coefficient of determination; Model assumptions; Testing of significance; Predictions; Residual analysis.	3	3	4
9	**Index Numbers** Method of construction of index numbers; price and quantity index, Consumer price index (CPI) & Wholesale price index.	2	3	0
	TOTAL	**34**	**23**	**06**

Evaluation criteria:

The break-up of the evaluation procedure is as follows:

- Test 1 : Written Examination (Module 1, 2 & 3) - 20%
- Test 2 : Written Examination (Module 4) - 20%
- Test 3 : Project Work (Primary data collection, analysis and presentation) (Module 2 -8) - 20%

[Indicators for assessment: (a) Identification of the problem; (b) Data collection; (c) Relevance of the data analysis method; (d) Representation and explanation; (e) Punctuality and timeline adherence.

Note: (a), (b) and (c) would carry a weightage of 10% each; (c) would carry 30% weightage and (d) would carry 40 % weightage.]

- Major Exam: Written Examination (Module 4 – 9) - 40%

Learning outcomes:

After successful completion of the course, students will be able to:

- Develop a sense of the role of mathematics, statistics and data analysis in business (Test 1, 2 and 3)
- Apply the principles, techniques and approaches for statistical inferences (Test 3 & Major)
- Apply statistical concepts to business and economic models for predicting outcomes (All Tests)
- Application of data analysis for informed decision making (All Tests)

Pedagogical approach

The course will be delivered through lectures and tutorials. Application of statistical tools in business & economics related problems would also be a part of the pedagogical approach for the course.

References:

Textbooks:

- Anderson DR., Dennis J. Sweeney and Thomas A. Williams. Statistics for Business and Economics, Cengage Learning (latest edition), India.
- Miller CD., Salzman SA. & Clendenen G. Business Mathematics. Addison Wesley (latest edition).
- Gupta SC & Kapoor VK. Fundamentals of Mathematical Statistics, Sultan Chand & Sons. (latest edition). India.

Additional Readings:

- Kohler, H. (2010). Statistics for Business & Economics, Harper Collins.
- Levin, R. and Rubin, D. (2012). Statistics for Management, Pearson.
- McClave J. and Benson, P.G. (2013). Statistics for Business and Economics, Pearson.
- Richard I.L. and David S.R. (2011). Statistics for Management, Pearson.
- Stine R. and D. Foster (2014). Decision making and Analysis, Pearson New International Edition.
- Thukral J.K. (2015). Business Mathematics & Statistics, Mayur Paperback.
- Triola M.F. and Franklin, L.A. (2015). Business Statistics.
- Watsnam TJ. and Keith P. (2014). Quantitative Methods in Finance, International Thompson Business Press.

Additional information (If any): None

Student responsibilities:
Attendance, feedback, discipline etc.

Prepared by: Dr. Montu Bose

Course reviewers:

1. Dr. Yamini Gupt, Professor, University of Delhi, Delhi.
2. Dr. Neelanjan Sen, Assistant Professor, Madras School of Economics, Chennai.
3. Dr. Tamal K. Kayal, Assistant Professor, Jadavpur University, Kolkata.

Course title: Accounting for Managerial Decisions			
Course code: PPM 130	**No. of credits:** 4	**L-T-P**: 44-16-00	**Learning hours:** 60
Pre-requisite course code and title (if any): None			
Department: Policy & Management Studies			
Course coordinator(s): Dr. Shikha Mittal Shrivastav		**Course instructor(s):** Dr. Shikha Mittal Shrivastav	
Contact details: shikha.shrivastav@terisas.ac.in			
Course Type: Core		**Course offered in:** Semester 1	

Course Description

Accounting is the language of business. It attempts to measure and report corporate performance. Managers use accounting in making decisions; while investors use it for valuing stocks. The bankers and lender rely on accounting information to decide to whether to lend money to business. The accounting information is also crucial in evaluating the performance of employees at various levels in an organization. Thus, this is a very useful course in management education in almost every graduate management program the world over, a full course on accounting and reporting remains an obvious choice. This course is indispensable as the first step towards understanding the financials of business.

Course objectives

The objectives of the course are to ensure that the participants:

- to understand the conceptual framework of Accounting and the process that leads to the preparation of financial statements;
- to develop the ability in them to use financial statements to assess a company's performance;
- to understand how the accounting information system works in a firm;
- to interpret the need of accounting information in managerial decision-making process;
- to analyse the performance vis-à-vis financial health of the firm.

Course content

Module	Topic	L	T	P
1	**Accounting and Economic Decisions** Accounting, Users of Accounting Information, Financial, Cost and Management Accounting, Accounting Information System, Generally Accepted Accounting Principles, Indian Accounting Standards and IFRS, Forms of Business Organization, Accounting Equation	4	2	0
2	**Recording of Business Transactions** Types of Accounts, Double Entry System of Accounting, Recording Transactions - Journal, Ledger and Trial Balance	4	2	0
3	**Understanding Income Statement** Income Measurement, Preparation of Income Statement, Incorporating Adjustments, Format as per Companies Act	3	1	0
4	**Understanding Balance Sheet** Liabilities and Shareholder's Equity, Classification of Assets and Liabilities, Preparation of Balance Sheet, Format as per Companies Act	3	1	0
5	**Revenue Recognition** Income and Revenue, Measurement of Revenue, Accrual Principle, Matching Principle, Sale of Goods, Service Revenues, Interests and Dividends; Expense Recognition, Relevant Accounting Standards	2	1	0
6	**Inventory Valuation** Nature of inventories, Measurement of Inventory Costs, Method of record, keeping of Inventories; Inventory Valuation, Net Realizable Value (NRV), Relevant Accounting Standards	2	1	0
7	**Accounting for Fixed Assets (Property, Plant, and Equipment)** Fixed Assets, Property, Plant and Equipment, determining cost of Acquisition, Depreciation Accounting- Methods, Accounting including Impairment, Disposal of Assets, Relevant Accounting Standard	3	1	0
8	**Cash Flow Statement** Cash Flow Statement - Purpose and Use, Operating, Investing and Financing Activities, Preparation of Cash Flow Statement, Relevant Accounting Standard	3	1	0

9	**Annual Reports** Contents of Annual Reports, The Regulatory Framework, The Disclosure System, Qualitative and Quantitative Reporting, Component wise discussion	2	0	0
10	**Financial Statement Analysis** Common Size Statement, Comparative Statement Analysis, Trend Analysis and Ratio Analysis- Liquidity, Solvency, Turnover and Profitability, Intra and Inter Firm Comparisons, Du-Pont Analysis	5	3	0
11	**Basics of Cost Accounting** Cost Concepts, Elements of Cost and Cost Behaviour, Cost Sheet, Cost-Volume-Profit Relationship, Absorption and Marginal Costing and Managerial Decision Making	5	2	0
12	**Management Accounting and Control** Standard Costing, Variance Analysis- Material and Labour, Budgetary Control	4	1	0
13	**Accounting- Role, Ethics and Recent Developments** Role of Accounting in Capital Market and Corporate Governance, and Ethical Issues in Accounting, Recent developments in Accounting	2	0	0
14	**Project Presentation**	2	0	0
	TOTAL	**44**	**16**	**0**

Evaluation criteria:

- Test 1 : Quiz 20%
- Test 2 : Written Test 30%
- Assignments : 20%
- Major Exam : Written Test 30%

Learning outcomes:

Upon completion of this course, the students will be able to:

- Understanding of the various principles on which financial statements are prepared.
- Acquire critical thinking skills to analyse financial data, and demonstrate the ability to communicate such data effectively, as well as the ability to provide knowledgeable recommendations.
- Develop an overall understanding of emerging corporate reporting framework in the context of International Financial Reporting Standards (IFRS)
- Understanding and interpreting the various cost information for planning and control purposes in managerial decision making.
- Understanding the role of managerial accounting in decision making.

Pedagogical approach

The course will be delivered through lectures and discussion of case studies, videos, annual reports of the companies, research papers and newspaper articles.

References:

- Financial accounting: a managerial perspective by R Narayanaswamy Prentice-Hall of India, Sixth Edition.
- Principles and Practice of Cost Accounting by Ashish K. Bhattacharyya, Prentice-Hall of India, Third Edition
- Accounting: Text and Case, Robert N. Anthony, David F Hawkins, and Kenneth A Merchant (AHM), Tata McGraw Hill, Thirteenth Edition.
- Accounting for Management: Text and Cases by S.K. Bhattacharyya and John Dearden, Vikas Publishing House; Third edition
- Cost Accounting - A Managerial Emphasis by Charles T. Horngren, Srikant M. Datar and George Foster, Pearson Education, Thirteenth Edition.
- Introduction to Management Accounting by Charles T. Horngren, Gary L. Sundem, William O. Stratton, Pearson Education, Thirteenth Edition.

Websites and Web resources –

- Maria B. & Alexandru IC. (2005). Economic decision-making and the role of accounting information. retrieved from. http://www.oeconomica.uab.ro/upload/lucrari/1020081/17.pdf

- Damodaran A. (2006). Understanding Financial Statements. retrieved from
- http://people.stern.nyu.edu/adamodar/pdfiles/valn2ed/ch3.pdf
- The Institute of Company Secretaries of India. retrieved fromhttps://www.icsi.edu/
- Financial Times. Retrieved from https://www.ft.com/,
- Learn Accountancy the Easy Way. Retrieved from http://accounting-simplified.com/

Additional information (If any): None

Student responsibilities:
All students are expected to read the assigned readings prior to the class. Students are expected to analyse the case following the discussion questions. All students must maintain full attendance and do timely submission of assignments.

Prepared by: Dr Shikha Mittal Shrivastav

Course reviewers:

1. Dr. Anjala Kalsie (Associate Professor), Faculty of Management Studies, University of Delhi
2. Prof. (Dr) Deepak Tandon, Professor, IMI, New Delhi
3. Prof. (Dr) K. P. Kaushik, Professor, AJNIFM, Faridabad

Course title: Managerial Economics			
Course code: PPM 148	**No. of credits:** 4	**L-T-P**: 50-10-00	**Learning hours:** 60
Pre-requisite course code and title (if any): None			
Department: Department of Policy & Management Studies			
Course coordinator(s): Dr. Gopal Sarangi		**Course instructor(s):** Dr. Gopal Sarangi	
Contact details: gopal.sarangi@terisas.ac.in			
Course Type: Core		**Course offered in:** Semester 1	

Course Description

The basic objective is to equip students with skill sets in applying analytical approaches to the study of how individuals and business units deal with the fundamental problems of scarce resources, understanding of the nature of prices and of markets, role of information and of interventions, etc. Specific topics to be covered include applications of supply and demand, market structure, laws of production, market failure, game theory and auctions and their applications in the context of business and business decision making. Students would appreciate and understand how markets organize things and when markets fail and how market failures could be addressed. Examples from services sectors, energy and infrastructure sectors would be particularly important in attaining course goals.

The course would provide the base for macroeconomics, organizational behaviour, marketing, finance and strategic management.

Course objective

The course objectives are:

- To increase students understanding of economic way of thinking and analyzing to business decision making problems
- To develop students critical thinking skills and analytical abilities is resolving business problems by employing various tools and techniques of economics
- To make students understand the rigors of various economic models and their applications in business decisions.
- To make students understand how economic variables are interpreted, analyzed through the use of various tools and techniques

Course content

Module	Topic	L	T	P
1	**Introduction to Economics, Demand and Supply, Elasticity and Market Efficiency** Human wants and scarce resources Basics of demand, supply and market Concept of market Demand and supply schedules and equilibrium Changes in price when demand/supply shifts Demand Analysis and demand estimation Derivation of demand curve Consumer surplus and producer's surplus Market efficiency and their applications Concept of Elasticity – point, arc, income and cross elasticity's Elasticity and revenue Application of elasticity	10	2	0
2	**Utility, Preferences and Choice** Utility Theory and utility function How people make decisions? Utility – total, marginal Marginal analysis and its use in economic analysis Preferences, budget constraints, choices, and optimal choices Consumer Behaviour Indifference curve analysis and revealed preference analysis Changes in income and prices, income and substitution effects	8	2	0
3	**Theory of Firms and pricing strategies** Market and market structure Market equilibrium and price determination under different market structures Perfect Competition, monopoly, and price discrimination (definition and types of price discrimination, necessary conditions for the existence of price discrimination, price discrimination and the price elasticity of demand) Other pricing strategies of firms Monopolistic competition, models of oligopoly (Bertrand duopoly and Cournot duopoly Application of auctions and game theory in understanding the market structure, behaviour, and business strategy	12	2	0

	Average cost pricing, other pricing strategies			
4	**Market failure, Economics of regulation, Economics of information, and Role of behavioural economics in managerial decision making** Externalities and public goods Monopoly power and social costs Regulation of public monopolies Economics of Information and uncertainty, Search costs Asymmetric information and adverse selection and moral hazard, Market signalling, Switching costs Principal agent problem Managerial judgements through behavioural economics	10	2	0
	TOTAL	**50**	**10**	**00**

Evaluation criteria:

The overall course grade will be allocated as follows:

- Test 1 : Class exercises and participation: 10 %
- Test 2 : 20 %
- Test 3 : Assignment: 20 %
- Major Exam : Written test: 50 %

Learning outcomes:

After the completion of the course, the students will:

- Understand the key concepts, models, tools and techniques of managerial economics (Test 1, 2, 3 & Test 4)
- Understand and appreciate the applications of various tools and techniques of managerial economics (Assignment and Test 1)
- Develop abilities of applying the tools, techniques and models in resolving real life business problems (Assignment & Test 3)

Pedagogical approach

Pedagogical approach consists of classroom teaching and participation; interactive sessions; case study discussion, students' presentation.

Materials

Textbooks and Readings:

- Dominick S., (2012), Managerial Economics, 7th Ed., Oxford University Press.
- Karl Case, Ray Fair, and Sharon Oster, Principles of Economics.12th edition
- Frank, R. and B. Bernanke (2004), Principles of Economics, 2nd Ed., Tata McGraw Hill
- Dominick S., (2009), Principles of Microeconomics, International Version, 5th Ed., Oxford University Press.
- Varian, H. R., (2006), Intermediate Microeconomics, 8th ed. W. W. Norton & Company
- Sen, A., (2006), Microeconomics – Theory and Applications, 2nd Ed., Oxford University Press.
- Pindyck, R. S., D. J. Rubinfeld and P. L. Mehta (2009), Microeconomics, 7th Ed., Pearson Education, India.
- Martin J. Osborne (2004), An Introduction to Game Theory, Oxford University Press, New Delhi.

Additional information (If any):

Attendance

Attendance will be taken on a regular basis, and it is expected that all students attend ALL sessions.

Student responsibilities:

Attendance, feedback, discipline etc.

Prepared by: Dr. Gopal K Sarangi

Course reviewers:

1. Prof. Sajal Ghosh, Professor of Economics, MDI, Gurgaon
2. Prof. Ranjan Kumar Ghosh, Assistant Professor of Economics, IIM Ahmedabad

Course title: Marketing Management			
Course code: PPM 196	**No. of credits:** 3	**L-T-P**: 35-08-04	**Learning hours:** 45
Pre-requisite course code and title (if any): None			
Department: Policy & Management Studies			
Course coordinator(s): Dr. Shruti Sharma Rana		**Course instructor(s):** Dr. Shruti Sharma Rana	
Contact details: shruti.rana@terisas.ac.in			
Course Type: Core		**Course offered in:** Semester 1	

Course Description

This is a core course in Marketing meant to build a foundation for students in the MBA Program. Marketing is a critical function that determines the health of an organization. Marketing is the set of activities designed to scan and identify market opportunities and plan to design price, promotion and the distribution of products, services and ideas that satisfy the needs of chosen target market(s). The Marketing Manager uses his range of marketing tools to transform the identified opportunities in a manner that achieves the organizational objectives.

Course objectives

This course is a fundamental course on marketing and develops the basic analytical skills, conceptual abilities, and substantive knowledge in marketing concepts like the marketing mix in a variety of real-life marketing situations. The objectives are:

- To provide an in-depth understanding of the marketing process
- To give students an appreciation of the global and domestic marketing environment.
- To develop conceptual understanding of the STP process in the Indian environment.
- To learn about all the elements of the marketing-mix
- To sensitize the students about new developments like Multichannel and Omni channel marketing
- To develop the ability to formulate a marketing plan

Course content

Module	Topic	L	T	P
1	**Introduction**: Marketing concepts and philosophies. Evolution of Marketing. Marketing Myopia What Business Are You In: Theodore Levitt HBR October 2006? (Marketing Myopia) Concept of Marketing Mix Marketing Plan The sixth P of Marketing The changing face of Marketing Mix.	6	0	0
2	Strategic Marketing; PEST analysis Porter's Generic Strategies Michael Porter's Big Ideas Application and Evaluation of Strategy BCG Matrix, GE 9 Cell model Nokia's Strategy Derrick's Ice Cream Company Understanding Customer – Customer Value What have you done for me lately? Customer loyalty and satisfaction Why satisfied customers defect.	6	2	2
3	**Consumer Behavior:** Defining Consumer Behavior - Scope of Allocation of Consumer Behavior - Why Study Consumer Behavior - Evolution of Consumer Behavior as a Field of Study and Its Relationship with Marketing: Behavior Dimension - The Interdisciplinary Nature of Consumer Behavior	4	2	0
4	Segmenting the consumer markets Basis of segmentation Product diff and market segmentation strategies Targeting and positioning Lessons from faded Levi Strauss We try harder Dealing with competition Marketing warfare Guerilla marketing Gaining competitive advantage Kodak Vs. Fuji	6	1	0

5	Introduction to brands and Brand Management. customer Based Brand Equity: Brand Knowledge, Sources of Brand Equity, The Four Steps of Brand Building; Brand Positioning: Identifying and implementing brand positioning, Points of Parity, Points of Difference, Brand Audits.	5	2	0
6	Pricing Strategies Distribution Strategies Retailing Promotion Strategies Integrated Marketing Communications IMC. New Age Marketing concepts. Message evolution by McDonald's in India Services Marketing	6	1	2
	TOTAL	**35**	**8**	**4**

Important Sessions to Remember – (Remember no 'make-ups' allowed for any component) Session 21: Mid Term Test, Session 39: Submission of the group project report, Session 44-46: Group Presentation on the project

Evaluation criteria

- **Test 1: Class participation** 10% (Based on attentiveness and active participation during the entire course)
- **Test 2: News presentations** 10% (To pick and critically present latest news about marketing activities done by any company)
- **Test 3:** 20% (Written exam after completion of 16 sessions –to test the understanding of concepts of marketing, strategic planning and consumer behavior)
- **Group Project** 20% (To develop the Marketing Plan for a product / service and apply all the knowledge of marketing gained throughout the course. Report to be submitted at the end of 28 sessions and presentation in the last 2 sessions)
- **Major Exam 5: Written Test** 40% (Written examination covering the entire course)

Group Project: Marketing News Presentation and Creating a Marketing Plan

Each group should be prepared to make a presentation of news related to marketing gathered over one week prior to its turn to present in the class.

Each group needs to select one product category from the suggested list. No overlap of product category within each section is permitted. Your group may take the perspective of an organization that is either a leader in the category or a follower or a new entrant.

Prepare a detailed report on the project. The report should be submitted in soft copy on my email.

Each group should be prepared to make a presentation project in the class. Time limit is 15 minutes per group.

Case Study discussion: A case may be studied keeping in mind the following:

- a problem definition statement, which identifies the key issues facing management (not more than a few lines);
- the objectives
- alternative plan of action
- an analysis section which synthesizes and integrates the answers to the key questions for the case, but does not repeat the facts themselves, and presents logical arguments in defense of both the problem definition and the recommended solution;
- a set of detailed recommendations and suggestions for their implementation, including how to overcome any potential issues of implementation identified by the analysis.

Learning outcomes:

After attending this course, students will be able to:

- Develop an understanding of the role of marketing in the success of an organization (News presentation, Mid Term exam)
- Develop an ability to identify and assess strategic choices in marketing (Mid Term exam, End Term exam)
- Be able to propose innovative solutions to customer needs and continuous improvement of offerings (News presentation, Group Project)
- Be able to develop the Marketing Plan for any organization (Group Project, End Term exam)

Pedagogical approach

- Interactive Lectures
- Case discussions and presentations
- News crunching

Materials:

- **Text Book**: Marketing Management by Philip Kotler, Kevin Keller, Pearson, New Delhi, 15th edition 2016,

ISBN:978-81-317-3101-7 ▪ **Reference Book:** Philip Kotler, Kevin Lane Keller, Abraham Koshy, Mithleshwar Jha, "Marketing Management, A South Asian Perspective", 14th Ed (2013) by Pearson Education, New Delhi
Additional information (If any): None
Student responsibilities: Attendance, timeline adherence for assignments, come prepared with readings / cases according to the session plan and as and when provided

Prepared by: Dr. Shruti Sharma Rana

Course reviewers:

1. Dr.Ruchi Khandelwal, Amity University, Noida
2. Dr.Shampy Kambhoj, NIT Hamirpur

Course title: Corporate Governance and Business Ethics			
Course code: PPM 201	**No. of credits:** 3	**L-T-P**: 36-6-6	**Learning hours:** 48
Pre-requisite course code and title (if any): None			
Department: Policy & Management Studies			
Course coordinator(s): Dr. Vidhi Madaan Chadda		**Course instructor(s):** Dr. Vidhi Madaan Chadda	
Contact details: vidhim.chadda@terisas.ac.in			
Course Type: Core		**Course offered in:** Semester 1	

Course Description

The Enron and WorldCom implosions, that were discreet events involving fraud and loss to shareholders, employees and pensioners resulted in changes in policy and legal framework like the enactment of the Sarbanes-Oxley Act, 2002. This marked a significant increase in interest in the field of corporate governance.

The subsequent Global Financial crisis of 2007-2009 which resulted in various governments spending billions of taxpayer money in bail-out packages to business organizations has led to a view that corporate governance reforms need to be much more profound and, possibly, even intrusive and has resulted in a debate on the role to be played by the state, as a regulator, in ensuring good governance. The impact of corporate mis-governance is quite significant and extends far beyond the affected organization; therefore, corporate governance has fast emerged as a significant academic discipline in the last few decades and today occupies a significance presence in the curricula at business schools.

Even though corporate governance reforms in India are of recent origin they are increasingly occupying centre stage in discussions. While the reform process got a kick start with the liberalization of the Indian Economy in the 90s and the progress in legislating and introducing corporate governance reforms in India in the last two decades has been quite significant, their effectiveness continues to be a matter of considerable debate.

Corporate India has also had its share of governance scams with Satyam, which has been described as India's Enron, being the most notable one.

The Companies Act, 2013 ushered in the new regime of corporate governance in India through enhanced disclosures, transparency and good governance. Further, with the evolving framework for responsible business in the country it becomes incumbent to acquaint the participants with the theoretical and practical aspects of corporate governance.

Course objectives

Given that effective corporate governance is crucial to a successful and sustainable corporate enterprise and also the fact that it is an evolving discipline, this course would help the participants to:

- Understand the theoretical underpinnings of ethics and governance for businesses.
- Appreciate how developments in corporate governance have been evolved and trace the history of developments in this field- internationally and in India.
- Analyse the models and frameworks that exist globally and domestically for corporate governance.
- Critically examine the roles, responsibilities, obligations, liabilities and effectiveness of boards of directors, management, shareholders, regulators and other corporate stakeholders with specific reference to the challenges that are faced in a business environment.

Course content

Module	Topic	L	T	P
Module 1: Introduction and Conceptual framework	Introduction to the course and discussion on the pedagogy, readings, evaluation pattern.	1	0	0
	Ethics, Morals & Values: Concepts of Utilitarianism andUniversalism; Values & Value Orientation of the Firm; Theories and major sources of ethical values in business.	2	0	0
	The Theoretical Framework (s) for corporate governance: Agency Theory;Stakeholder Theory; Stewardship Theory: Resource Dependency Theory; Gandhian concept of Trusteeship.	4	0	0
	Corporate Governance: Why governance? The Global Financial Crisis of 2007-09: Its Antecedents and Consequences –the increasing relevance of Corporate Governance. Ethical Perspective to Corporate Governance. Ancient Indian Connections; History of Corporate form and models; Corporate Objectives and goals: Ownership pattern: Issues in managing public limited	5	0	0

	firms; Agency problems.			
	Corporate Governance Mechanisms **Internal Corporate Governance Mechanism:** Board of Directors; Functional Committees of Board; Code of conduct, whistle blowers; Board and Committee Assurance Providers and Other Advisors; **External Corporate Governance Mechanism**: Regulators, Gate keepers, Institutional Investors, Corporate raiders. Auditing, Internal Controls and Compliance	5	0	0
Module 2: Framework for Ethical and Responsible business	Principles of ethical conduct, ethical dilemma, how corporations manage ethics. Companies as a 'good' corporate citizen; Responsible business paradigm. Ethics v. social responsibility of business, Adoption and model of CSR agenda. Responsible business strategies, policies and practices. Multinational Corporations, ethics and responsible business. Principles of GBS Codex, The United Nations Global Compact, Responsible business reporting frameworks.	5	0	0
Module 3: Global Perspectives and Practices on Corporate Governance	Global Corporate Governance models; Anglo- Saxon model other models (Germany & Japan); Emergence and emerging trends of corporate governance in the US & UK; Cadbury Report, OECD Committee Recommendations; The Sarbanes Oxley Act. **Case Study:** Enron	4	0	2
Module 4: Corporate Governance in India: Emergence and Trends	Colonialism and emergence of corporate sector in India, Developments post-independence 50s to 90s; developments in Corporate Governance in India in nineties and 2000s; CII, Kumara Mangalam Birla, Narayana Murthy, Naresh Chandra, JJ Irani, Kotak Committee reports; Legal and Regulatory reforms; introduction and implication of Clause 49; The Companies Act, 2013: Key features, SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015 and recent developments.	5	0	0
	Challenges for Corporate Governance in India: The role of the dominant shareholder; legal rights and enforcement; differences in cultural and political factors and their impact on the CG framework; Corporate Governance in family-owned companies. Role of board committees, managerial remuneration, Efficacy of auditors, 'Independence' of independent directors, Reporting and Disclosures. Contemporary challenges and future direction for corporate governance. **Case studies: Satyam** **Tata-Mistry** **IL&FS**	4	2	4
	Group presentations	0	4	0
	TOTAL	**36**	**6**	**6**

Evaluation criteria:

Test 1:	Assignment	– 25%
Test 2:	Group Presentation	– 25%
Major Exam:	Written Test	– 50%

Learning outcomes:

By the end of this course, the students would have:

- Developed an understanding of the conceptual framework for Business Ethics & Values and appreciate ethical issues and concerns that arise while taking decisions in personal and corporate life.
- Understood the various theoretical frameworks on which corporate governance theories are premised.
- Appraised the emergence of corporate governance models and frameworks as they have evolved internationally.
- Understood the specific roles, responsibilities, reporting obligations, liabilities and effectiveness of boards of directors, management, shareholders, regulators and other corporate stakeholders in good governance in organizations.
- Appreciate the challenges that are specific to the Indian context and understand why transplanting

- western concepts of corporate governance to the Indian setting may not give the desired solutions.
- Identify the direction for future corporate governance reforms.

Pedagogical approach

The pedagogy used for the course would be a blend of learning in the class room and then applying theory to the analysis of encapsulated situations (case studies), group discussions and project assignments. In this course Learning is not intended to be a one-way transmission of information through lectures and the course is designed to be very practical and supported by strong theoretical foundations. Students would be encouraged to be constructively critical of the assumptions, arguments, positions, the status quo and prevailing theories of corporate governance presently put forward by regulators, academics and other stakeholders. The objective of the pedagogy to be followed is, therefore, to develop the student into an engaged, critically reflective practitioner, who is not necessarily engaged only in quiet self-reflection, but is social, action- oriented and is able to analyze the dominant thinking in this field. Through reflection, students would acquire new (and hopefully more powerful) understanding and appreciation of the phenomenon of corporate governance, individually and in concert with their colleagues.

The contact sessions for this course would be broadly organized as:

- sessions for Class Room Lecture given by the course Instructor that would expound and package the theory and concepts with illustrations and relate with real life examples;
- sessions of Case Discussion, facilitated by the course Instructor and/or Guest Speakers with dynamic student interaction to simulate, apply and illustrate any given concept, theory or argument;
- sessions of Group discussion and Presentation, led by students, under the supervision of the course Instructor, to communicate, draft and develop the concepts, theory and arguments and make presentations in the class.

Materials:

- Bhattacharyya, A.K. (2016). Corporate Governance in India: change and continuity. Oxford University Press.
- Fernando, A.C. (2009). Corporate ethics, governance and social responsibility: Percepts and practices. Dorling Kindersley Pvt Ltd. Pearson
- Fernando, A.C., Satheesh, K.P. et.al. (2018). Corporate Governance: Principles, Policies and Practices. (3rd ed.). Dorling Kindersley Pvt Ltd. Pearson.
- Fernando, A.C., Muralidharan, K.P. et.al. (2019). Business Ethics: An Indian perspective. (3rd ed.). Dorling Kindersley Pvt Ltd. Pearson.
- Indian Institute of Corporate Affairs. (2015). Corporate Governance. Taxmann Publications Ltd.
- Steiner, J.F. & Steiner, G.A. (2012). Business, Government and Society: Texts and Cases. (12th ed.) McGraw Hill (India) Pvt. Ltd.
- Valasquez, M. G. (2011). Business Ethics: Concepts and Cases (7th ed.), USA: Prentice Hall.
- These texts will be supplemented with additional teaching aids such as academic papers, cases and research studies in this field.

Additional information (If any): None

Student responsibilities:

Attendance, Pre-reading, Class participation, Presentation, Assessment and Feedback.

Prepared by: Dr. Vidhi M Chadda

Course reviewers:

1. Prof. Deva Prasad M., IIM-Kozikode
2. Prof. Kiran Rai, Maharashtra National Law University, Mumbai

Program Structure

M.Sc. Economics

Semester	Courses
Semester 1	Microeconomics 1 (Core: 4 credits)
	Macroeconomics I (Core: 4 credits)
	Mathematical methods for Economics (Core: 4 credits)
	Econometrics I (Core: 4 credits)
Semester 2	Microeconomics II (Core: 4 credits)
	Macroeconomics II (Core: 4 credits)
	Econometrics II (Core: 4 credits)
	Environmental Economics (Core: 4 credits)
Semester 3	Development Economics (Core: 4 credits)
	Methods of Research in Economics (Core: 4 credits)
	Natural resource economics (Core: 4 credits)
	Two electives to be chosen from a list of approved elective courses worth 8 credits ❖ Indian agricultural development: Contemporary Issues (Elective – 4 credits) ❖ Time series and regression analysis (Elective – 4 credits) ❖ Trade, Development and Environment (Elective – 4 credits) ❖ Labour Economics (Elective – 4 credits) ❖ Economics of health and environment (Elective – 4 credits) ❖ Environment and Economic Development (Elective- 4 credits) ❖ Ecological Economics ❖ Law and Economics ❖ Energy Economics ❖ **Advanced Macroeconomics** ❖ Theory of Finance ❖ Industrial Organisation ❖ Theory of Contracts ❖ Public Economics ❖ Collective action and environmental management

Semester 4	*Compulsory Thesis (20 credits)*
Total Credits	*72*

Course title: Econometrics I			
Course code: MPE 186	**No. of credits:** 4	**L-T-P:** 57–0– 6	**Learning hours:** 60
Department: Department of Policy and Management Studies			
Course coordinator: Dr Seema Sangita		**Course instructor:** Dr Seema Sangita	
Contact details: seema.sangita@terisas.ac.in		**Course offered in:** Semester 1	
Course type: Core			

Course description:

This course introduces the theories of statistics and econometrics and provides an insight into their applications to economic problems. The course starts with fundamental concepts random variables. After a discussion of some special families of distributions that are widely used in economic applications, the students are introduced to estimation and hypothesis testing. These concepts create a foundation for the subsequent modules on estimation and inference in regression models. The course also emphasizes a discussion of challenges and limitations of regression analysis. The students learn the techniques for preparing raw data for analysis, summarisation, and visualisation of data, and carrying out basic econometric analysis using software such as STATA and R. This course also creates a foundation for advanced econometrics classes and research methods.

Course objectives:

1. To provide a foundation of Statistics and Econometrics for undertaking data analysis in Economics.
2. An exposure to various theories of Statistics and Econometrics, along with a demonstration of their applications.
3. To introduce students to use of statistical software for data analysis.

Course contents

Module	Topic	L	T	P
1	**Introduction** Meaning of 'statistics' Observational versus experimental data Structure of economic data	2	0	0
2	**R/STATA Software – Part 1** Tools of exploratory data analysis.	0	0	2
3	**Random Variables** Discrete and continuous random variables Joint, marginal and conditional distributions and statistical/stochastic independence Measures of central tendency and their properties Measures of dispersion and their properties Measures of association and their properties Central limit theorem and law of large numbers.	6	0	0
4	**Selected Special Distributions** Binomial distribution Poisson distribution Uniform distribution Normal, standard normal and log-normal distributions Exponential distribution Chi-square, t and F distributions	6	0	0
5	**Estimation** Populations, parameters, and random sampling Estimation of population mean, population proportion and population variance Finite Sample and Asymptotic Sample Properties of estimators Different approaches to parameter estimation: method of moments; maximum likelihood; least squares Point and interval estimation	10	0	0
6	**Hypothesis Testing** Setting up a hypothesis test Type 1 and type 2 errors Level of significance Power of a test Hypotheses tests involving 2 populations: independent 2 sample t tests, paired t-tests, tests of equality of population proportions; variance ratio test; chi square test of independence. Relationship between hypothesis testing and confidence intervals	5	0	0

7	**Simple Regression Model** Derivation of OLS estimates Properties of OLS estimators Gauss-Markov assumptions for simple regression Log-log and semi-log regression models	8	0	0
8	**Multiple Regression Model: Estimation** Derivation of OLS estimates Interpretation of coefficients Gauss-Markov assumptions and theorem for multiple regression	10	0	0
9	**Multiple Regression Model: Inference** Sampling distributions Testing hypotheses in OLS: t test and F test Confidence intervals in OLS	5	0	0
10	**Gauss Markov violations** Heteroskedasticity Endogeneity	3	0	0
11	**R/STATA Software – Part 2** Regression analysis Reporting and interpreting results	0	0	4
12	**Way forward** Introduction to time series data analysis Introduction to limited dependent variable models	2		
	Total (in hours)	**57**	**0**	**6**

Evaluation criteria:

1. Assignments (Across all modules) - 10%
2. **Test 1** - (Modules 1, 3, 4, 5, 6) - 25%
3. **Test 2** - software based (Modules 2, 11, application of knowledge from all modules - 25%
4. **Major Exam**- (Modules 7, 8, 9, 10) - 40%

Learning outcomes:

At the end of this course, students will be able to

1. Build a knowledge base of the fundamental principles of Statistics and Econometrics (Evaluation criteria 1,2 and 4)
2. Develop expertise in the principles, techniques and approaches used for statistical inferences (All evaluation criteria)
3. Apply statistical and econometric concepts to economic models (All evaluation criteria)
4. Ability to use R/STATA for summarising and visualization of data; correlation and regression analyses; and reporting and interpreting software outputs (Evaluation criteria 3)

Study Materials:

1. *DeGroot, M. H., and M.J. Schervish. 2012. *Probability and Statistics*. 4th Ed., Pearson India.
2. Mood, A. M., F. A. Graybill, and D. C. Boes. 1974. *Introduction to the Theory of Statistics*. 3rd Ed., New York: McGraw Hill.
3. Casella, G, and R.L. Berger. 2002. *Statistical inference*. 2nd Ed., Pacific Grove, Calif: Duxbury.
4. Crawley, M. J. 2014. *Statistics: An Introduction Using R*. 2nd Ed. Chichester: John Wiley & Sons.
5. *Wooldridge, J.M. 2007. *Introductory Econometrics: A Modern Approach*, 7th Edition, Boston: Cengage
6. Greene, W. H. 2003. *Econometric Analysis*, 5th edition, New Jersey: Prentice Hall.
7. *Dayal, V. 2015. *An Introduction to R for Quantitative Economics*, New Delhi: Springer.
8. Baum, C. 2006. *An Introduction to Modern Econometrics Using STATA*, Stata Press

* Indicates core reference

Pedagogical Approach:

- Classroom teaching, problem solving, assignments and quizzes
- Hands-on introduction to software applications

Additional information: The students registering for this course are advised to review concepts of mathematics of 10+2 level

Student responsibilities: Attendance, feedback, discipline: as per university rules.

Prepared by: Seema Sangita

Course Reviewers:

1. Dr. Ananya Ghosh Dastidar,
   Professor, Dept. of Finance and Business Economics,
   University of Delhi South Campus
   New Delhi

2. Dr. Ishita Chatterjee,
   Senior Lecturer, Economics
   UWA Business School,
   The University of Western Australia
   Perth, Australia

Course title: Macroeconomics-I			
Course code: MPE 127	**No. of credits:** 4	**L-T-P distribution:** 60-0-0	**Learning hours:** 60
Department: Department of Policy and Management Studies			
Course coordinator (s): Dr Shantanu De Roy		**Course instructor(s):** Dr Shantanu De Roy	
Contact details shantanu.roy@terisas.ac.in		**Course offered:** Semester 1	
Course type: Core			

Course description

Macroeconomics—the study of the dynamics of economic aggregates—is one of the foundational areas of economics. Attempts to understand macroeconomic phenomena have been one of the major drivers of modern economic theory and the fruits of this study have helped to improve economic policy. This course aims to introduce students with the major schools of macroeconomic thought with the objective to expose them to different debates in macroeconomic theory.

Course objectives

1. Acquaint students to the different schools of macroeconomic thought.
2. Exposing students to the debates on macroeconomic theories and policy making at different points in time.

Module	Course content	L	T	P
1	**Introduction** - Classical theory of output, employment, and money - Macroeconomic aggregates, circular flow of income, Simple Keynesian Model, IS-LM model	6		
2	**Keynesian Macroeconomics** - The principle of aggregate demand Saving-Investment balance and the realization of profits; quantity and price adjustments and the multiplier analysis; money and real wage; wage-unit and the wage-cut controversy; pricing of industrial commodities. - Determination of investment The marginal efficiency of capital; the role of expectations; financing of investment plans. - Liquidity preference theory The social device of money; the general theory of the rate of interest	16		
3	**Neo-classical Synthesis and Monetarism** Neoclassical synthesis: Hicksian interpretations of the General Theory Monetarism: The role of monetary policy; A heterodox critique of monetarism: the limitations of monetarism	4		
4	**New Classical Approach: Micro-foundations in Macroeconomics** - A mainstream critique of monetarism—rational expectations and neutrality of money	4		
5	**Real Business Cycle Theory** - Explaining macroeconomic fluctuations from a mainstream perspective— General equilibrium models with microeconomic foundations; behaviour of a representative household—optimization problem of a representative household; Effects of technology shocks and effects of changes in government purchases on macroeconomic variables	6		

6	**New Keynesian Framework** Basic framework; Price rigidity in the product market; Wage rigidity in the labour market: Efficiency wage theories and existence of involuntary unemployment; Macroeconomics without the LM curve; Relationship between output and inflation—Keynesian, Monetarist, New Classical and New Keynesian Phillips Curve	18		
7	**Dynamic Stochastic General Equilibrium Modelling** Dynamic New Keynesian models: basic framework; The Basic Three Equations in the New Keynesian DSGE model; Monetary policy from the New Keynesian perspective; Extensions of the basic model: financial frictions, unemployment	6		
Total		**60**		

Evaluation criteria:

The course evaluates students on three grounds:

Test 1 - (written exam)**:** 25%. (at the end of teaching of module 1)
Test 2 - (written exam) **:** 30%. (at the end of teaching of modules 2 and 3)
Major Exam- (written exam)**:** 45%. (after the completion of modules 4, 5, 6 and 7, at the end of the semester)

Learning outcomes

By the end of the course, students will:
-Command understanding of the basic concepts of Macroeconomics (Test 1 exam)
-Be equipped with alternative traditions of Macroeconomics through deeper understanding of the Keynesian school of thought and identify the key theoretical differences with the schools of thoughts that emerged as critiques of Keynesianism(Test 2 exam)
-Command critical understanding of the mainstream views and micro-foundations of Macroeconomics (Major exam)

Pedagogical approach
-Class interactions and discussions

Additional information
10+2 level knowledge of Mathematics is desirable

Materials

Optional textbook:
Bhaduri, A. (1986). *Macroeconomics: The Dynamics of Commodity Production*, Macmillan India Ltd.
Keynes, J. M. (1935): *The General Theory of Employment, Interest and Money*, Atlantic Publishers and Distributors, New Delhi. Patnaik, P. (2009): *The Value of Money*, Columbia University Press.
Romer, D. (2012): *Advanced Macroeconomics* (fourth edition), McGraw-Hill Publishers.
Woodford, Michael (2003). *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press.

Reading materials:

Module 1:
Froyen, R. T. (2008). *Macroeconomics: Theories and Policies*, (Chapters 5-8), 9th Edition, Pearson.

Module 2:
Bhaduri, A. (1986). *Macroeconomics: The Dynamics of Commodity Production,* (Chapters 1-4), Macmillan India Ltd. Kalecki, M. (1967). The Principle of Increasing Risk. *Economica*, 16(4), pp. 440-447.
Keynes, J. M. (1975): *The General Theory of Employment, Interest and Money*, (Chapters 4, 11, 12, 13), Atlantic Publishersand Distributors, New Delhi.

Module 3:
Hicks, J. R. (1937). Mr. Keynes and the "Classics": A Suggested Interpretation. *Econometrica,* 5(2), pp. 147-159.
Friedman, M. (1968). The Role of Monetary Policy, *American Economic Review,* 58(1), pp. 1-17.
_____(1976). Nobel Memorial Lecture: Inflation and Unemployment.
December 13. Kaldor, N. (1985). Why Monetarism Failed? *Challenge*, 28(2)pp.413.
Patnaik, P. (2009): *The Value of Money*, (Chapters 2, 4 and 5)

Module 4:

Lucas Jr., R. E. (1978). Unemployment Policy, *The American Economic Review*, 68(2), pp. 353-357.
----do ----_____(1996). Nobel Lecture: Monetary Neutrality, *Journal of Political Economy.* 104(4), pp. 661-682.
Patnaik, P. (2009): *The Value of Money*, (Chapter 6)

Module 5:

Romer, D. (2012). *Advanced Macroeconomics* (Chapter 5), 4th Edition, McGraw-Hill.

Module 6:

Shapiro, C and Stiglitz, J. E. (1986). Equilibrium Unemployment as a Worker Discipline Device in Akerlof, G. A and J. L.Yellen (eds.), *Efficiency Wage Models of the Labour Market.* Cambridge University Press.
Gordon, R. J. (1990). What is new-Keynesian Economics?. *Journal of Economic Literature*, 28(3), pp. 1115-1171.
Romer, D. (2000). Keynesian Macroeconomics without the LM Curve, *The Journal of Economic Perspectives*, 14(2),pp. 149- 169.
Snowdon, B. & Vane, H. R. (2005). *Modern Macroeconomics: Its Origins, Developments and Current States* (Chapter 7), Edward Elgar.

Module 7:

Romer, D. (2012). *Advanced Macroeconomics* (Chapter 7), 4th Edition, McGraw-Hill.
Clarida, R., Gali, J. and Gertler, M. (1999). The Science of Monetary Policy: A New Keynesian Perspective, *Journal of Economic Literature*, 37(4), pp. 1661-1707.
Azad, R. & Saratchand, C. (2015). A Macro-theoretic Survey of Monetary Policy in a Closed Economy, in P. Patnaik (Ed.), *ICSSR Research Surveys and Explorations*, Volume 3, pp. 75-116, Oxford University Press

Optional Readings:

Kay, John (2015). *Other People's Money: The Real Business of Finance*, Public Affairs, New York.
Turner, Adair (2016). *Between Debt and the Devil: Money, Credit and Fixing Global Finance*, Princeton University Press, Princeton and Oxford.

Course reviewers:

Dr. Mausumi Das, Associate Professor, Delhi School of Economics
Dr. Jyotirmoy Bhattacharya, Associate Professor, School of Liberal Studies, Ambedkar University,DelhiDr. Rohit Azad, Assistant Professor, Centre for Economic Studies and Planning, JNU

Prepared by: Dr. Shantanu De Roy

Course title: Mathematical Methods for Economics			
Course code: MPE 113	**No. of credits:** 4	**L-T-P:** 46-14-0	**Learning hours:** 60
Department: Department of Policy and Management Studies			
Course coordinator: Dr Shantanu De Roy	**Course instructor**: Guest Faculty		
Contact details: shantanu.roy@terisas.ac.in			
Course type: Core	**Course offered in:** Semester 1		

Course description:

The use of optimization techniques in economics can be motivated by Robbins' (1932) definition of economics as "the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses". This course brings together central results in Linear Algebra and Real Analysis to provide the foundation of constrained optimization techniques used in modern economics. However, Linear Algebra and Real Analysis are important topics in their own right, and many results thereof are used in different branches of economics. Besides equipping the student with economists' essential toolbox, this course emphasises on understanding important mathematical properties that motivate the underlying assumptions of economic models.

Course objectives:

1. Understanding major concepts of Linear Algebra and Real Analysis.
2. To appreciate the criticality of the role of mathematical assumptions in economic modelling.
3. To provide foundations of major techniques to solve optimization problems in economics.
4. To familiarise students with logical arguments and proofs.

Course contents

Module	Topic	L	T	P
	Group 1			
I	**Preliminaries** (a) Symbolic logic; (b) Necessary vs. sufficient conditions; (c) Methods of proof	2	0	0
	Group 2			
II	**Linear Algebra** (a) Vectors; Vector Spaces; Linear Dependence; Rank and Basis; Inner Product and Norm. (b) Matrices; Basic operations; Rank of a matrix; Inverse of a matrix. (c) Systems of Linear Equations; Existence, uniqueness and calculation ofsolutions; Determinants; Matrix Inversion; Cramer's Rule. (d) Eigenvalues and Eigenvectors; Relationship with Trace and Determinant; Symmetric matrices; Spectral Decomposition; Quadratic Forms and their Definiteness	10	3	0
	Group 3			
III	**Real Analysis** (a) Real Space; (b) Sequence and Limit; Sequence and Limit in Vector Space; (c) Open Set; Closed Set; Compact Set in Vector Space; Bolzano-Weierstrass Theorem;	6	3	0
IV	(d) Continuous functions; Weierstrass' Theorem. **Differential Calculus** (e) Single variable case: Slope of a function and its derivative; Continuity andDifferentiability; approximation by differential; higher order derivatives. (f) Multiple variables case: Partials; Total Derivative; higher order derivatives.(c)Vector-valued functions; Jacobian Matrix.	9	3	0
V	(d) Composite functions; Chain Rule. Inverse function and its derivative. **(e)** Implicit function; Implicit functions of several variables; Systems of Implicit Functions; Solutions of Systems of Implicit Functions: the Implicit Function Theorem. **Convex Analysis** Convex Sets; Intermediate Value Theorem; Mean Value Theorem; Taylor's Expansion. Concave functions; Concave functions on convex sets; differentiable functions on	4	1	0

	convex sets and concavity. Quasi-concave functions on convex sets; differentiable functions on convex sets and quasi-concavity.			
	Group 4			
VI	**Unconstrained Optimization** (a)Local and Global maximum; Existence and uniqueness; (b)Necessary and sufficient conditions for local maximum; (c) Necessary and sufficient conditions for global maximum	3	1	0
VII	**Constrained Optimization** (a) Optimization with equality constraints; Necessary and sufficient conditions for constrained local maximum; sufficient conditions for constrained globalmaximum. (b) Optimization with inequality constraints; saddle point; constrained global maximum and saddle points; Kuhn-Tucker Conditions and Saddle Points; Sufficient conditions for constrained global maximum; Necessary and sufficient conditions for constrained local maximum.	8	3	0
VIII	**Applications** (a) Linear Programming (b)Integration; differential equations; Optimal Control and Dynamic Programming Problems	4	0	0
	Total	**46**	**14**	**0**

Evaluation criteria:

Homework Assignments	:	30%
Test 1 [Group 2]	:	20%
Test 2 [Group 3]	:	30%
Major Exam - [Group 4]	:	20%

Learning outcomes:

At the end of this course, students will be able to

1. Master the essential concepts and techniques of Linear Algebra, Real Analysis and Optimization and apply them to important economic problems [Test 1, Test 2, and Major exam]
2. Understand and appreciate the motivation of essential mathematical assumptions made in economic modelling [Major exam]

Pedagogical approach:

Classroom teaching, interaction and quizzes; tutorials to discuss problem sets and economic applications

Materials:

Primary Textbook:

1. Simon, C.P. and Blume, L., 1994. *Mathematics for economists*, New York: Norton.

Additional Textbooks:

1. Sydsæter, K., Hammond, P., Seierstad, A. and Strom, A., 2008. Further mathematics for economic analysis. Pearson education.
2. Sydsæter, K. and Hammond, P., 2008. Essential mathematics for economic analysis. Pearson Education.
3. Sundaram, R.K., 1996. A first course in optimization theory. Cambridge university press.
4. Vohra, R.V., 2004. Advanced mathematical economics. Routledge.
5. Lucas, R.E. and Stokey, N.L., 1989. Recursive methods in dynamic economics, Harvard University Press
6. Alpha C. Chiang, 1992. Elements of dynamic optimization. McGraw-Hill.

Preparatory Textbook:

1. Chiang, A.C., 1984. *Fundamental methods of mathematical economics*, McGraw-Hill.

Additional information (if any):

Lecture notes and problem sets will be provided.
Knowledge of Mathematics at the level of 10+2 is required.

Student responsibilities: Attendance, feedback, discipline: as per university rules.

Course reviewers:

1. Tridip Ray, Professor, Economics and Planning Unit, Indian Statistical Institute, New Delhi
2. Subrata Guha, Associate Professor, Centre for Economic Studies and Planning, JawaharlalNehru University, New Delhi

Prepared by:

Soumendu Sarkar

Course title: Microeconomics-I			
Course code: MPE 134	**No. of credits:** 4	**L-T-P:** 44-16-0	**Learning hours:** 60
Department: Department of Policy and Management Studies			
Course coordinator: Dr Montu Bose	**Course instructor:** Dr Montu Bose		
Contact details: montu.bose@terisas.ac.in			
Course type: Core	**Course offered in:** Semester 1		

Course description:

Microeconomics is the study of decision-making at the level of the individual or the firm and how it relates to market behaviour. It begins with study of decision-making when markets are competitive, i.e., when individuals cannot influence the market price and there is no information asymmetry. We show that rational decision-making in competitive markets lead to efficient outcomes. Subsequently, we show that markets are no longer efficient when the assumption of competition is withdrawn. We consider three such deviations from competitive markets, viz., monopolistic behaviour, strategic behaviour and asymmetric information, leaving the analysis of public goods andexternalities for courses on environment and natural resources.

Course objectives:

1. To introduce students to models of individual and market behaviour at an advanced level of rigour
2. To familiarise students with mathematical modelling in Microeconomics
3. To emphasize the role of simplifying and critical assumptions in microeconomic modelling

Course contents

Module	Topic	L	T	P
	Group 1			
I	**Consumer Behaviour** Preference and utility representation; utility maximisation and expenditure minimisation; duality; market demand; consumer's welfare.	7	2	
II	**Producer Behaviour** Technology and its representations; profit maximisation and cost minimisation; duality; market supply.	3	2	
III	**Competitive Market: Partial equilibrium** Competitive equilibrium; comparative statics; welfare.	5	2	
IV	**Competitive Market: General Equilibrium and Pareto Optimality** Fundamental Theorems of Welfare Economics.	5	2	
V	**Uncertainty** Expected Utility Theorem, Measures of Risk Aversion; Insurance; General Equilibrium with uncertainty	4	2	
	Group 2			
VI	**Monopoly**	4	2	
VII	Monopoly pricing; Price Discrimination; durable goods; Coase conjecture;Product differentiation. **Strategic Behaviour** Representation of games; Dominant Strategy; Nash Equilibrium; subgame perfection; repeated games; Applications: Cournot, Bertrand, Stackelberg leadership, Entry deterrence, Rubinstein bargaining.	6	2	
	Group 3			
VIII	**Information and Games of Incomplete Information** Information Asymmetry and the "Lemons" problem; Adverse selection; Moral Hazard; Games of Incomplete Information and Bayes-Nash equilibrium; Basic Theory of Auctions; Myerson optimal auction; Dynamic Games of Incomplete Information and Perfect Bayesian equilibrium; Spence job market signalling.	8	2	
IX	**Markets as Institutions** Transaction cost approach: Coase and Williamson	2		
	Total	**44**	**16**	**0**

Evaluation criteria:

Homework Assignment: 20% [Module I-V]
Test 1: Written Examination : Group 1 40%; [Module I-V]
Test 2: Written Examination : Group 2: 20%; [Module VI-VII]
Major Exam: Written Examination : Group 3: 20% [Module VIII- IX]

Learning outcomes:

At the end of this course, students will be able to

1. Understand standard theoretical models of individual and market behaviour at a rigorous level [Homework Assignment and Test 1 exam]
2. Mathematically formulate key microeconomic problems and salient variations [Homework Assignment, Test 2 exam and Major exam]
3. Critically appreciate microeconomic assumptions and their limitations [Test 1,2 exam and Major exam]

Pedagogical approach: Classroom teaching; interactive sessions; tutorials for problem solving.

Materials:

Required Texts:

1. Mas-Colell, A., Whinston, M.D. and Green, J.R., 1995. *Microeconomic theory*. New York: Oxford university press.
2. Jehle, G.A. and P.J. Reny,2011.*Advanced Microeconomic Theory* (3rd Edition), Prentice Hall.
3. Tirole, J., 1988. *The theory of industrial organization*. MIT press.
4. Gibbons, R., 1992. *Game theory for applied economists*. Princeton University Press.
5. Salanié, B., 2005. *The economics of contracts: a primer*. MIT press.

Required papers:

1. Coase, R.H., 1960. The problem of social cost. *The journal of Law and Economics*, 3(1), pp.1-40.
2. Coase, R.H., 1937. The nature of the firm. *Economica*, *4*(16), pp.386-405.
3. Williamson, O.E., 2000. The new institutional economics: taking stock, looking ahead. *Journal of Economic Literature*, *38*(3), pp.595-613.

Additional information:

Lecture notes and problem sets will be provided.
Knowledge of high school calculus is required to follow most of the topics.

Student responsibilities: Attendance, feedback, discipline: as per university rules.

Course reviewers:

1. Krishnendu Ghosh Dastidar, Professor, Centre for Economic Studies and Planning, Jawaharlal Nehru University, New Delhi.
2. Manipushpak Mitra, Professor, Economic Research Unit, Indian Statistical Institute, Kolkata.

Programme Structure (MA SDP)

First year			
	Course	**Credit**	**Duration**
SEM-I	7 core courses	18	15 weeks
SEM-II	7 core courses	20	15 weeks
	Minor Project	2	8 weeks
Second Year			
SEM-III	3 core courses	10	15 weeks
	3 (or more) electives	9 (can be exceeded if student opts for more than 3 electives)	
SEM-IV	Major Project	16	20 weeks
Total Credit		**75**	

Course outline for MA SDP (Semester-1)

Course Code	**Course Name**	**Proposed Credit**	**Type**
Semester- 1			
MPD-114	Current Advances in Environmental Science	3	Core
MPD-143	Principles of Economics	3	Core
MPD-139	Themes and Perspective on Development	2	Core
MPD-107	Global Classroom: Integrated Approaches to Sustainable Development	2	Core
MPD-154	Law, Society and Sustainable Development	2	Core
MPD-137	Qualitative Research Methods for Development practice	3	Core
MPD-115	Quantitative Approaches & Methods for Development Practice	3	Core
Total Credit (SEM-I)		**18**	

Course title: Principles of Economics			
Course code: MPD 143	**No. of credits:** 3	**L-T-P: 37-08-00**	**Learning hours:** 45
Pre-requisite course code and title (if any): NA			
Department: Department of Policy and Management Studies			
Course coordinator(s): Dr Gopal Sarangi		**Course instructor(s):** Dr Gopal Sarangi	
Contact details: gopal.sarangi@terisas.ac.in			
Course type: Core		**Course offered in:** Semester 1	

Course description

This introductory course primarily covers the core and fundamental aspects of microeconomics and macroeconomics. The goal of this course is to make students understand the key economic concepts, theories, and principles and how they relate to the world they live in. The emphasis is laid on building students critical thinking and analytical abilities in microeconomics and macroeconomics. The central focus of this course is how and why markets (one important mechanism for allocating scarce resources) operate, and why markets and pricing principles are fundamental in trade-off and choice questions. Besides, how the key economic decisions are made by households and firms are discussed and exemplified. Production, costs, and market structures are analyzed at firm level. Key macro-economic issues such as output, income, and employment are discussed and their impact on inflation and other macroeconomic indicators are examined. In each module, Indian context is highlighted so that students can connect theories to practice and to policies. Explanations of economic concepts are supplemented by application-based cases studies and live examples.

Course objectives-

- To develop students critical thinking and analytical abilities around concepts of economics
- To make students understand key economic principles, theories and relate it to the world they live in.
- To make students understand how and why markets work and how prices are determined
- To understand and analyze how output and income are determined at an aggregated level and impact the (un)employment and inflation
- To help students hone skill sets of analyzing, interpreting economic variables through diagrams, and graphs

Course content

Module	Topic	L	T	P
I	**Introduction to economics** - Basic concepts of Economics - Understanding the philosophy o of economics - Nature of economics: Is economics a science or an art? - Definitional pluralities and distinctions such as micro-versus macro, theories versus models - A brief history of ideas in economics - Techniques of economic analysis: theories, models and tools	4	0	0
II	**Demand, Supply, Elasticities, and Market Efficiency** - The economic problem of scarcity, choice, and opportunity cost - Demand, supply, and market equilibrium - Demand and supply applications - Consumer surplus and producer's surplus - Market efficiency and their applications - Elasticity: its various forms and estimation methods, elasticity, and total revenue - Elasticity applications in the field of energy and environment - Utility, Preferences and Choice - Budget constraints, determination of optimal choices using indifference curve analysis and its applications - Behavioral economics as an alternative framework of consumer choice	8	2	0
III	**Production and Cost** - Production Theory - Production function and different forms - Short-run and long-run production function, Isoquants, MRTS - Total, average, and marginal products Economies of scale and scope - Theory of cost - Short-run and long run costs, cost minimization - Total, average and marginal costs - Applications of production and costs theory	8	2	0
IV	**Market structure and regulation** - Market equilibrium and price determination under different market structure - Perfect and Imperfect market structure, welfare costs of monopoly	6	2	0

	- Market structure, efficiency, and regulation - Regulation of public monopolies - Application in case of infrastructure industries such as energy and water			
V	**National Income Accounting** - Measuring national income, output, and employment – different approaches - Determination of aggregate output, price level and interest rate – classical, Keynesian, and modern theories and approaches - GDP estimation in India	6	1	0
VI	**Macro-economic policies** - Policy effects: monetary and fiscal policy - Indian monetary and fiscal policies: evidence from its evolving dynamics - Open economy macro-economic: balance of payment, exchange rate, international trade, Indian case study	5	1	0
	Total	**37**	**8**	**0**

Evaluation criteria:

- Test 1: 20%
- Assignment (individual): 20 %
- Summative Quizzes: 10%
- Classroom exercises: 10 %
- Major Exam: 40%

Learning outcomes

By the end of the course, students would be able to –

- understand the core micro and macroeconomic concepts, theories, models, principles, tools, and techniques
- understanding the role of market and prices in influencing key economic activities
- develop the skills to interpret, analyze the economic concepts and variables through diagrams, tables and graphs
- relate the key economic principles to real life situations, especially in the context of development challenges which would help students to make informed decisions

Pedagogical approach

The course will be delivered through a mix of classroom lectures, quizzes, discussions, classroom exercises and assignments and case studies discussion and presentation.

Course Reading Materials

Suggested core readings:

- Principles of Economics, Karl Case, Ray Fair, and Sharon Oster, 12th Edition, Pearson Education Inc., 2017.
- Principles of Economics, Mankiw, N. Gregory, 4th edition. South-Western College Publications, 2006.
- Principles of Economics, Stiglitz, J.E. and C.E. Walsh, 3rd Edition. New York: W.W. Norton & Company, 2002.
- Macro Economics, R. Dornbusch, S. Fischer, and R. Startz, 10th Edition, Tata-McGraw-Hill, 2012.
- Macroeconomics, Olivier Blanchard, 5th edition, Pearson Education Inc., 2009.

Advanced Reading Material

- Intermediate Micro-economics: A Modern Approach, H.L Varian, 8th Edition, W.W. Norton & Company, 2010.
- Fundamentals of Microeconomics, C. Snyder and W. Nicholson, 11th Edition, Cengage Learning (India), 2012.
- Macro-Economics: Theory and Policy, W.H. Branson, Third Edition, East-West Press, 2005.
- Macroeconomics, Richard T. Froyen, 2nd Edition, Pearson Education Asia, 2005

Additional readings

- An Inquiry into the Nature and Causes of the Wealth of Nations, Adam Smith
- Economics: A Very Short Introduction, Partha Dasgupta, First Edition, Oxford University Press, 2007
- The Company of Strangers, Paul Seabright, Princeton University Press, 2010
- Free to Choose, Milton Friedman and Rose Director Friedman, First Edition, Mariner Books, 1990
- The Armchair Economist: Economics and Everyday Life, Steven E. Landsburg, The Free Press, New York, 2012

Additional information

Student responsibilities

Attendance: At-least 75% attendance will be necessary to be able to appear for the final exam

Course reviewers:

Prof. Saon Ray, Professor, ICRIER

Dr Chandra Sekhar Bahinipati, Assistant Professor, IIT Tirupati

Course title: Global Classroom: Integrated Approaches to Sustainable Development			
Course code: MPD 107	**No. of credits:** 2	**L-T-P: 30-0-0**	**Learning hours: 30**
Pre-requisite course code and title (if any):			
Department: Department of Policy and Management Studies			
Course coordinator(s): Dr Swarup Dutta	**Course instructor(s):** Dr Swarup Dutta		
Contact details: swarup.dutta@terisas.ac.in			
Course type: Core	**Course offered in:** Semester 1		

Course description

The course largely comes under the global MDP Programme, coordinated by the Global Secretariat of MDP located within the UN Sustainable Development Solutions Network (SDSN) office, New York, USA. Through this global MDP association, the students get an opportunity to take the lectures in global classroom which is essentially in online mode. The broad goal of this course is to introduce the foundations of key sectoral and thematic knowledge for challenges to sustainable development and for this, the course has been divided into four modules, one for each pillar of sustainable development: governance, economic well-being, environmental protection, and social inclusion. All the modules are interrelated and integrated with each other and that is why the course is named as integrated approach to sustainable development.

The course is unique in nature as it allows the students from different parts of the world to participate in collective learning experiences. The global classroom is currently conducted by Lehigh University USA and is attended for 14 weeks, beginning each September. The course materials, including the syllabus, readings, lecture videos, etc. are available to the students. Besides global classroom, local lectures are also being conducted by the local experts. This helps the students to sync both global and local perspectives while identifying the challenges and way forward to implement the SDGs. Each module is divided into four sections, starting with (i) a global thought leader to provide a current overview of the module, (ii) a global expert to lead a deeper dive into the module, and (iii) a practitioner who is currently applying the SDGs in action to offer a perspective from the front lines and finally (iv) a regional or local expert, who will share the regional and local perspectives.

Course objectives

Main objectives of the course are to make the students to –

- familiar with current and emerging global issues related to sustainable development
- be equipped to analyze critical dimensions of sustainable development in the context of both industrialized and developing countries
- be cognizant of the key spatial and temporal connections and their integration for successful policy and practice of sustainable development.

Course content

Module	Topic	L	T	P
1	**Economic well-being** Main aim of this module is to make the students understand the basic aspects wellbeing in relation to sustainable development and related SDGs. a) Both global and local experts will specifically highlight the economic wellbeing including the ability of individuals, families, and communities to consistently meet their basic needs (including food, housing, utilities), health care, transportation, education, childcare, clothing, and paid taxes), and have control over their day-to-day finances and financial security.	**7**	**0**	**0**
2	**Environmental Dimension of Sustainable Development** Main aim of this module is to provide a systematic approach for conserving natural resources and the existing natural environment, managing hazardous materials, and raising awareness of environmental impacts. The experts will be focusing on a) various SDGs, providing country-wise case studies on national policy for the environment and for water resources. b) orient the students reading various policies for the preservation, conservation and sustainable use of ecosystems, biodiversity, and forests.	**7**	**0**	**0**
3	**Governance for sustainable development** The basic objective of this module is to understand the role of SDGs in good governance. The global experts will explain how various agencies assist developing countries to develop on effective government within a democratic system, and to implement sustainable development principles through global partnership. Three major highlights are – a) mechanisms of empowering the public to enable them to effectively participate in decision making for public interest and to undertake local initiatives.	**7**	**0**	**0**

	b) how to develop and strengthen good governance at the local level? c) how the capacity of public and the government at the local level help to cooperate in increasing welfare of the people?			
4	**Social Inclusion** The objective of this module is to orient the students regarding the concept of social inclusion. The students will be able to understand – a) different forms of inequalities, employment related concerns, informal sector b) how poverty, social stratification like caste, class, gender, ethnicity etc. play a divisive role in the society, which in fact major hindrance for achieving SDGs. **c)** how SDGs could play a major role for eradicating the exclusion to direct it more inclusive society.	**9**	**0**	**0**
	Total	**30**	**0**	**0**

Evaluation criteria

- **Assignment 1 (90%):** A policy brief, written in a group of two individuals, would be approximately 1500-2000 words in length. The policy brief would require the students to display deep substantive knowledge of sustainable development policy field and grasp of relevant methods / data challenges. The policy brief accounts for 90% of the final grade
- **Active class participation (10%)** throughout the semester, accounting for 10% of the final grade: Students are expected to actively participate in Global Classroom discussions and Local Classroom discussions, drawing deeply on class readings and on their experience. Students are expected to attend every session and actively participate in the discussions.

Learning outcomes

- The students will be able to identify and analyze key challenges in the implementation of Sustainable Development Goals (SDGs)
- The students will be able to synthesize and review the policy relevant to their area of intervention
- It will relate the findings to current policy debates, with an emphasis on applying the research outcomes rather than assessing the research procedures.

Pedagogical approach

- The course will achieve its learning objectives by deploying a combination of lectures from internationally recognized experts, local experts, classroom and online discussion, extensive readings, and class writing projects like Policy Brief etc.
- The global classroom will be conducted online through the Zoom Video Conferencing web-based platform, and the local lecturer will be conducted in the campus and the local lectures will be conducted in offline mode.
- Global Thought Leaders will speak for at least 45 minutes, and any remaining time will be devoted to Q&A session between classrooms and the speaker, whereas the experts and practitioners will speak for a shorter period than the Global Thought Leaders, the class will be opened to live Q&A session and interactive discussion among participating classrooms
- As far as local expert lecture is concerned there will be one lecture in modules 1, 2 and 3, and two local lectures in module 4.

Course Reading Materials:

All readings will be posted on the course website a minimum of one week in advance, with some indicated as required and others as recommended. These may change as new ones are considered. For some topics, students may be requested to view a video or become familiar with relevant websites. While the Tuesday Global Classroom speakers will address some of the issues covered in the readings, the readings are designed to provide a background to the topic of discussion and are complementary to the lectures. Students may be invited at random to provide an overview of issues for debate.

Module--1

- Gérard Roland, (2020) 'Transition and Politics: Politics, Markets and Firms', The MIT Press, Cambridge, Massachusetts
- Peter Hall and David Soskice, (2001) 'Varieties of Capitalism: The Institutional Foundations of Comparative Advantage', First edition, New York: Oxford University Press
- Walsh PP, Murphy E, Horan D. (2020) "The Role of Science, Technology and Innovation in the UN 2030 Agenda", Technological Forecasting and Social Change.
- Rene Karsenti, Social Bonds in Response to Covid-19 Crisis: When Financial Markets Save Lives, European Capital Markets Institute, May 20, 2020

- Patel, S., Maley, S., & Mehta, K. (2014). Appropriate Technologies in the Globalized World: FAQs [Commentary]. IEEE Technology and Society Magazine, 33(1), 19-26.
- Gilliam, J., & Mehta, K. (2018). A taxonomy of failure modes of agricultural technology ventures in developing countries: part 1. Journal of Humanitarian Engineering, 6(1). [click "download manuscript" button on right]
- Gilliam, J., & Mehta, K. (2018). A taxonomy of failure modes of agricultural technology ventures in developing countries: part 2. Journal of Humanitarian Engineering, 6(1).
- Sundin, P., Callan, J., & Mehta, K. (2016). Why do entrepreneurial mHealth ventures in the developing world fail to scale? Journal of medical engineering & technology, 40(7-8), 444-457.

Module-2

- Pendleton, L., Evans, K. and Visbeck, M. (2020) Opinion: We need a global movement to transform ocean science for a better world. PNAS Proceedings of the National Academy of Sciences of the United States of America, 117 (18). pp. 9652-9655. DOI 10.1073/pnas.2005485117.
- Visbeck, M. (2018). Ocean science research is key for a sustainable future. Nature communications, 9(1), 690.
- Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, M. C., Shyamsundar, P., … & Noble, I. (2013). Policy: Sustainable development goals for people and planet. Nature, 495(7441), 305-307. Chicago
- Nilsson, M., Griggs, D., McCollum, D., & Stevance, A. (2017). A guide to SDG interactions: From science to implementation. [Read at least the Executive Summary/Introduction (pages 7-30) and SDG 14/Looking Ahead (pages 174-225)]
- Visbeck, M., Kronfeld-Goharani, U., Neumann, B., Rickels, W., Schmidt, J., Van Doorn, E., … & Quaas, M. F. (2014). Securing blue wealth: The need for a special sustainable development goal for the ocean and coasts. Marine Policy, 48, 184-191.
- Vitousek, P. M., Mooney, H. A., Lubchenco, J., & Melillo, J. M. (1997). Human domination of Earth's ecosystems. Science, 277(5325), 494-499.
- Jayachandran, S. (2015). The roots of gender inequality in developing countries. Economics, 7(1), 63-88.
- Beaman, L., Duflo, E., Pande, R., & Topalova, P. (2012). Female leadership raises aspirations and educational attainment for girls: A policy experiment in India. Science, 335(6068), 582-586.
- Dhar, D., Jain, T., & Jayachandran, S. (2018). Reshaping adolescents' gender attitudes: Evidence from a school-based experiment in India (No. w25331). National Bureau of Economic Research.

Module:3

- Sachs, J. D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rockström, J. (2019). Six transformations to achieve the sustainable development goals. Nature Sustainability, 2(9), 805-814.
- United Nations (2015). Transforming our World: The 2030 Agenda for Sustainable Development.
- Bertelsmann Stiftung and Sustainable Development Solutions Network (2020). The Sustainable Development Goals and Covid-19. (The 2020 SDG Index and Dashboards Report).
- Sachs, J. D. (2015). The Age of Sustainable Development. Columbia University Press.
- Sachs, Jeffrey D. (2005). The End of Poverty. New York: Penguin Press [Chapters 2 and 3]
- Acemoglu D. and Robinson J.A. (2013). "Economics versus politics: pitfalls of policy advice." Journal of Economic Perspectives. 27, 2:173–92.
- Chambers, Robert (1995). "Poverty and Livelihood: Whose reality counts?" Environment and Urbanization, 7: 173.
- Strandenaes, J. G. (2011). Sustainable development governance towards Rio+ 20: framing the debate. SDG 2012.
- Strandenaes, J. G. (2014). Participatory Democracy—HLPF Laying the Basis for Sustainable Development Governance in the 21st Century. Report for UN-DESA. Available at: http://sustainabledevelopment. un. org/index. php. [Read Executive Summary only]

- Caballero, P. (2019). The SDGs: changing how development is understood. Global Policy, 10, 138-140.

Module 4

- Gates Foundation (2021). 2021 Goalkeeper Report: Innovation & Equity.
- Vallely, P. (8 September 2020). How Philanthropy benefits the super-rich. The Guardian, 8.
- Ducharme, J. (9 September 2021). Time Magazine. "COVAX Was a Great Idea But Is Now 500 Million Doses Short of Its Vaccine Distribution Goals. What Exactly Went Wrong?"
- Pattberg, P., & Widerberg, O. (2016). Transnational multistakeholder partnerships for sustainable development: Conditions for success. Ambio, 45(1), 42-51.
- Conway, R., Masters, J., & Thorold, J. (2017). From design thinking to systems change. How to invest in innovation for social impact. RSA Action and Research Centre.
- Horan, D. (2019). A new approach to partnerships for SDG transformations Sustainability, 11(18), 4947.
- Wear, S. L. (2019). Battling a common enemy: joining forces in the fight against sewage pollution. BioScience, 69(5), 360-367.
- Wear, S. L. (2016). Missing the boat: Critical threats to coral reefs are neglected at global scale. Marine Policy, 74, 153-157.
- Wear, S. L., & Thurber, R. V. (2015). Sewage pollution: mitigation is key for coral reef stewardship. Annals of the New York Academy of Sciences, 1355.
- Wear, S. L., Acuña, V., McDonald, R., & Font, C. (2021). Sewage pollution, declining ecosystem health, and cross-sector collaboration. Biological Conservation, 255, 109010.
- United Nations (2018). Youth 2030: Working with and for Young People, the first-ever UN system-wide strategy on youth.
- ActionAid International (2020). Believe in Better: A Working Paper on Young People's Inclusion in National Follow Up, Review and Accountability Processes of the 2030 Agenda for Sustainable Development.

Student responsibilities

- Attendance: At-least 75% attendance will be necessary to be able to appear for the final exam.

Course Reviewer:

- **Dr C. Mahajan, Associate Professor, University of Delhi**
- **Dr Emily Van Houweling, Associate Professor, Regis University, USA**

Course title: Current Advances in Environmental Science			
Course code: MPD-114	**No. of credits:** 3	**L-T-P distribution:** 42-0-6	**Learning hours:** 45
Pre-requisite course code and title (if any):			
Department: Department of Policy and Management Studies			
Course Instructor: Prof. V. Subramanian			
Contact details: subra42@gmail.com			
Course type: Core		**Course offered in:** Semester 1	

Course Description:

The course aims at transferring basic knowledge in environmental science with a special emphasis in ecology. Based on this knowledge the students will learn and experience the practical implication of environmental science in the context of natural resource management. Lectures and tutorials will be supplemented with a field trip to expose the students to realities of land use, agriculture and water quality issues specially designed for students of social science and humanities with limited or no knowledge of physical/biological sciences; studies on sustainability requires knowledge of natural processes and their interlinkages with social and land use changes and natural resources management

Course objectives:

- The objective of the course to get the students an insight of the role of environmental science in selected fields of natural resource management in a development context.

Module	Topic	L	T	P
1	**A brief introduction to physical, natural, and environmental sciences** – Issues in today's earth systems – Resources including oceans – Shift from green to blue energy and technology – Data basis for science and technology	**5**	**0**	**0**
2	**Ecological concepts** – Earths system - land, oceans, water and life and changes with space and time – Evolution and extinction - past mass extinctions and future scenario in view of forced climate change – Origin of life and theories of evolutionary process – Science of ecology – Mineral and other natural resources – Fresh water and marine ecosystem resources	**9**	**0**	**0**
3	**Biodiversity- past, present, and future trends** – Threats to land and blue ocean biodiversity – IUCN approach to study biodiversity – Global and local hot spots – Conservation measures both traditional and technology-based approach to preserve nature – Regional and global scenes on richness and threats to flora and fauna – Marine pollution and impact on blue water bio-resources urbanization, land use changes and biodiversity impact	**7**	**0**	**0**
4	**Forestry:** – Origin and distribution of forests, deforestation, and social forestry – types of forests and their role in carbon sink and sources – global approach to forest conservation – Urbanization and impact on forests – forest dwellers and their role in traditional forest conservation – Chipko movement (environmental conservation movement) – hotspots in South Asia – Reforestation of degraded land (case studies from Brazil, India, and Indonesia)	**6**	**0**	**0**

	– Modern forest management tools (IUCN based modern tools – case study Myanmar)			
5	**Agriculture:** – Origin and history of agriculture – Diversity of crops over space and time – cost factors and management practices – Climate change and agriculture: Impact on climate change due to greenhouse gases from agricultural practices – Globalisation and impact on agricultural practices regionally and locally – issues specific to Indian farmers – Conflict with other land use pattern – Biotechnology and agriculture	**7**	**0**	**0**
6	**Water Resources** – Demand supply related conflict – Cost benefit, equity, and affordability – Rural-urban divide – Water conflicts at different scales – Impact of climate change on water resources – Water demand for crops, forests, people- conflicts and contradictions – Technology driven management practices in urban water distribution	**8**	**0**	**0**
7	**Fieldwork** – A short fieldwork will be conducted in Delhi to understand various environmental issues. The students will visit the field with prior questions. Both observation and interview techniques will be employed. They will observe various environmental challenges and will conduct interviews with the community to get more deeper understanding of the problems. After the visit, the students will present the observation and findings and will submit a report subsequently.	**0**	**0**	**6**
	Total	**42**	**0**	**6**

Evaluation procedure:
Each module will be evaluated by written test, assignments, or oral presentations:

- Test 1: 10%
- Test 2: 15%
- Field Trip: 15 %
- Term paper: 10%:
- Major: 50%

Learning outcomes:

- The students will understand the principles of environmental science.
- The students will be familiar with basic ecological principles and their application.

Pedagogical approach: The course will be delivered through a mix of classroom lectures and case study discussion. The field visit and group exercises will help students understand real – life challenges and willenable them to identify practical solutions from social, environmental, and economic perspective.

Suggested Readings:

- Cunningham and Cunningham (2007). Principles of Environmental Science, special Indian editions, Tata McGraw Education Private Limited, New Delhi
- Driessen et al. (2001): Lecture notes on the major soils of the world, FAO 2001
- Odum E. P. and Gray W. B. (2005). Fundamental of Ecology, Indian reprint 2007 Akash Press, New Delhi
- Withmore, T. C. (1998). Forest Dynamics. Kapitel 7 in "An Introduction to Tropical Rain Forests" Oxford University Press, S. 109-155.
- Rockström et al. (2009): A safe operating space for humanity, *Nature* 461, 472-475
- Fukuoka, M (1975), One Straw Revolution, Rodale Press, New York.

- V. Subramanian (2005) A textbook on environmental sciences, Narosa publishers. 301 pages
- V. Subramanian (2010) Rivers of South Asia- To link or not to Link. Capital publishers. 410 pages.

Other supporting readings:

- Linden Mayer, B. and Franklin, J. F. (2006): Conserving Forest Biodiversity, A comprehensive multiscale approach, Island Press, Washington - Covelo - London
- Millennium Ecosystem Assessment. (2005). Ecosystems and Human Well-Being - Synthesis. Washington, DC.
- Begon M. et al. (2006): Ecology, From Individuals to Ecosystems, 4th edition, Blackwell Publishing, Malden - Oxford - Victoria
- FAO CD 19: Soils of the tropics
- Journal: Biodiversity Conservation
- Journal: Forest Ecology and Management
- Schumacher, E (1989), Small is beautiful – Economics as if People Mattered, Harper and Row Publishers, New York.

Additional information (if any):

Student responsibilities:

Attendance: At-least 75% attendance will be necessary to be able to appear for the final exam.

Course Reviewers:

- Dr. Neeraj Khera, Biodiversity Programme, GIZ, New Delhi.
- Dr. Peter v. d. Meer, ALTERRA, Wageningen, Netherland

Course title: Quantitative Approaches and Methods for Development Practice			
Course code: MPD 115	**No. of credits:** 3	**L-T-P:** 34-6-10	**Learning hours:** 50
Pre-requisite course code and title (if any):			
Department: Department of Policy and Management Studies			
Course coordinator(s): Dr Chandan Kumar	**Course instructor(s):** Dr Chandan Kumar		
Contact details: chandan.kumar@terisas.ac.in			
Course type: Compulsory Core	**Course offered in:** Semester 1		

Course description

This course is designed and implemented to help students develop and strengthen their ability to understand the importance and scope of quantitative approaches and methods in development-related investigations. The course aims to create a firm base on basic statistical tools and techniques, their appropriate application in development research and to help students build perspectives based on robust analytical approaches.

Learning objectives:

- To provide students with a basic ability to design a quantitative study.
- To enable students to draw inferences from the data.
- To help students make the optimal decision on the selection of appropriate statistical methods for quantitative data analysis.

Course content

Module	Topic	L	T	P
1	**Gains and Fundamentals of Quantitative Approaches in Development Inquiry** This module aims to orient students towards the need and application of statistical tools and quantitative approaches in the development sector. Since the students pursuing the MA-SDP programme come from diverse disciplines' backgrounds and they might not have sufficient exposure to statistics during their undergraduate courses, example-basedintroduction to statistical techniques and their applications is emphasized. This module will include discussion and practices on: a) Importance and Examples of Quantitative Approaches in Development Inquiry b) Statistical Thinking c) Types of Data	4		
2	**Quantitative Study Design and Process of Data Collection** The focus of this module would be on describing in detail the strategies a practitioner would use to collect data, making a note of how they will address the primary issues associated with the method they are employing to investigate development-related inquiries. The details included in this module are: a) Experimental Research Design: pre-experimental, true experimental, and quasi-experimental study design b) Non-Experimental/Observational/Survey Research Design: Cross-Sectional Design, Longitudinal Study Design c) Population, Sampling, and Subjects: concept of population and sample, various approaches to the sampling, central limit theorem, issues in sample size selection, and basic sampling designs d) Preparation of Survey Instrument: Questionnaire Construction – two-column-table-approach	8	2	2
3	**Quantitative Data Analysis and Assessment** This module will focus on describing the methods of quantitative data analysis, including the descriptive and inferential statistical tests. Discussion would also encompass the measures the practitioners should take to increase the validity and reliability of their results. The details included in this module are: a) Descriptive statistics: Frequencies, Measures of Central tendency, Measures of Dispersion b) Inferential statistics: introduction to hypothesis testing, type of statistical errors, level of significance, confidence interval, statistical vs. practical significance, and some commonly used statistical tests. c) Evaluating quantitative research: Validity and Reliability d) Bivariate analysis; Concept of Correlation and Regression (OLS) e) Concept of weighting survey data	14	2	6

4	**Introduction to Multivariate Analysis** The focus of this module is to provide students with an orientation on select multivariate regression models and their applications in different contexts of development inquiry, such as: a) Correlation Matrix and Multivariate Linear Regression method: application and fundamental assumptions/considerations; examples taken from different analyses carried out in the domain of the development sector; basic nuances including the method of ordinary least squares, regression coefficients, R^2 and adjusted R^2 b) Multivariate Logistic Regression Model: application and prerequisites; examples taken from different analyses carried out in the domain of the development sector c) Other popular multivariate models: application and prerequisites; examples taken from different analyses carried out in the domain of the development sector	6	2	
5	**Outlining, Interpreting and Discussing Quantitative Analysis** This module would focus on orienting the students to layout, interpret, present (including visual depictions of the data), and document the results of a quantitative research study. Major discussion would be around: a) Organization/presentation of quantitative data into meaningful tables b) Graphical presentation c) Interpretation and Discussion of results d) Acknowledging limitations of a quantitative study	2		2
	Total	**34**	**6**	**10**

Evaluation criteria:

Course grades will be based on the following criteria:

- **Test-1:** Written Test (20%); as a part of a mid-course evaluation under each Programme by the University in terms of intermediary minor tests, the students will be evaluated based on a written test. The structure of the minor test usually follows short-answer-type questions, which would cover the initial two modules of the course. This minor test would share one-fifth of the total marks required for evaluatingthe candidates under this course. The test will be conducted after 8 weeks of lectures or after the completionof modules 1-2.
- **Test-2:** Submission of Assignment (30%); the students are required to submit a set of three assignments basedon the statistical exercises conducted in the classroom. The preparation of this assignment would be made during the tutorial/practical classes and will be submitted and presented after the completion of relevant sections of the course or as suggested by the Course Instructor. One of those assignments could be the preparation of a structured questionnaire on their area of inquiry.
- **Major exam:** Presentation and submission of a quantitative study proposal (50%); the students are required to select any development inquiry which is quantitative in nature (based on the study objective), and develop a research proposal, which will be submitted and presented as a part of the major/final test. The structure of the research proposal for a quantitative research study includes:
  - Introduction
  - Research Questions
  - Objectives
  - Methodology: Research hypothesis; Study setting; Study design; Reference and study population; Sample size; Sampling method; Exclusion criteria (if any); Specify the measures/variables; Study tools/instruments; Technique/Process of using the instruments and making the measurements; Pilot study, Data analysis plan
  - Expected Outcomes
  - Study Timeline

Indicators for evaluation: (a) Identification of research problem; (b) Framing research questions, objectives and hypothesis (if any); (c) Description of components under methodology section; (d) Conceptualizing expected outcomes and timeline; (d) Content, language, clarity; (e) Reference style and number of references cited

Learning outcomes

1. Upon completion of the course, candidates would be able to use basic statistical tools, learn ways to present quantitative data and get the ability to draw useful inferences from analysed data.
2. Knowledge of statistical tools and their usage will help students appropriately apply such techniques in the research that they'll carry out in the following semesters as well as in future.
3. Students would get the ability to develop a research proposal based on objective(s) which require(s) investigation using quantitative approaches and methods.

Pedagogical approach

Classroom lectures, excel-based data analysis, interesting TED talks from renowned development specialists e.g., Hans Rosling, who uses Gap-minder software to bring data alive, and invited talks from guest speakers, especially those working in the development sector who could provide exposure to different sorts of quantitative analysis carried out by them on real-world data.

Suggested Readings

Module 1:

- Peck R, Olsen C, Devore JL (2016). *Introduction to Statistics and Data Analysis, 5th Edition*. Boston, MA,USA: Cengage Learning.
  - Chapter -1: The Role of Statistics and the Data Analysis Process [pp. 1-28]
  - Chapter -2: Collecting Data Sensibly [pp. 29-79]
- Gravetter FJ, Wallnau LB (2014). *Essentials of Statistics for the Behavioral Sciences, 8th Edition*. Belmont:Thomson Wadsworth.
  - Chapter -1: Introduction to Statistics [pp. 4-29]

Module 2:

- Creswell JW, Creswell JD (2018). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition*. California: SAGE Publication, Inc.
- Rosenbaum PR (2017). *Observation and experiment: an introduction to causal inference*. Massachusetts: Harvard University Press.
- Roy TK, Acharya R, Roy AK (2016). *Statistical Survey Design and Evaluating Impact*. Delhi: CambridgeUniversity Press.
  - Chapter -1: Introduction to Sample Survey Designs [pp. 1-12]
  - Chapter -2: Basic Sampling Designs [pp. 13-61]
- Kothari CR (2004). *Research Methodology: Methods and Techniques, 2nd Revised Edition*. New Delhi:New Age International Publishers.
  - Chapter -4: Sampling Design [pp. 55-68]

Module 3:

- Gupta SP (2005). *Statistical Methods*. New Delhi: Sultan Chand & Sons Educational Publishers
- Angrist JD, Pischke J-S (2015). Mastering 'Metrics: The Path from Cause to Effect. Princeton, New Jersey: Princeton University Press.
- Peck R, Olsen C, Devore JL (2016). *Introduction to Statistics and Data Analysis, 5th Edition*. Boston, MA,USA: Cengage Learning.
  - Chapter -5: Summarizing Bivariate Data [pp. 202-282]
  - Chapter -10: Hypothesis Testing Using a Single Sample [pp. 505-560]
  - Chapter -12: The Analysis of Categorical Data and Goodness-of-Fit Tests [pp. 624-661]
  - Chapter -13: Simple Linear Regression and Correlation: Inferential Methods [pp. 662-701
- Woodbury G (2002). *An Introduction to Statistics, 8th Edition*. Pacific Grove, CA, USA: Duxbury.
  - Chapter -6: The Central Limit Theorem and Confidence Intervals [pp. 263-309]
  - Chapter -7: One-Sample Hypothesis Tests [pp. 311-366]
- Kirk RE (2008). *Statistics: An Introduction, 5th Edition*. Belmont: Thomson Wadsworth.
  - Chapter -17: Statistical Inference for Frequency Data [pp. 468-497]
  - Chapter -18: Statistical Inference for Ranked Data [pp. 500-517]
- Gravetter FJ, Wallnau LB (2014). *Essentials of Statistics for the Behavioral Sciences, 8th Edition*. Belmont: Thomson Wadsworth.
  - Chapter -15: The Chi-Square Statistic: Tests for Goodness-of-Fit and Independence [pp. 509-534]

Module 4:

- Heeringa SG, West BT, Berglund PA (2010). Applied Survey Data Analysis. Chapman & Hall CRC Statistics in the Social and Behavioral Sciences Series. Boca Raton, FL: Chapman and Hall/CRC (Taylor & Francis Group).

Module 5:

- Peck R, Olsen C, Devore JL (2016). *Introduction to Statistics and Data Analysis, 5th Edition*. Boston, MA,USA: Cengage Learning.
  - Chapter -3: Graphical Methods for Describing Data [pp. 80-151]
  - Chapter -4: Numerical Methods for Describing Data [pp. 152-201]

Additional information: Up to 5 candidates will be accommodated from other courses/disciplines after discussion with the course coordinator

Student responsibilities

Attendance: At least 75% attendance will be necessary to be able to appear for the final exam.

Prepared by: Dr. Chandan Kumar

Course reviewers

1. Dr. Mathew Gayman, Associate Professor, Department of Sociology, Georgia State University, Atlanta, Georgia, United States of America.
2. Dr. Baowen Xue, Researcher, Department of Epidemiology and Public Health, University College London (UCL), London, United Kingdom.

Course title: Qualitative Methods for Development Practice			
Course code: MPD 137	**No. of credits:** 3	**L-T-P:33-0-24**	**Learning hours:** 45
Pre-requisite course code and title (if any):			
Department: Department of Policy and Management Studies			
Course coordinator(s): Dr Swarup Dutta	**Course instructor(s):** Dr Swarup Dutta		
Contact details: swarup.dutta@terisas.ac.in			
Course type: Core	**Course offered in:** Semester 1		

Course description

The course aims to build perspective, attitude, and skills for systematic enquiry of qualitative research while focusing both on theoretical and practical dimension. Considering holistic approach as a key principle, the course uses a combination of didactic, interactive, and applied techniques to teach knowledge and skills relevant to qualitative research in development studies. Starting with an understanding of philosophical foundation and theoretical framework, various elements of qualitative research design, data collection and analysis will be discussed thoroughly.

Course objectives

- To expose students to the insights of qualitative research from the perspective of development studies
- To Recognize the uniqueness and distinctiveness of qualitative research
- To orient students with various theoretical frameworks while designing the qualitative research
- To give practical training of qualitative data collection and analysis

Course content

Module	Topic	L	T	P
1	**Philosophy of social research** The main aim of this module is to facilitate the students to elucidate their philosophical stance in relation to elaborating their research approach towards social inquiry. The module will begin with the rationale of philosophical assumptions in research – ontology, epistemology, and methodology followed by the conceptualization of three broad research paradigms or worldviews – positivism, constructivism or interpretivism and pragmatism. Further, the students will also be oriented with few interpretive frameworks. Hence, the following topics will be covered in this module – – Key philosophical assumptions – ontology, epistemology, and methodology – Research paradigm/worldview – positivism, constructivism or interpretivism and pragmatic approach – Interpretive frameworks: Social Constructivism, Transformative Frameworks, Social Justice Interpretive Framework, Critical Theory	6		
2	**Designing qualitative study** Purpose of this module is to make a framework or blueprint for conducting the qualitative research. The module will start with the rationale of using qualitative study focusing exclusively on when to use and what a qualitative study requires from us. Five key approaches to qualitative research design followed by various aspects of literature review, formulation of research problems and questions will be discussed elaborately. – Rationale of using qualitative study – Five key approaches to qualitative inquiry – Narrative research – Phenomenological research – Grounded theory research – Ethnographic research – Case study research – Review of Literature – Referencing and citation (training in Mendeley software) – Framing research problem statement and questions – Research proposal writing	8		6
3	**Qualitative data collection** The purpose of this module is to understand various aspects of data collection in the field starting from the rapport establishment to qualitative sampling strategy, usage of various qualitative tools etc. The module will enable the students to expose the reality in the field situation while explaining various field related issues. The following topics will be covered in the module. – Access and Rapport (within the Five Approaches)	9		8

	– Qualitative sampling strategy (participants, types of sampling, sample size) – Forms of Data: *Interview methods* (in-depth interview and FGD); *Observation method* (direct, indirect, and participant observation) – Validity in qualitative research and mixed method – Field Issues (access to the organization, observations, interviews, documents and audiovisual materials, ethical issues)			
4	**Qualitative data analysis and representation** The main objective of this module is to analyze qualitative data as it largely involves organizing the data, conducting a preliminary read-through of the database, coding and organizing themes, representing the data, and forming an interpretation of them. The module will start with the qualitative content analysis and will subsequently highlight data coding and thematic analysis. The module will also introduce qualitative data analysis software called NVivo and a training session will be conducted at the end of the module. – Qualitative content analysis (conventional, directed, and summative content analysis, – Qualitative data coding (in-vivo coding, process coding, open coding, descriptive, and structural coding, simultaneous coding) and thematic analysis – Qualitative data analysis software (NVivo)	**10**		**10**
	Total	**33**		**24**

Evaluation criteria:

- **Test-1 (20%):** the minor test will specifically focus on students' overall understanding on research process covering Module 1 and 2.
- **Submission of Research Report (80%):** the students will conduct a small fieldwork in the Delhi and NCR region while choosing a topic. The students must incorporate qualitative in-depth interview, FGD, and observation methods. A brief literature review is also required for the submission. The structure of the report as follows
  - Introduction
  - Review of Literature
  - Research Methodology
  - Research Findings
  - Conclusion

  Indicators for assessment: (a) Gaps in the literature review and Identification of research problem; (b) Identification of research objectives and question(s) and methodological design; (c) analytical rigor of research findings and data representation; (d) Content, language, clarity (e) reference style and number of references cited

Learning outcome

- The students will be able to articulate the key features and benefits of qualitative research and when and how it can be utilized
- The students will be able to assess the applicability of a range of core qualitative approaches to their own research topics and understand how these approaches can be applied to conduct effective research
- The students will be competent to implement a range of qualitative data collection techniques including interviews, observations, and documents.
- With the help of hand-on-training, the students will be able to analyze qualitative data

Pedagogical approach

- To support active learning (both individual and group learning), the lectures in this course are supplemented with many practical works. The emphasis of practical hours (field visits) is to encourage the active involvement of students in undertaking tasks that help them better understand concepts / methods / tools in qualitative research in the field. Students practice and learn by conducting interviewing, focus groups, participatory exercises and survey methods are practiced, and evaluated, in the form of role play, in-class activities and group exercises.

Course Reading Materials

Module 1: Philosophy of social research

- Creswell, John W. (2013) Qualitative inquiry and research design: choosing among five approaches, 3rd ed. SAGE Publication Washington DC (Chapter 2)
- McCaslin, M.L. and Scott K. W. (2003) The Five-Question Method for Framing a Qualitative Research Study, *The Qualitative Report* Vol. 8(3) pp. 447-461
- Shah, S.S., Shah, A.A. and Khaskhelly, N. (2018) Pragmatism Research Paradigm: A Philosophical Framework of Advocating Methodological Pluralism in Social Science Research, *Grassroots*, Vol.52 (1)
- Carter, S. M., and Little, M. (2007). Justifying knowledge, justifying method, taking action: Epistemologies, methodologies, and methods in qualitative research. Qualitative health research, 17(10), 1316- 1328
- Rehman A. A. and Alharthi K. (2016) An Introduction to Research Paradigms, *International Journal of Educational Investigations*, Vol.3 (8), pp. 51-59

Module 2: Designing qualitative study

- Bryman, A., 2008, Social research methods, 3rd edition, Oxford: Oxford University Press.
- Creswell, John W. (2013) Qualitative inquiry and research design: choosing among five approaches, 3rd ed. SAGE Publication Washington DC (Chapters 3, 4 and 6))
- Desai, V. and Potter, R. B., 2006, eds., Doing Development Research, London: Sage.
- Joseph Maxwell. Qualitative Research Design: An Interactive Approach. Sage Publications. Chapter 4: "Research Questions: What do you want to understand?" (Chapter-4)

Module 3: Qualitative data collection

- Creswell, John W. (2013). Qualitative inquiry and research design: Choosing among five approaches, 3rd ed. SAGE Publication Washington DC (Chapters 7))
- Morse, J. M. (2000). Determining sample size. Qualitative Health Research, 10(1), 3-5.
- Russell Bernard. Research Methods in Anthropology: Qualitative and Quantitative Approaches. (Chapter 8)
- Timothy C. G. (2015). Descriptions of Sampling Practices Within Five Approaches to Qualitative Research in Education and the Health Sciences. *Forum: Qualitative Social Research* Vol.16(2), Qualitative Research Designs, Sample Size and Saturation:
- Sarfo, J.O.; Debrah, T.P.; Gbordzoe, N.I.; Afful, W.T. and Obeng, P (2021). Qualitative Research Designs, Sample Size and Saturation: Is Enough Always Enough? *Journal of Advocacy, Research and Education.* Vol. 8(3)

Module 4: Qualitative data analysis and representation

- Coffey, A. and Atkinson, P., 1996, Making sense of qualitative data: Complementary research strategies, Thousand Oaks, CA: Sage (particularly chapters 1 and 2).
- Creswell, John W. (2013). Qualitative inquiry and research design: Choosing among five approaches, 3rd ed. SAGE Publication Washington DC (Chapters 8)
- Robson C., 1993, Real world research: A resource for social scientists and practitioner-researchers. Oxford: Blackwell (chapter on analysing qualitative data).
- Silverman D. 2006, Interpreting qualitative data: Methods for analyzing talk, text and interaction, 3rd edition, London: Sage (sections in part two)
- Bazeley P. and Jackson K. (2013). Qualitative Data Analysis with NVivo (2nd ed.). London: Sage.
- Hilal A.Y.H. and Saleh Said Alabri S.S. (2013) Using Nvivo for Data Analysis in Qualitative Research, *International Interdisciplinary Journal of Education,* Vol.2 (2)

Student responsibilities

Attendance: At-least 75% attendance will be necessary to be able to appear for the final exam.

Course reviewers:

- Prof. R.P. Mitra, Professor, Department of Anthropology, University of Delhi
- Dr Ragini Sahay, Associate Professor, Amity University

Course title: Themes and Perspectives on Development

Course code: MPD-139	**No. of credits:** 2	**L-T-P:** 27-3-0	**Learning hours:** 30

Pre-requisite course code and title (if any): Interest to learn social science scholarship on development discourses

Department: Department of Policy and Management Studies

Course coordinator(s): Dr L.N. Venkataraman	**Course instructor(s):** Dr L.N. Venkataraman

Contact details: venkataraman.ln@terisas.ac.in

Course type: Core	**Course offered in** 1st Semester

Course description Themes and Perspectives on Development is a Core Course which provides a base for other subjects in MA-SDP Programme in TERI SAS. Hence, basic social science lexicons of Development will be introduced. Examples from diverse regional contexts in India will be used to facilitate discussions in the classroom. This course lays the foundation for other courses including the *Management of Development Organisations* (MPD 153) and *Development Theories and Processes* (PPS 132). The nature of the Course is interdisciplinary in nature.

Course objectives This course introduces the conceptual foundations of Development and demonstrates the complexities of 'development'.

Course content

Module	Topic	L	T	P
1	**Introduction** and Disposition skills; Social Science and Common Sense; The Social Construction of Reality	6	0	0
2	**Basic concepts**: Social Institutions; Social Stratification; Social Class; Norms; Structure; and Agency	4	0	0
3	**Conceptions** and Complexities of 'development'; Histories of Development: Colonialism & Imperialism	8	0	0
4	**Political economy of Development: Conceptual discourses** The State and Development: Themes and Perspectives; Market and Development: Themes and Perspectives; Civil Society and Development: Themes and Perspectives	6	0	0
5	**Political economy of Development: Contemporary discourses on India;** The State and Development: Contemporary Reflections; Market and Development: Contemporary Reflections; Civil Society and Development: Contemporary Reflections	3	3	0
		27	3	0

Evaluation criteria

- Weekly Assignments [25%]
- Class Participation [25%]
- Presentation [25%]
- Book Review [25%]

Learning outcomes: At the end of the course, students will be able to critically reflect on the diverse discourses of Development; In addition, they will be able to examine the State-Market and Civil Society actors in Development. Lastly, the course facilitates an understanding of the politics and sociology of Development

Pedagogical approach: The course will be taught through discussion-centric lectures augmented through relevant academic readings. In addition, contemporary issues will be conceptualized as a practical component to deconstruct the complexities of Development.

Essential Reading

1. Escobar, Arturo (1995), *Encountering development: the making and unmaking of the Third World*, Princeton, N.J.: Princeton University Press. Harvard
2. Gilbert Rist (2008) *The History of Development: From Western Origins to Global Faith*, Zed Books, New York.
3. Hettne, Bjorn (2009), *Thinking about development*, Zed Books, London.

Supplementary Readings [for reference]

1. Beteille, Andre (1996), "Sociology and Common Sense", *Economic and Political Weekly*, Vol. 31, No. 35/37, (pp. 2361-2365).
2. Perry, John A & Erna K Perry (2016), *Contemporary Society: An Introduction to Social Science*, Routledge, New York.

Recommended journals [for reference]

1. *Economic and Political Weekly*
2. *Journal of Human Development and Capabilities*
3. *Indian Journal of Human Development*
4. World Development

5. Journal of Development Studies
6. Oxford Development Studies

Third World Quarterly

Student responsibilities

1. Students are expected to prepare for the classes. In case, they are unprepared, the same should be informed in advance. However, only one-time exemption is allowed
2. In addition, we shall follow NO mobile phone policy during the class hours
3. As the University has the policy of minimum 75% of physical presence, the students are expected to plan their academic activities considering the learning goals and evaluation criterion of the Course
4. All the submissions shall be done one-day before the deadline
5. Lastly, any sorts of academic dishonesty including cheating, copying, inappropriate collaboration and plagiarism will NOT be acceptable.

Course reviewers:

1. Dr David Clark. *University of Cambridge*, The UK
2. Des Gasper, Professor Emeritus, *International Institute of Social Studies*, The Netherlands
3. Dr William A. Jackson, *University of York*, The UK

Course title: Law, Society and Sustainable Development			
Course code: MPD-154	**No. of credits:** 2	**L-T-P distribution:** 30-0-0	**Learning hours:** 30
Pre-requisite course code and title (if any): NA			
Department: Department of Policy and Management Studies			
Course coordinator (s): Mr. Vivekanandan	**Course instructor (s):**		
Contact details:			
Course type: Core	**Course offered in:** Semester 1		

Course Description:

The course on Law, Society and Sustainable Development will explore the role of the judiciary, particularly the Supreme Court of India, in environmental governance in India. India has several laws and policies to protect and conserve the environment. Yet, it is the Indian judiciary, and not the legislature, which has been credited for evolving various types of environmental rights and delineating obligations on the state and the citizens to protect the environment.

Course objectives:

The course is designed to expose students to various Indian environmental legal principles, familiarize them with the concept of judicial activism and the tool of public interest litigation that is often used in environmental cases and give them a basic understanding of how courts influence environmental decision making in India.

Course Contents:

Module	Topic	L	T	P
1	**Introduction to the course and sources of law in India** • Discussion on relevant constitutional provisions, justice, equity, and broad issues to think about and deliberate on during the course	10	0	0
2	**Key legal concepts** • Judicial Review and the Indian Constitution • Judicial Activism and Public Interest Litigation • Principle of sustainable development • Human rights • Gender Issues	10	0	0
3	**International Law and the Environment** • Introduction, sources, and principles • International Climate Change Law	4	0	0
4	**Some specific areas of Indian environmental law** • The environmental clearance processes • The Godavarman case (Forest case) • The National Green Tribunal • Need for special environmental courts • Jurisdiction and powers of the National Green Tribunal	6	0	0
	Total	**30**		**0**

Evaluation procedure:

	Weightage (%)
• Class participation	10
• Essay 1 (1000-1500 words)	10
• Essay 2 (4000-5000 words)	25
• Group Presentation	15
• Final examination	40

Learning outcomes:

1. Awareness about the basic tenets of Indian environmental law.
2. Familiarity with the institutional structure of Indian environmental governance and the role of the Indian

judiciary.
3. Familiarity with the Gender and Human rights issues
4. Understanding the procedural and substantive requirements in certain areas of environmental regulation such as environmental clearance and forest clearance.
5. Appreciating the need for transparency, accountability and effective public participation in environmentaldecision making

Pedagogical approach:

The course will be taught through interactive sessions based on previously circulated readings. Many environmental legal principles in India have organically developed through judgments of the courts and these judgments will be discussed in class. It is understood that most students do not have a background in law and therefore the readings for class will be decided and the student assessment undertaken keeping that in mind.

Suggested Readings:

1. S. Divan and A. Rosencranz, *Environmental Law and Policy in India* (New Delhi: Oxford University Press, 2002, 2nd edn.)
2. P. Leelakrishnan, *Environmental Law in India* (New Delhi: Lexis Nexis, 2008, 3rd edn)
3. B.N. Kirpal et al. (eds), *Supreme but not Infallible: Essays in Honour of the Supreme Court of India* (New Delhi:Oxford University Press, 2000, 2008 edn)
4. S.P. Sathe, *Judicial Activism in India: Transgressing Borders and Enforcing Limits* (New Delhi: Oxford UniversityPress, 2002)

Additional information (if any) :

Student responsibilities:

Attendance: At-least 75% attendance will be necessary to be able to appear for the final exam.

- Dr Vijoy V., Faculty of Law, University of Delhi
- Dr Sujith Koonan, National Law University, Odisha

Enclosure 6

MTech UDM: Programme Structure and Total Credits with List of All Courses

(75 Credits)

Semester	Existing Programme Structure			Proposed Programme Structure		
	Core	Elective	Total Credits	PC	PE	Total Credits
Semester 1	22	0	22	23	0	23
Semester 2	19	0	19	20	0	20
Semester 3	14	4	18	12	4	16
Semester 4	16	0	16	16	0	16
	71	4	75	71	4	75

Semester	Courses	Credits	Duration (Weeks)
1	8 Core Courses + 1 Compulsory Audit	23	15
2	7 Core Courses	20	15
3	12 Credits from Major Project Part 1+ 4 Credits from 2 Elective Courses + 1 Compulsory Audit	16	15
4	16 Credits from Major Project Part 2	16	15
	Total MTech UDM Programme Credits	**75**	

Course Type	No. of Credits
Programme Core	71
Programme Elective	4
Open Elective (Mandatory and Open)	0
Total	75

PC - Programme Core; PE - Programme Elective; CA - Compulsory Audit

Semester	Course Code	Course Title	Course type	Credits
1	NRE-165	Introduction to Sustainable Development*	CA	(1)
1	MEU-173	Stochastic Modelling	PC	4
1	MEU-172	Geoinformatics for Urban Development	PC	3
1	MEU 123	Urban Finance	PC	3

1	MEU 161	Theories of Urbanisation	PC	3
1	MEU 163	Sustainable Provision and Management of Urban Services	PC	3
1	MEU 143	Urban Governance	PC	3
1	NRE 106	Communication Skills and Technical Writing*	PC	2
1	MEU-177	Qualitative Research Methodology for Urban Studies	PC	2
			Total Credits	**23**
2	MEU 167	Urban Development Policies and Programmes	PC	3
2	MEU 121	Urban Ecology and Environment	PC	3
2	MEU 152	City and Regional Planning and Management	PC	3
2	MEU 154	Regeneration and City Competitiveness	PC	2
2	MEU 184	Real Estate Development	PC	3
2	MEU 183	Urban systems Modelling	PC	3
2	NRG 103	Project Management**	PC	3
			Total Credits	**20**
3	MEU 102	Major Project Part 1	PC	12
3	MEU 112	Energy Efficient Buildings	PE	2
3	MEU 178	Urban Water Supply and Wastewater	PE	2
3	MEU 144	Sustainable Urban Transport	PE	2
3	PPM-179	Design Thinking***	CA	(2)
3	MEU 162	Urban Disaster Management and Climate Resilient Cities	PE	2
3	MEU-168	Urban Housing Policy and Practice	PE	2
			Total Credits (2 Electives)	**16**
4	MEU-104	Major Project Part -2	PC	16
			Total Credits	**16**

* Course offered by ESRM

** Course offered by DNR

*** Course offered by MBA

Audit courses not counted in SGPA/CGPA calculation

MTech REEM: Programme Structure and Total Credits with List of All Courses

(70 Credits)

Semester	Existing Programme Structure			Proposed Programme Structure		
	Core	Elective	Total Credits	PC	PE	Total Credits
Semester 1	22	0	22	17	0	17
Semester 2	22	0	22	19	0	19
Semester 3	12	9	21	12	6	18
Semester 4	16	0	16	16	0	16
	72	9	81	64	6	70

* Audit courses not counted in SGPA/CGPA calculation

Semester	Courses	Credits	Duration (Weeks)
1	7 Core Courses + 3 Audit Courses##	17 (+ 5 CA)	15
2	8 Core Courses	19	15
3	2 Core Courses + 6 Credits from Dissertation - I + 6 Credits from 2 Elective Courses + 1 Audit Course	18 (+ 2 CA)	15
4	16 Credits from Dissertation - II	16	15
	Total MTech REEM Programme Credits	**70 (+ 7 CA)**	

Course Type	No. of Credits
Programme Core	64
Programme Elective	6
Open Elective (Mandatory and Open)	0
Compulsory Audit	7
Total	70 (+ 7 CA)

PC - Programme Core; PE - Programme Elective; CA - Compulsory Audit

Semester	Course Code	Course Title	Course type	Credits
1	NRE-106	Communication skills and technical writing*	CA	(2)
1	ENR 101	Energy lab - I (Power system lab and heat transfer lab)	PC	2
1	ENR XXX	Energy and environmental implications	PC	2
1	ENR 119	Fundamentals of thermal and electrical engineering	CA	(2)
1	ENR XXX	Renewable energy resource characteristics	PC	3
1	ENR 135	Power system engineering	PC	3
1	ENR 185	Introduction to management techniques	PC	1
1	ENR XXX	Heat transfer	PC	3
1	NRE 165	Introduction to sustainable development	CA	(1)

1	ENR XXX	Renewable energy policies and regulations	PC	3
			Total Credits Sem-1	**17**
2	ENR 151	Solar technologies	PC	3
2	ENR 153	Wind, Biomass and other renewable energy technologies	PC	3
2	ENR 156	Renewable energy project management	PC	3
2	ENR 157	Energy lab - II	PC	3
2	ENR 103	Seminar on Field visits to RE plants/sites	PC	1
2	ENR 111	Energy conservation and management	PC	2
2	ENR XXX	Electric Vehicle, Energy Storage System and Hydrogen technologies	PC	3
2	ENR XXX	Energy and Carbon Markets	PC	1
			Total Credits Sem-2	**19**
3	ENR 107	Energy simulation laboratory	PC	3
3	ENR XXX	Machine Learning for Renewable Energy	PC	3
3	ENR 108	Industrial Project: Dissertation – I	PC	6
3	PPM-179	Design Thinking**	CA	(2)
	A	Technical Electives		
3	ENR 163	Biofuels and Decentralized Energy Systems	PE	3
3	ENR 113	Wind power generation	PE	3
3	ENR 145	Solar photovoltaic power generation	PE	3
3	ENR 115	Building energy and green building	PE	3
		Additional Elective(s)		
	B	Management Electives		
3	ENR 165	Energy economics	PE	3
3	ENR 116	Energy audit and management	PE	3
3	ENR 143	Grid Integration of Renewable Energy	PE	3
3	BSI 125	Accounting and Finance for Sustainability**	PE	3
		Additional Elective(s)		
		3 PC + 1 PE from A and 1 PE from B) = 5 courses	**Total Credits Sem-3**	**18**
4	ENR 109	Major Project: Dissertation – II	PC	16
			Total Credits Sem-4	**16**

* Course offered by ESRM

** Course offered by MBA

Audit courses not counted in SGPA/CGPA calculation

Course title: Energy and environmental implications			
Course code: ENR 148	**No. of credits:** 2	**L-T-P:** 30-0-0	**Learning hours:** 30
Pre-requisite course code and title (if any): N.A.			
Department: Sustainable Engineering			
Course coordinator: Dr Aviruch Bhatia	**Course instructor(s):** Dr Aviruch Bhatia/ Dr Sapan Thapar		
Contact details: aviruch.bhatia@terisas.ac.in			
Course type: Programme Core	**Course offered in:** Semester 1		

Course description

The course discusses and analyse the role of energy in the development of India. The focus of the course is on the conventional energy sources & their conversion technologies as well as the environmental impacts including global warming and climate change.

Course objectives

The objective of the courses is to develop understanding for the following:

- Utilization of conventional energy sources - coal, oil & natural gas, nuclear and hydro
- Environmental implications due to use of conventional energy resources

Course contents

Module	Topic	L	T	P
1	**Overview of Energy Sector – Global & Indian Context**	2	0	0
	COAL			
2	**Coal Basics** Formation of coal World and domestic reserves of coal Production & imports of coal Coal types, coal characteristics and properties Quality of Indian coals	2	0	0
3	**Coal Utilization Technologies** Uses of coal Coal washing, pyrolysis, combustion gasification, liquefaction, Coal bed methane, ash utilisation	2	0	0
4	**Environmental Aspects and Clean Use of Coal** Environmental impacts of coal mining and combustion and pollution control measures Clean coal technologies Carbon dioxide capture, storage and utilization	3	0	0
	OIL & NATURAL GAS			
5	**Basics** Formation of oil and natural gas Reserves of oil and natural gas Production, imports of oil & gas	2	0	0
6	**Uses &Environmental Aspects** Use of petroleum products as fuels and feedstock Uses of natural gas, LNG, CNG, LPG Oil Refining Environmental aspects of oil and natural gas	2	0	0
	NUCLEAR			

7	**Basics** Overview on Radioactivity -half- life, nuclear decay, nuclear reactions Uranium and thorium reserves Nuclear Reactors and technologies	3	0	0
8	**Fuel Processing and Safety** Nuclear fuel cycle Nuclear fuel reprocessing, safety & nuclear waste management	2	0	0
	HYDRO			
9	**Basic & Technology** Basic concepts, hydro potential and exploitation in India Major hydroelectric power plants in India Components of hydroelectric power plant: weir/intake, channel, desilting, forebay, spillway, penstock, turbine – Impulse and Reaction, generator, governor	5	0	0
10	**Environmental Issues** Environmental issues Constraints and problems Future Prospects	3	0	0
	ENERGY AND CLIMATE CHANGE LINKAGES			
11	Energy and carbon emissions International Response to Climate Change – UNFCCC SDGs and Energy - Accessibility, affordability reliability and sustainability	4	0	0
		30	**0**	**0**

Evaluation criteria

- Assignments: (after completion of module 6) - 20%
- Test 1: (after completion of modules 1, 2, and 3) - 20%
- Test 2: (after completion of modules 4, 5, 6, and 7) - 20%
- Major exam: (at the end of the semester after completion of all modules) - 40%

Learning outcomes

At the end of the course the student will be able to

- To understand the energy systems. (Test 1)
- Quantify the scale of pollution from a conventional Energy source. (Test 2 and Major exam 3)
- Identify strength and weak-linkages in the energy systems. (Test 2 and Major exam 3)

Pedagogical approach

A combination of class-room interactions, tutorials, assignments and projects.

Materials

Recommended readings

Rao. S and Parulekar B.B., "Energy Technology", Khanna Publishers
Bernard R Cooper and William A Ellingson, "The Science & Technology of Coal and coal utilization" Edited, ISBN0-306-41436.8, Plennwell
Pradip Kumar Das & Hrishikesh, "Petroleum and Coal", ISBN 81-7533-042-2, MDDeshpande, B G, "The World of Petroleum"
Yadav, M S, "Nuclear Energy and Power" SBS Publishers & Distributors Pvt. Ltd.
Jack J Fritz, "Small and Mini Hydropwer system", ISBN 0-07-022470-6, MC Graw Hill

Reference Books

Bruce G Miller, "Coal Energy System", ISBN 0-12-497451-1, Elsevier Academic PressWilliam L Leffler, Petroleum Refining, ISBN 0-87814-776-4, Pennwell
Dr. Duncan Seddon, "Gas Usage and Value", ISBN 1-59370-073-3, Pennwell Raymond L Murray, NuclearEnergy, Pergamon Press
Small Hydropower Initiative and Private Sector Participation, Alternate Hydro Energy Centre, IITRoorkee
Charles Simeons, "Hydropower-The use of water as an alternate source of energy", ISBN 0 08 023269 8Pergamon press

Douglas M Considine, Energy Handbook, Mc Graw Hill
Editor in Chief- Cutler J Cleveland, "Encyclopedia of Energy", Elsever Academic PressWiley Encyclopedia Series, Energy, Technology & Environment

Websites

coal.nic.in,
worldcoal.org,
petroleum.nic.in,
dae.gov.in
npcil.nic.in,
nhpcindia.com
https://cimfr.nic.in/

Additional information (if any)

Student responsibilities

Attendance, feedback, discipline: as per university rules.

Course reviewers

- Dr O. Prasada Rao, Scientist 'F' Council of Scientific & Industrial Research (CSIR), Retd.
- Dr Subhasis Maji, Indira Gandhi National Open University (Retd.)

Course title: Renewable energy resource characteristics			
Course code: ENR 146	**No. of credits:** 3	**L-T-P:** 34-11-0	**Learning hours:** 45
Pre-requisite course code and title (if any): Not required			
Department: Sustainable Engineering			
Course coordinator: Dr Aviruch Bhatia		**Course instructor(s):** Dr Aviruch Bhatia/ Dr Naqui Anwer/ Mr Abhishek Agrawal	
Contact details: aviruch.bhatia@terisas.ac.in			
Course type: Programme Core		**Course offered in:** Semester 1	

Course description

The course is designed to familiarize and train the students with the tools and techniques used to assess the various renewable energy resources and their potential at any location, so that they are able analyse a case quantitatively at the end of the term.

Course objectives

The objective of the courses is to develop in-depth knowledge in the following:

- Various renewable energy resources available at a location and the assessment of their potential
- Solar energy radiation, its interactions, measurement and estimation
- Site selection for wind turbines, measurements and instruments
- Bioenergy resource assessment, pathway selection, biomass supply

Course contents

Module	Topic	L	T	P
	SOLAR			
1	**Introduction** Introduction to renewable energy sources **Solar Energy Resources** Solar radiation: Spectrum of EM radiation, sun structure and characteristics, extra-terrestrialradiation, solar constant, air mass, beam, diffused and total solar radiation, spectral distribution Sun-earth movement in different seasons, solar geometry, solar radiation on tilted surface,local apparent time, irradiance, insolation Attenuation of solar radiation by the atmosphere, albedo, beam and diffuse components ofhourly and daily radiation, GHI and DNI, clearness index, Radiation augmentation Different climatic zones and their impact on site selection	1 1 1 2 1	1	0
2	**Measurement of solar radiation** Instruments: sunshine recorder, Pyranometer, Pyrheliometer, Albedometer. Radiation measurement stations in India (NIWE, IMD etc.), Solar radiation data, graphs, Meteonorm, NASA-SSE and other databases, Daily, monthly andannul average radiation data analysis using annual and TMY data	2	2	0
3	**Prediction of available solar radiation** Solar mapping using satellite data, Typical Meteorological Year	2	2	0
	Models and methods for estimating solar radiation, estimation of global radiation, estimationof diffused components			
	WIND			

4	**Introduction** Introduction to Atmospheric Boundary Layer Theory, Wind gradient and geographicalimportance, Wind energy database-Wind atlas	3	0	0
5	**Physics of Wind** Wind Systems in India as Case, Potential sites, diurnal and seasonal variations	5	0	0
6	**Basic Introduction to Wind Energy** Introduction to wind power, Worldwide Developments	2	1	0
7	Instruments used and measurement process wind data	2	2	0
	BIOMASS			
8	**Basics** Biomass resources: plant derived, residues, aquatic and marine biomass, various wastes, photosynthesis. **Biomass resource assessment** Estimation of woody biomass, non woody biomass and wastes, ASTM standards.	2 2	0	0
9	**Bulk chemical properties** Moisture content, proximate and ultimate analyses, calorific value, waste water analysis forsolids.	2	1	0
10	**Chemical composition of biomass** Cellulose, hemicelluloses and lignin content in common agricultural residues and theirestimation, protein content in biomass, extractable, COD.	2	1	0
11	**Structural properties** Physical structure, particle size and size distribution, permeability. Physical properties: Bulk density, angle of repose, thermal analysis (thermogravimetric,differential thermal and differential scanning calorimetry). Properties of microbial biomass: Protein estimation, flocculating ability, relative hydrophobicity of sludge, sludge volumeindex.	4	1	0
		34	**11**	**0**

Evaluation criteria:

- Quizzes/Assignments: 30% (During module 1-11)
- Test 1: 15% (after Module 1, 4, 8 and 9)
- Test 2: 15% (after Module 2,3, 5, 6,10)
- Major exam: 40%

Learning outcomes:

At the end of the course the student will be able to:

- Identify a Renewable Energy Resource at a given location [Test 1 and assignments]
- Assess/quantify the potential of the renewable-energy resources at a given location [Test 2, Major exam 3]
- Develop understanding for case studies [assignments and Major exam 3]

Pedagogical approach:

A combination of class-room interactions, group discussion and presentations, tutorials and assignments

Material
Text Books:
Renewable Energy Engineering and Technology – A Knowledge Compendium, ed. VVN Kishore (TERI Press, 2008).

Reference Books:

Donald Klass, "Biomass for Renewable Energy, Fuels, and Chemicals", Entech International Inc., USA
JA Duffie and WA Beckman, "Solar Engineering of Thermal Processes", Third Edition (John Wiley & Sons)
S Sukhatme and J Nayak, "Solar Energy: Principles of Thermal Collection and Storage", Third Edition (Tata McGraw Hill, 2008)TERI Energy Data Directory (TEDDY) 2020-21 (TERI Press, 2021)

Websites:

Ministry of new and renewable energy
NITI Aayog

Additional information (if any):

Student responsibilities:

Attendance, timely feedback, discipline: as per university rules, adopt peer learning and knowledge sharing within the class

Course reviewers:

- Dr. Anish Modi, Assistant Professor, IIT Bombay
- Dr. Birinchi Bora, Deputy Director (Technical), National Institute of Solar Energy (NISE)

Course title: Renewable energy policies and regulations			
Course code: ENR 154	**No. of credits:** 3	**L-T-P:** 32-13-00	**Learning hours:** 45
Pre-requisite course code and title (if any): N.A.			
Department: Sustainable Engineering			
Course coordinator: Dr. Sapan Thapar	**Course instructor(s):** Dr. Sapan Thapar		
Contact details: sapan.thapar@terisas.ac.in			
Course type: Programme Core	**Course offered in:** Semester 1		

Course description

The course is meant to comprehensively impart knowledge on the overall policy and regulatory environment governing renewable energy development in the country. The students will also be sensitized to emergent trends competitive bidding in Solar and Wind based capacity addition.

The course will cover national and state policies, regulatory and legislative frameworks on Renewable Energy. Some of these policies and guidelines emanate from an overarching Act such as the Electricity Act and policies such as the National Climate Change Policy. The policies, regulations and guidelines determining grid integration of renewable energy such as electricity off-take approaches, tariffs, control period and even technical requirements like maintenance of grid frequency in a certain bandetc. It is also important to have an understanding of the institutional architecture that enables implementation of the policies and regulation as much as the policies in force.

The course will present a policy and regulatory framework for renewable energy as it is practiced in India. However, similar frameworks either exist in other developed and developing countries will also be studied for possible adoption in India.

Course objectives

- To impart knowledge on the overall policy, regulatory and institutional framework on Renewable Energy
- To provide understanding of the main drivers that influence Renewable Energy policy formulation
- To provide insights on emergent policy trends with regard to generation and procurement of renewable energy
- To describe and analyse policy instruments used in promotion of renewable energy in India and globally

Course contents

Module	Topic	L	T	P
1	**Energy Statistics, Regulatory Bodies & Entities** Introduction to Indian energy sector with focus on renewable energy Key Statistics - Installed capacity, Generation Mix, Consumption Trends Entities –GENCOS, TRANSCOs, DISCOMs, Power Trading Companies Regulators- CERC, SERC, FoR, BEE Institutions- MoP, MNRE, CEA, NISE, NIWE, NIBE, State Agencies Public Sector Entities (NTPC, NHPC, IREDA, SECI, PGCIL, POSOCO, REC, PFC) Private Players - IPPs, EPC contractors, System Integrators, Financiers, etc.	10	0	0
2	**Indian Energy Legislations, Policies & Programmes** Global Overview - RE policies and regulatory structures Electricity Act, National Tariff Policy, National Electricity Policy & Plan National Action Plan on Climate Change National Solar Mission, including Grid and Off-grid schemes and Programmes Programme on Wind Power, including repowering, hybrid and off-shore wind Programme on Biomass Sector including cogeneration & cofiring Programme on Waste to Energy Programmes on Small Hydro and other RE technologies RE Enablers – Subsidies, FiT, VGF, Bundling Scheme, Auctions/ Bidding, low-cost funds, accelerated depreciation and other fiscal options Promotional measure like must run, merit order dispatch and deemed generation Regulations on banking, wheeling and open access CERC/ SERC Regulations/ Guidelines – REC-RPO, RE Tariff Electricity Trading, including Green Exchange Markets, Open Access	14	4	0

	Captive / Group Captive Projects & Corporate PPAs Grid Code, including Scheduling and Forecasting Green Energy Corridors Green Hydrogen Mission EV Policies & Schemes Hybrid, Storage & RTC Mode Projects Emerging areas - smart metering, remote monitoring, DSM, ancillary services, etc.			
3	**Policies on Distributed/ Decentralized/ Off grid Sectors** Solar Rooftop - Policy framework, Status, Central and state government policies Micro and Mini grids –Scope, Significance and challenges Rural electrification schemes: Saubhagya, RDSS, and Solar Off-grid Programme Schemes on decentralized RE systems Biofuels schemes, including Satat, Gobardhan PM-KUSUM Scheme for Agriculture Small solar plants (EESL Scheme) Socio-economic impact of decentralized renewable energy programmes	8	2	0
4	**Seminar** Case Study - Group Activity to analyse RE policies and regulations (Select countries & Indian states)	0	7	0
		32	**13**	**0**

Evaluation criteria:

- Test 1: 20% (after completion of module 1)
- Test 2: 20% (after completion of module 2)
- Assignment: 30% (after completion of module 1 and 2)
- Major exam: 30% (after completion of all modules)

Learning outcomes:

- Enhanced understanding of renewable energy policy and regulatory environment including global developments
- Sound understanding of the institutional frameworks w.r.t. Renewable Energy
- Sound understanding of policy and regulatory framework for grid connected and off grid renewable energy

Pedagogical approach:

A combination of class-room interactions, tutorials, assignments and projects.

Materials:
Recommended readings/Reading Materials/Reference Documents:

CEA Annual Reports
CEA Monthly Executive Summary Reports
CEA Monthly RE Power Generation Reports
Electricity Act 2003
Energy Statistics, MOSPI, GoI
IRENA – RE Capacity Statistics
IRENA – Off-grid renewable energy statistics 2021
IRENA – Renewable Power Generation Costs in 2020
REN-21 – Renewables Global Status Report
National Electricity Policy, 2021
Solar Park Scheme
MNRE Off-shore Wind Policy
MNRE Wind Repowering Scheme
Off-grid and Decentralized Solar PV Applications Programme
Solar Rooftop Scheme Phase-II

CERC RE Tariff Order MNRE PM-KUSUM Scheme MoP – Hydrogen Policy National Biofuel Policy Annual Reports of MoP, MNRE and its institutions SERC RE Tariff Orders IEGC REC-RPO Scheme, CERC CEEW Report – How India's Solar and Wind Policies Enabled its Energy Transition Indian Energy Exchange, Monthly Reports GTAM & GDAM Markets, IEX
References: Electricity Act 2003 CERC Regulations on Renewable Energy **Journals and Magazines:** Energy Policy Energy for Sustainable Development Renewable Energy
Additional information (if any): NA
Student responsibilities: Attendance, feedback, discipline: as per university rules.

Course Reviewers:

1. Mr. J K Jethani, Director, Ministry of New and Renewable Energy, New Delhi
2. Mr. Shirish Garud, Director, The Energy and Resources Institute, New Delhi

Course title: Heat transfer			
Course code: ENR 192	**No. of credits:** 3	**L-T-P:** 33-12-0	**Learning hours:** 45
Pre-requisite course code and title (if any): N.A.			
Department: Sustainable Engineering			
Course coordinator: Dr Aviruch Bhatia	**Course instructor(s):** Prof. S C Mullick		
Contact details: aviruch.bhatia@terisas.ac.in			
Course type: Programme Core	**Course offered in:** Semester 1		

Course description

The course is designed to familiarize the students with the basic principles of heat transfer mechanisms and applications. Students will learn in detail about the concepts of conduction, forced convection, natural convection and radiation, how their combinations contribute in any heat transfer process, how a heat transfer process can be made more efficient and how to reduce heat losses. The students would also learn about types of heat exchangers and their analysis. The course also covers basics of boiling and condensation on different surfaces.

Course objectives

- To impart knowledge of conduction, convection and radiation, their fundamental equations and correlations
- To apply the principles of heat transfer into engineering applications such as heat exchanger, heatpipe, insulation wall etc.
- To develop understanding on boiling and condensation process

Course contents

Module	Topic	L	T	P
1	**Fundamentals of Heat Transfer** Relevance and application of heat transfer in renewable energy technologies Introduction to different heat transfer mechanisms: conduction, convection and radiation	2	0	0
2	**Conduction** Derivation of general heat conduction equation for constant properties, initial and boundary conditions Steady state heat conduction in uniform solids and composite systems of rectangular, cylindrical and spherical geometries, electrical analogy, thermal contact resistance Critical thickness of insulation Heat transfer from extended surfaces Transient heat conduction, lumped system analysis, time constant	8	2	0
3	**Convection** Physical mechanisms of convection Velocity and Thermal boundary layer, external and internal forced convection underlaminar and turbulent flow conditions Laminar and turbulent natural convection over surfaces, natural convection inside enclosures	8	4	0
4	**Heat Exchangers**			
	Different types of heat exchangers: tube-in-tube, shell-and-tube, plate exchangers: parallel, counter and cross-flow configurations, overall heat	4	2	

	transfer coefficient, fouling factors Analysis of heat exchangers: logarithmic mean temperature difference (LMTD) method, effectiveness-NTU method			
5	**Radiation** Thermal radiation, emission characteristics of black and grey surface Emissivity and absorptivity, Reflectivity and transmissivity, Planck's law, Stefan-Boltzmann Law, Directional intensity of radiation, Kirchhoff's Law Radiative heat transfer between surfaces, Shape factor: reciprocityrelation, summation rule, superposition rule and symmetry rule Radiative heat transfer within an enclosure, radiation shield, Solar radiation	6	2	0
6	**Boiling and Condensation** Pool boiling curve, nucleate boiling, critical heat flux, flow boiling, boiling heat transfer correlations Film-wise and drop-wise condensation, estimation of heat transfer coefficients for condensation on surfaces, condensation on tube and ontube banks	5	2	0
		33	12	

Evaluation criteria:

- Assignments: 20% (During Module 2-5)
- Test 1: 15% (after Module 2)
- Test 2: 15% (after Module 4)
- Major exam: 50% (after Module 6)

Learning outcomes:

After studying this course students will be able to:

- Develop fundamental understanding of different heat transfer processes and relate them to practicalproblems in renewable energy technologies (Assignments and Test 1)
- Model heat transfer problems and solve it (Test 1,2, Major exam)
- Develop the skill to analyse heat exchangers, their sizing and selection (Test 2, Major exam)

Pedagogical approach:

A combination of class-room interactions, tutorials, assignments and group projects.

Reading materials:

Text Books:

S. P. Sukhatme, "A Textbook on Heat Transfer", Fourth Edition (University Press India Ltd., 2005)YA Cengel. "Heat and Mass Transfer: A practical approach", Third Edition (Tata McGraw Hill, 2005)

Reference Books:

JP Holman, "Heat Transfer", Ninth Edition (Tata McGraw-Hill, 2007)
PK Nag, "Heat Transfer", First Edition (Tata McGraw-Hill, 2002)
FP Incropera and DP De Witt, "Fundamentals of Heat and Mass Transfer", Fifth Edition *(Wiley-India, 2007)*

Additional information (if any):

Student responsibilities:

Attendance, feedback, discipline: as per university rules.

Course reviewers

- Dr. Maddali Ramgopal, Professor, Mechanical Engineering, Indian Institute of Technology Kharagpur
- Dr K B Rana, Rajasthan Technical University, Kota, Rajasthan

Course title: Geoinformatics for urban development			
Course code: MEU 179	**No. of credits:** 3	**L-T-P:** 22-12-22	**Learning hours:** 56
Pre-requisite course code and title (if any): None			
Department: Sustainable Engineering			
Course coordinator(s): Dr Deepty Jain	**Course instructor(s):** Dr Deepty Jain		
Contact details: deepty.jain@terisas.ac.in			
Course type: Programme Core	**Course offered in:** Semester 1		

Course description

In today's time, spatial data analysis helps support decision making in urban domain. It is prudent that the students of MTech Urban Development Management learn the techniques of spatial data analysis that includes data collection, management, interpretation and analysis. The course is designed to introduce the concepts and develop understanding of Geoinformation Systems (GIS) and remote sensing imageries application in urban domain to the students joining the program and holding graduation from varied disciplines. The course structure will help them build knowledge base and develop skills that they can use in various courses and in practice.

Course objectives

1. To provide understanding of remote sensing / GIS techniques.
2. To develop acumen of remote sensing/ GIS tool application for urban development and management.
3. To enable handling of raster data including image classification and hyperspectral analysis.
4. To develop technical skills in GIS application and software for spatial analysis.

Course content

Module	Topic	L	T	P
1	Introduction to Remote sensing: Electromagnetic spectrum and earth observation, Types of sensors and applications, Image correction, Spatial referencing, Image interpretation	6	4	4
2	Applied Remote sensing for UDM: Supervised and unsupervised classification for mapping land use land cover, Thermal remote sensing for land surface temperature mapping, Hyperspectral remote sensing for vegetation index and built-up index mapping, Spatial statistics – neighbourhood and zonal statistics, Case examples	6		6
3	Introduction to Geoinformation systems: Spatial and non-spatial database management systems, Spatial data types, Vector representations, Topology and spatial relationships, Sequential query language (Spatial), Map Coordinate Systems (Data Reprojection GCS to UTM)	6	4	4
4	Applied Geoinformation system for UDM: Digitizing urban features, Data Collection (Mobile survey, Geotagging photos, geocoding, Data quality/data gaps checks and repairs, Data interpolation, Spatial data analysis (overlay functions, proximity analysis, multicriteria analysis), Data visualization (symbology, map layout and for alternate platforms), Case examples	4	4	8
	Total	**22**	**12**	**22**
Details of the labs				
1	Acquiring remote sensing imagery and spatial referencing of imageries			2

2	Image correction technique			2
3	Supervised and unsupervised image classification and validation through site visits			2
4	Land surface temperature mapping			2
5	Normalized Difference Vegetation Index, Normalized Difference Built-up Index mapping and spatial statistics			2
6	Spatial database management and attribute management			2
7	Map projection and datum			2
8	Vector data acquisition using open-source platforms, digitization and editing			2
9	Spatial and non-spatial SQL, Join and Relate with vector data			2
10	Spatial data analysis			2
11	Map visualization, data classification and map composition			2

Evaluation criteria:
Lab assignments / tutorial

Test 1: 15%, Assessment based on module 1

Test 2: 15%, Assessment based on module 3

Lab Assignments/Tutorials: 20%, submission of regular assignments in correspondence to practical lab components, showcase learning of tools and methods based on lab component module 1 - 4

Project: 20%, a project on integrated application of the tools and methods taught throughout the semester.

Major exam: 30%, overall syllabus and course

Learning outcomes:
Students will be able to

1. Use remote sensing imageries in various applications of urban development and management.
2. Gather and manage spatial data.
3. Conduct analysis using spatial data on GIS platforms.
4. Generate maps ready for visual interpretation and inclusion in reports and presentations.

Pedagogical approach:
The course is designed in a way that remains independent of a particular software. The knowledge gathered can be applied on any platform. For practical exercises in the class like QGIS, ILWIS, ERDAS IMAGINE and ArcGIS will be used.
The course will be delivered through class lectures, lab exercise and tutorials and appropriate case studies will be introduced to strengthen the understanding of application of tools and techniques in practice.

Course Reading Materials:

1. Jensen J., Remote Sensing of the Environment: An Earth Resource Perspective, Pearsons, 2009.
2. Lillesand T., Kiefer R. W. and Chipman J., Remote Sensing and Image Interpretation, Wiley & Sons, 2009.
3. Lo, C.P. and Yeung, A.K.W., Concepts and Techniques of Geographic Information Systems, PHI Leaning Private Limited 2011.
4. Longley P. A., Barnsley M. J., Donnay Jean-Paul, Remote Sensing and Urban Analysis, Taylor & Francis, 2001.
5. Yang, X., Urban Remote Sensing Monitoring, Synthesis and Modeling in the urban Environment, WileyBlackwell, 2011.

Journals for reference:
Computers, Environment and Urban Systems
International Journal of Geographic Information Systems
Urban Planning and Development

Student responsibilities:
Timely submission of weekly lab assignments, Initiative for conducting project, regularity in class, thorough reading of provided material, practice, etc.

Course reviewers:

Dr. A. K. Gosain, Professor, Department of Civil Engineering, Indian Institute of Technology Delhi

Ms. Eleza Boban, Senior GIS Specialist, Stantec, Qatar

Enclosure 7

Course title: Entrepreneurship in Solid Waste Management			
Course code:	**No. of credits:** 4	**L-T-P:** 53-7-4	**Learning hours:** 64
Pre-requisite course code and title (if any): No pre-requisite required			
Department:			
Course coordinator(s):		**Course instructor(s): ICWMR**	
Contact details:			
Course type: Elective		**Course offered in:** Semester III	

Course description

India is grappling with an increasing rate of waste generation. According to a recent CPCB report, India generates 67 million tonnes of solid waste annually. The figure will rise to 125 million tonnes in 2030 and 377 million tonnes in 2050 (PIB, 2016). Therefore, managing this growing waste will demand professional interventions by trained people with knowledge and skills. Currently, only a handful of qualified individuals are involved in solid waste management. Thus, it is the need of the hour that individuals are capacitated to manage solid waste professionally and responsibly.

The course has been designed to develop entrepreneurial skills and a knowledge base of the solid waste management sector among students. The course will help students approach waste management with innovation, creativity, and a sound understanding of the ground reality.

Course objectives

- To impart knowledge on solid waste management
- To identify gaps/ challenges in the sector and explore the scope of scientific intervention
- To promote an entrepreneurial mindset and temper among students, young professionals, and others who are passionate about contributing to this sector
- To provide mentorship and support to aspiring entrepreneurs
- To create a batch of technically sound and professionally trained entrepreneurs in the realm of solid waste management

Course content

Module	Topic	L	T	P
1.	**Demystifying Entrepreneurship** Defining entrepreneurship; factors influencing entrepreneurship; characteristics of entrepreneurs; risk and benefits associated with entrepreneurship; SWOT Analysis and its importance; SWOT Analysis at individual and organizational level; setting up an organization; types of organizations; procedures to set up organization; statutory compliance in setting up organization	7	1	
2.	**Understanding Solid Waste Management** Meaning, types and characteristic of solid waste; global and local trends in generation of solid waste; opportunity- threat analysis of solid waste; solid Waste Management- meaning and importance; components of solid waste management; analysis of current status of management of solid waste in India; challenges faced by the sector	3	1	
3.	**Policy Frameworks** Solid Waste Management Rules 2016; Plastic Waste Management (Amendment) Rules 2022; E-Waste Management Rules 2021; Bio-Medical Waste Management Rules 2016; Construction & Demolition Waste Management Rules 2016; Hazardous and other waste (Management and Transboundary Movement) Rules 2016; guidelines, policies and schemes on entrepreneurship in India; linkage between policy framework and business opportunity.	8		

4.	**Exploring Opportunities in Supply Chain of Solid Waste Management** Collection, Storage and Transportation of waste- methods of waste collection- functional details of bins and vehicles- business opportunity in collection and transportation- Material Recovery Facility; recycling of compostable waste material- composting types and model- decentralized vs. centralized composting model- manual vs semi-mechanized vs mechanized model- marketing of compost- anaerobic digestion and other methods of treatment; recycling of non-compostable waste material- recycling technologies for different waste commodities -market for recycled products and their application- circular economy; sanitary landfill; waste management compliances; IEC as a business opportunity; other opportunities in urban waste management.	14	2	4
5	**Developing Business from Opportunities** Business design; business pitch; technical proposal; financial proposal	4	2	
6	**Financial evaluation of projects and partnerships models** Assessing financial feasibility of business opportunities; importance of assessment; cost-benefit analysis; return on investment; importance of partnership; factors affecting partnership; models of partnerships; hypothetical cases of a SWM business (financial component).	6		
7	**Implementing the Plan** Site survey; brainstorming for readiness; resource mobilization; training of manpower; revisiting business/project plan; operations and maintenance; financial management; documentation; monitoring and evaluation; communication; evaluation	7	1	
8	**Branding and Marketing** Basics of branding and marketing; impact of marketing; platforms for marketing; important tools for branding and marketing of service/product; strategies of marketing and branding	4		
	Total	53	7	4

Evaluation Criteria

Test 1: 20% [Module 1, 2 & 3, after 5-6 weeks of teaching]
Test 2: 20% [Module 4 & 5, after 12-13 weeks of teaching]
Test 3: 40% [Module 1 to 8, end of semester]
Tutorials: 20% [Tutorial assignments spread over entire semester]

Learning outcomes

After completing this course, the students will be able to

- develop an understanding of solid waste and its management;
- analyze the global and local scenario of solid waste management;
- grasp policy framework associated with solid waste management and entrepreneurship;
- understand the supply chain of waste management and technological advancement in the field;
- explore entrepreneurial opportunities offered by the sector;
- learn project management skills;
- set up and manage their enterprise in the field of solid waste management.

[Assessment mechanism for learning outcomes: The three tests and tutorial assignments spread over the entire semester]

Pedagogical approach

The course will in Hybrid mode, Classes will be held on Saturday and Sunday including a field trip, tutorial assignment and relevant case studies.

Material

Textbooks
The following textbook covers most of the modules

Singh, S. Jain, A et al (2022) *A Handbook for Entrepreneurs in Solid Waste Management: A Step Towards Atmanirbhar Bharat*, Cambridge Scholars Publishing, UK

Suggested readings
Suggested readings may be referred to for getting more insights and additional relevant examples for themore interested student.

Agarwal, Raveesh, Mona Chaudhary, and Jayveer Singh. "Waste Management Initiatives in India for Human Well Being." *European Scientific Journal*, Special Edition (2015): 105–27. https://home.iitk.ac.in/~anubha/H16.pdf.

Ahluwalia, I. J., Patel, U. (2018). Solid Waste Management in India: An Assessment of Resource Recovery and Environmental Impact. Indian Council for Research on International Economic Relations. https://icrier.org/pdf/Working_Paper_356.pdf

Ahluwalia, Isher Judge, and Utkarsh Patel. *Solid Waste Management in India: An Assessment of Resource Recovery and Environmental Impact*. Working Paper No. 356. Indian Council for Research on International Economic Relations (ICRIER), 2018. https://icrier.org/pdf/Working_Paper_356.pdf

Amount of municipal solid waste (MSW) generated across India from 2001 to 2041 (n.d.). Statista. https://www.statista.com/statistics/1009110/india-msw-generation-amount

cleartax. "Which One Should You Choose: a Society, Trust, or Section 8 Company?" Accessed June 6, 2021. https://cleartax.in/s/society-trust-section-8-company-comparison

Frankel, Nina, and Anastasia Gage. *M&E Fundamentals: A Self-guided Mini Course*. MEASURE Evaluation: University of North Carolina at Chapel Hill, 2007. https://www.measureevaluation.org/resources/publications/ms-07-20-en/at_download/document

India's Growth Story. Recycling Today (25 March 2019) https://www.recyclingtoday.com/article/indias-recycling-growth-story/

Kaza, S., Yao, L., Bhada-Tata, P., Woerden, F.V. (2018). What a Waste 2.0, A global snapshot to Solid Waste Management to 2050. Urban Development Series of The World Bank. doi: 10.1596/978-1-4648-1329-0 Accessed on 18.04.21

Keulder, Theunis, and Erika Benz. *A Practical Guide to Financial Management of NGOs*. Windhoek, Namibia: Namibia Institute of Democracy, 2011. https://www.nid.org.na/images/pdf/ngo_management_training/Practical_Guide_to_the_Financial_Management_of_NGOs.pdf

Khushi, Samina. "Financial Management Basics for NGOs." *LinkedIn*, January 31, 2017. https://www.linkedin.com/pulse/financial-management-basics-ngos-samina-khushi/

Kumar, A., Agarwal, A. (2020). Recent trends in solid waste management status, challenges, and potential for the future Indian cities – A review. Current Research in Environmental Sustainability Journal. doi.org/10.1016/j.crsust.2020.100011

Kumar, S., Smith, S.R., Fowler, G., Velis, C., Kumar, S.J., Arya, S., R., Kumar. R., Cheeseman, C. (2017). Challenges and opportunities associated with waste management in India. Royal Society Open Science. doi.org/10.1098/rsos.160764

Lahiri, S.(2017). India's Challenges in Waste Management. Down to Earth. https://www.downtoearth.org.in/blog/waste/india-s-challenges-in-waste-management-56753

Levine, S. Joseph. *Guide for Writing a Funding Proposal*. East Lansing, Michigan: Michigan State University, 2020. https://www.learnerassociates.net/proposal/

Management Accounting for Non-governmental Organizations. *Financial Management Essentials: a Handbook for NGOs.* Oxford: Mango, 2013. https://cuts-cart.org/pdf/Financial_management_handbook_for_NGOs.pdf

Ministry of Corporate Affairs. *Companies (Corporate Social Responsibility Policy) Amendment Rules, 2021.* Gazette of India, Government of India, 22 January 2021. https://www.mca.gov.in/Ministry/pdf/CSRAmendmentRules_22012021.pdf

Ministry of Corporate Affairs. *Societies Registration Act, 1860*. Government of India, 21 May 1860. https://legislative.gov.in/sites/default/files/A1860-21.pdf

Ministry of Corporate Affairs. *The Companies Act, 2013*. New Delhi: Gazette of India, Government of India, 29 August 2013. https://www.mca.gov.in/content/dam/mca/pdf/CompaniesAct2013.pdf

Ministry of Environment and Forest. *Municipal Solid Waste (Management and Handling) Rules, 2000*. New Delhi: Gazette of India, Government of India, 25 September 2000. https://www.mpcb.gov.in/sites/default/files/solid-waste/MSWrules200002032020.pdf.

Ministry of Environment and Forest. *Plastic Waste (Management and Handling) Rules 2011*. New Delhi: Gazette of India, Government of India, 4 February 2011. https://www.indiawaterportal.org/sites/default/files/iwp2/Plastic_waste__management_and_handling__rules_Ministry_of_Environment_and_Forests_Government_of_India__2011_.pdf

Ministry of Environment, Forests and Climate Change. *Amendment in Plastic Waste Management Rules, 2016.* Press Information Bureau, Government of India, 13 August, 2021. https://pib.gov.in/PressReleseDetail.aspx?PRID=1745433

Ministry of Environment, Forests and Climate Change. *Amendment in Hazardous Waste (Management & Transboundary Movement) Rules, 2016*. Press Information Bureau, Government of India, 6 March 2019. https://pib.gov.in/pressreleaseshare.aspx?prid=1567682

Ministry of Environment, Forests and Climate Change. *Bio-medical Waste Management Rules, 2016.* New Delhi: Gazette of India, Government of India,28 March 2016. https://dhr.gov.in/sites/default/files/Bio-medical_Waste_Management_Rules_2016.pdf

Ministry of Environment, Forests and Climate Change. *Construction and Demolition Waste Management Rules, 2016*. New Delhi: Gazette of India, Government of India, 29 March 2016. https://cpcb.nic.in/displaypdf.php?id=d2FzdGUvQyZEX3J1bGVzXzIwMTYucGRm

Ministry of Environment, Forests and Climate Change. *E-Waste (Management) Rules, 2016*. New Delhi: Gazette of India, Government of India, 23 March 2016. https://cpcb.nic.in/displaypdf.php?id=UHJvamVjdHMvRS1XYXN0ZS9FLVdhc3RlTV9SdWxlc18yMDE2LnBkZg==

Ministry of Environment, Forests and Climate Change. *E-Waste Management (Amendment) Rules, 2018*. New Delhi: Gazette of India, Government of India, 22 March 2018. http://www.indiaenvironmentportal.org.in/files/file/E-%20Waste%20(Managment)%20Amendment%20%20Rules,%202018.pdf

Ministry of Environment, Forests and Climate Change. *Hazardous and Other Wastes (Management and Transboundary Movement, 2016)*. New Delhi: Gazette of India, Government of India, 4 April 2016. https://cpcb.nic.in/displaypdf.php?id=aHdtZC9IV01fUnVsZXNfMjAxNi5wZGY

Ministry of Environment, Forests and Climate Change. *Plastic Waste Management Rules, 2016*. New Delhi: Gazette of India, Government of India, 18 March 2016. http://jaipurmc.org/PDF/Auction_MM_RTI_Act_Etc_PDF/PLASTIC%20WASTE%20MANAGEMENT%20RULES%202016.pdf

Ministry of Environment, Forests and Climate Change. *Plastic Waste Management (Amendment) Rules, 2018.* New Delhi: Gazette of India, Government of India, 27 March 2018. https://cpcb.nic.in/displaypdf.php?id=cGxhc3RpY3dhc3RlL1BXTV9HYXpldHRlLnBkZg==

Ministry of Environment, Forests and Climate Change. *Plastic Waste Management (Amendment) Rules, 2021*. New Delhi: Gazette of India, Government of India, 21 August 2021. https://static.pib.gov.in/WriteReadData/specificdocs/documents/2021/aug/doc202181311.pdf

Ministry of Environment, Forests and Climate Change. *Plastic Waste Management (Second Amendment) Rules, 2021*. New Delhi: Gazette of India, Government of India, 17 September 2021. https://egazette.nic.in/WriteReadData/2021/229867.pdf.

Ministry of Environment, Forests and Climate Change. *Solid Waste Management Rules, 2016*. New Delhi: Gazette of India, Government of India, 8 April 2016. https://cpcb.nic.in/uploads/MSW/SWM_2016.pdf

Ministry of Environment, Forests and Climate Change. *Solid Waste Management Rules Revised After 16 Years; Rules Now Extend to Urban and Industrial Areas*. Press Information Bureau, Government of India, April 5 2016. https://archive.pib.gov.in/newsite/PrintRelease.aspx?relid=138591

Ministry of Law and Justice. *Indian Partnership Act, 1932*. New Delhi: Government of India, 1 October 1932. https://www.mca.gov.in/Ministry/actsbills/pdf/Partnership_Act_1932.pdf

Ministry of Law and Justice. *Limited Liability Partnership Act (Amendment), 2021*. New Delhi: Gazette of India, Government of India, 13 August 2021. https://www.mca.gov.in/content/dam/mca/pdf/llpAct2021_19082021.pdf

Ministry of Law and Justice. *The Indian Trusts Act, 1882*. Government of India, 13 January 1882. https://legislative.gov.in/actsofparliamentfromtheyear/indian-trusts-act-1882.

Ministry of Law and Justice. *The Limited Liability Partnership Act, 2008*. New Delhi: Gazette of India, Government of India, 9 January 2009. https://www.mca.gov.in/content/dam/mca/pdf/LLP_Act_2008_15jan2009.pdf.

Nebiu, Besim. *Developing Skills of NGOs—Project Proposal Writing*. Szentendre: The Regional Environmental Centre for Central and Eastern Europe, 2002. https://www.academia.edu/4147985/DEVELOPING_SKILLS_OF_NGOS_Project_Proposal_Writing

NIUA (2020) "How does urban India manage its waste? An Almanac of Waste Management Practices" Delhi, India

Sayers, Richards. *Principles of Awareness-raising for Information Literacy: a Case Study*. Thailand: UNESCO Bangkok. 2006. http://www.unesco.org/new/en/communication-and-information/resources/publications-and-communication-materials/publications/full-list/principles-of-awareness-raising-for-information-literacy-a-case-study/

Singh, S. (2020) Solid Waste Management in Urban India: Imperatives for Improvement. ORF Occasional Paper.https://www.orfonline.org/wpcontent/uploads/2020/11/ORF_OccasionalPaper_283_SolidWasteManagement_FinalForUpload-2.pdf

Williamson, David. "Waste Management SWOT Analysis / SWOT Matrix." *Essay48* (December 5, 2018). https://www.essay48.com/term-paper/12828-Waste-Management-Swot-Analysis.

Wren, Alan. *The Project Management A-Z: a Compendium of Project Management Techniques and How to Use Them.* London: Routledge, Taylor & Francis Group, 2003.

Journals

1. Waste Management & Research
2. The Journal of Solid Waste Technology and Management
3. International Journal of Environment and Waste Management
4. Down to Earth
5. Environmental Sustainability Journal

Additional information (if any)

Student responsibilities

The students are expected to submit assignments in time and come prepared with readings when provided.

Course reviewers

Dr Suneel Pandey, Director, Environment & Waste Management Division, The Energy and Resources Institute (TERI), New Delhi

Prof. Narendra Kanhe, Ph.D. Principal, Bajaj Institute of Technology, Wardha, Maharashtra, INDIA.

Enclosure 8

Course title: Air quality monitoring			
Course code: NRE	**No. of credits:** 2	**L-T-P:** 24-0-12	**Learning hours:** 36
Pre-requisite course code and title (if any): No pre-requisite required			
Department: Natural and Applied Sciences			
Course coordinator(s):		**Course instructor(s):**	
Contact details:			
Course type: Core		**Course offered in:**	

Course description

The course focuses on the science behind air quality monitoring with significant emphasis on hands-on use, maintenance & calibration of monitoring instruments. The course aims to equip the participants with skill sets to carry out any monitoring exercise with competence & confidence.

Course objectives

- To enhance the skills in air quality monitoring
- To provide an understanding of the science behind air quality monitoring and analysis

Course content

Module	Topic	L	T	P
1.	**Introduction**			
	Ambient air quality: Overview, pollutants, sources of pollution, national standards;	1		
	Importance of air quality & its impacts on human health, plants/vegetation & agriculture;	1		
	Monitoring requirements under the air act and various methods of monitoring;	1		
	Units and materials and energy balance;	1		
	Local meteorology and its role in air quality management.	1		
2.	**Air quality sampling, infrastructure and instruments**	1		
	Ambient air sampling, techniques and infrastructure requirements;			1
	Demonstration of instruments;			2
	Setting up samplers for monitoring of PM10, PM2.5, SO2 & NOx in ambient air;	1		
	Techniques of monitoring ozone ammonia and heavy metals;	2		
	Standard operative procedures/methods of quantitative analysis of particulates and gases;	1.5		
	Modern instrument for monitoring of benzene and other organic gases.			
3.	**Instrument calibration & maintenance, sample retrieval and analysis**			
	Calibration of samplers;	2		
	Demonstration of calibration of samplers;			2
	Retrieval of samples from instruments, sample preservation, storage and transportation to lab for analysis;			2
	Demonstration of quantitative analysis of pollutants;			3
	Preventive maintenance of samplers;	1		
	Quality assurance and quality control	2		
	Real time monitoring & principles of different analyzers and calibration;	1.5		
	Sensor-based systems;			2
	Visit to CAAQMS.			
4.	**Air quality data analysis**			
	Air quality data analysis and interpretation;	1		
	Importance & need for source apportionment studies.	1		

5.	Air pollution control Appropriate techniques for air pollution control systems; Emerging technologies & mitigation of air pollution.	 1 1.5		
6.	**Noise pollution monitoring** Noise Pollution, its monitoring & control.	 1.5		
	Total	**24**	**0**	**12**

Evaluation criteria

- Major Test : 70%
- Viva voce: 30%

Learning outcomes

After completing this course the students will be able to

- techniques of obtaining reliable air quality data
- adequately use, operate, maintain, and calibrate air quality monitoring instruments

Pedagogical approach

Classroom lectures, hands on demonstration and site visit.

Additional information (if any)

Student responsibilities

The students are expected to submit assignments in time and come prepared with readings when provided.

Course reviewers

Dr Suresh Tiwari, Deputy Director, Indian Institute of Tropical Meteorology, New Delhi.

Prof S Shivanagendra, Department of Civil Engineering, Indian Institute of Technology, Madras.