MINUTES OF THE FORTY-FIRST OF THE ACADEMIC COUNCIL HELD ON 13 NOV 2017 AT 10.30 A.M.

PRESENT

The following members of the Academic Council attended the meeting:

Members		**Invitees**
Dr Leena Srivastava	Chairperson	Dr. Soumendu Sarkar;
Dr Rajiv Seth		Dr. Shantanu De Roy
Dr Prateek Sharma		Mr Sapan Thapar
Prof S Sundar		Dr. Nirupam Datta
Prof TC Kandpal		Dr LN Venkataraman
Dr Vivek Suneja		Dr Shaleen Singhal
Dr Suresh Jain		Dr Pradeep Kumar
Dr Sapna A Narula		Dr Kamna Sachdev
Dr Nandan Nawn		Dr Dr. C K Singh
Dr Chaithanya Madhurantakam		Dr Neeti
Dr MV Shiju		Dr Chubamenla Jamir
Dr Naqui Anwer		
Dr Anandita Singh		
Dr Anu Rani Sharma		
Capt. Pradeep Kumar Padhy (Retd.)	Secretary	

Dr Rakesh Khosa, Dr Kanchan Chopra, Dr Malathi Lakshmikumaran, Dr Anubha Kaushik, Dr Arun Kansal, Dr Sudipta Chatterjee and Ms Fawzia Tarannum could not attend the meeting.

The Vice Chancellor welcomed all the members of the Academic Council and Invitees.

ITEM NO. 1 To confirm the minutes of the fortieth meeting of the Academic Council held on 05 Jul 2017. The minutes of the fortieth meeting of the Academic Council held on 05 July 2017, were circulated to the members and no comments have been received.

TU/AC 41.1.1 The Council resolved that the minutes of the meeting of the Academic Council held on 05 July 2017 be confirmed.

ITEM NO. 2 To consider and approve TERI University PhD Regulations 2017**.** The registrar stated that the revised PhD regulations of the University (based on UGC Minimum Standards and Procedure for awards of M Phil/PhD Degree **Regulation** -2016) was presented to the 40th Academic council on 05 July 2017. He stated that as resolved at the 40th Council an amended was recirculated, and no comments had been received so far.

.**TU/AC 41.2.1** The Council resolved that the PhD regulations as amended be accepted and approved (Annexure 1).

ITEM NO 3. To consider and approve PPR of Distance Education Programme. Coordinator, Distance Learning Programme Mr Sapan Thapar presented the Programme Project Report (PPR) of the PGDRE and APGDRE programmes. The PPR was discussed by the Council

TU/AC 41.3.1 The Council resolved that PPR as given at Annexure 2 be accepted and approved.

ITEM NO 4. To consider and approve renaming of MTech (Water Science & Governance) programme as MTech (Water Resources Engineering and Management). The Registrar informed that the programme covered applied courses in water resources engineering including design and planning aspects and learners skills were honed in software applications including modelling and optimization. He stated that the programme facilitated courses on water resource management, water audit & demand management, water planning & management and water governance etc. He stated that being an M Tech course the emphasis had been on water resources engineering and not on water science and therefore a change in name as recommended which would add value to the course name and structure.

TU/AC 41.4.1 The Academic Council resolved to approve the change of name of MTech (Water Science & Governance) to MTech (Water Resources Engineering and Management).

ITEM NO.5. To consider and approve revised programme structure of MSc (Economics). The recommendations of the meeting of the Board of Studies of Department of Policy Studies held on 27 Oct 17 were placed before the Council (Details placed at annexure 3). The following suggestions were provided: -

(a) Percentage of overlap with other courses to be brought out explicitly.
(b) Rationalize with 02 courses in macro and 02 courses in micro.
(c) Not more than four courses should be taught per semester.
(d) Add credits for internship.
(e) Capitalise on the niche environment issues.
(f) Add more elective courses.
(g) Economic History may be made a core course.
(h) Public finance may be added.

TU/AC 41.5.1 The Council resolved that the programme structure of MSc(Economics) as under be approved.

Semester 1: 4 Core Courses of 4 credits each, viz.

1. Microeconomics
2. Macroeconomics
3. Constrained optimization and linear Algebra
4. Probability and Statistics

Semester 2: 4 Core Courses of 4 credits each, viz.

1. Growth and Development
2. Indian Economy
3. Econometrics
4. Environment and Economic Development

Semester 3:

(a) 1 Core Course of 4 credit: Research Methodology

(b) 3 Elective Courses (with at least one from either Economics of Environment or Economics of Natural Resources) from those offered in the MSc Economics programme or open electives. *

Semester 4:

(a) Thesis track (16 credits): Master's Thesis [Pre-requisite: B+ or above in Research Methodology]

OR

(b) Course track (16 credits): Elective courses from those offered in the MSc Economics programme or open electives.*

* Elective courses offered in the MSc Economics Programme are as follows:

- Economics of Environment
- Economics of Natural Resources
- Indian Agriculture in a Global Setting (MPE 128)
- Advanced Econometrics (MPE 179)
- Time Series and Regression Analysis (MPE 177)
- Ecological Economics (MPE 125)
- Labour Economics (MPE 174)
- Trade and the Environment (MPE 192)
- Law and Economics (MPE 151)
- Economics of Health and Environment (MPE 145)
- Energy Economics (MPE 183)
- Advanced Macroeconomics (MPE 123)
- Theory of Finance (MPE 126)
- Industrial Organisation (MPE 133)
- Theory of Contracts (MPE 140)
- Public Economics (MPE 148)
- Advanced Microeconomics

- Collective action and environmental management (MPE 135)

Students are also allowed to fulfil their elective credit requirement wholly or partly with courses offered in other programmes subject to the approval of the Programme Coordinator. Among others, they include the following:

- Water Resources Economics
- Corporate Finance
- Economics of Climate Change

The list of courses offered in either category may vary.

ITEM NO. 6. To consider and approve the outline of two courses for MSc (Economics). The recommendations of the meeting of the Board of Studies of Department of Policy Studies held on 27 Oct 17 w.r.t. MSc (Economics) programmes were placed before the Council. Members recommended that the name of the title be changed to Macroeconomics and books like 'Between Debt And The Devil: Money, Credit, And Fixing Global Finance by Adair Turner' be prescribed. In labour economics Marxian theories be included issues like NREGA and implications of labour laws be discussed.

TU/AC 41.6.1 The Council resolved that the outlines of the following courses placed at Annexure 4 be approved: -

Serial no	Course	Type	Credit
1	Macroeconomics*	Core	4
2	Labour Economics**	Elective	3

* Revision ** New course

ITEM NO. 7. To consider and approve the outline of three courses for LLM. The recommendations of the meeting of the Board of Studies of Department of Policy Studies held on 27 Oct 17 w.r.t. LLM were placed before the Council. A detailed discussion was held on the programme outline, and three new courses were suggested.

TU/AC 41.7.1 The Council resolved that the outlines of the following Courses placed at Annexure 5 be accepted as amended and approved: -

Serial no	Course	Type	Credit
Ser	Course	Type	Cr
1	Competition Law and Policy**	Elective	2
2	Hazardous Waste Law**	Elective	2
3	Water Resources law**	Elective	2

** New course

ITEM NO. 8 To consider and approve the outline of courses for MA (PPSD). The recommendations of the meeting of the Board of Studies of Department of Policy Studies held on 27 Oct 17 w.r.t. MA(PPSD) were placed before the Council. A detailed discussion was held on the course outlines. In the course 'Assessing Public Policy: Methods & Measurement', it was suggested that evaluation criteria shall be relooked, LTP allocations would be reconsidered. The council also suggested that CAG's methodologies of assessment and evidence based approaches in policy studies be considered. As regards to 'India: Major Policy issues' the Council recommended that the title should be changed to "Major Policy Issues: Education, Health and Infrastructure in India". While scrutinizing 'Water Science and Policy' the Council recommended that first Module should discuss Water as a component of Ecosystem instead of Environment system and since the course is policy based, the Title could either be "Water Resource Policy" or "Policy Perspectives on Water". The Council recommended to reconsider the term reaction papers in the evaluation criteria and term it as review papers. Council recommended that objectives of the course 'Public Policy Processes & Institutions' be clearly stated. With respect to 'Communities and Conservation' the Council recommended that evaluation criteria be reconciled and connected to the learning outcomes. As regards to 'Sustainable Consumption and Production in Cities' it was suggested that the title be revised to 'Sustainable Urbanization', production component be added in the course outline and L-T-P ratio be reconsidered. The Council recommended that in the course 'Agriculture and Rural Development' there was a need to cover non-agricultural livelihood aspects like organic farming etc, PURA as a case-study and PPP models in Rural Development. While examining the course 'Public Management: Issues and Challenges' with special reference to India the Council appreciated the coverage of diverse theories.

TU/AC 41.8.1 The Council resolved that outlines of the following eight courses of MA(PPSD) programme be accepted as amended (vide Annexure 6) and approved: -

Ser	Course	Type	Credit
1	Assessing Public Policy : methods and Measurements **	Core	2
2	Public Policy Processes and Institutions**	Core	2
3	Communities and Conservation**	Core	2
4	Major Policy Issues - Education, Health and Infrastructure in India **	Core	2
5	Policy perspectives on water**	Core	2
6	Sustainable Urbanization **	Core	2
7	Agriculture and rural development **	Core	2
8	Public management : Issues and challenges with special reference to India **	Core	2

****** New course

ITEM NO. 9. Extension of maximum period for submission of thesis. The Registrar informed the council that a doctoral candidate is expected to submit his/her thesis within five years from the date of registration and the period might be extended by Academic Council as a special case. He stated that the following candidates who had

registered for PhD programme require extension since they have completed the 5 year period as indicated below.

- Ms Nidhi Gupta (0921REB) of Department of Energy & Environment in May 2017
- Ms Shikha Tyagi (1033RBB) of Department of Biotechnology in July 2017
- Ms Jyoti Kashyap (1116RNA) of Department of Natural Resources in September 2017.

The Registrar informed that on the recommendation of the supervisor, approval was sought for an extension of one year in respect of above candidates for the submission of their theses.

TU/AC 41.9.1 The Council resolved that one-year extension be accorded to :-

- Ms Nidhi Gupta (0921REB)
- Ms Shikha Tyagi (1033RBB)
- Ms Jyoti Kashyap (1116RNA) .

ITEM NO 10. To consider and accord in-principle approval to start MTech (Sustainable Building Design and Management). The detailed justification is placed at Annexure 7.

TU/AC 41.10.1 The Council resolved that in-principle approval be accorded for starting a programme - MTech (Sustainable Building Design and Management).

ITEM NO. 11To consider and approve the revised structure of 2nd semester of MSc (Climate Science and Policy). The recommendations of the meeting of the Board of Studies of Dept of Energy and Environment held on 07 Nov 2017 were placed before the Council.

TU/AC 41.11.1 The Council resolved that the following revised structure of 2nd Sem of MSc (CSP) programme be accepted as amended and approved:-

Ser	Course	Type	Credit
	Core courses		
1	Research Methodology	Core	2
2	Principles of Geoinformatics		3
3	Climate Change Vulnerability and Adaptation	Core	3
4	Mitigation of Climate Change	Core	3
	Electives (can choose any two)		
5	Spatio Temporal Data Analysis	Elective	3
6	Climate Change and Water	Elective	3
7	Introduction to Climate Modelling	Elective	3
8	Climate Change and Public Health	Elective	3
	Open Elective		
9	Environment Health and Risk Assessment	Elective	3
10	Climate Change and Law	Elective	2

ITEM NO. 12. To consider and approve the outlines of five courses of MSc (Climate Science and Policy). The recommendations of the meeting of the Board of Studies of Department of Energy & Environment w.r.t. MSc (CSP) programme held on 07 Nov 2017 were placed before the Council. In the Course 'Vulnerability and adaptation 'it was suggested that the course description be changed and the content should be more specific to the course. Further it was recommended that the word 'sensitization' be changed. With regard to the course 'Spatiotemporal data analysis' the Council recommended that objectives of the course be revised With respect to 'Climate change and water' the Council recommended that aspects of Flood, Modeling etc. be added. It was also suggested that in the reading material section it could be specifically mentioned that the research papers would be given to students as study material or for assignments. While examining the outline for 'Introduction to Modeling' the Council recommended that details wrt Course objectives, Learning outcomes, Pedagogical approach and reading material be improved.

TU/AC 41.12.1 The Council resolved that outline of following courses of MSc (MSP) placed at Annexure 8 be accepted as amended and approved.

Ser	Course	Type	Credit
1.	Climate Change Vulnerability and Adaptation	Core	3
2	Spatio Temporal Data Analysis	Elective	3
3	Climate Change and Water	Elective	3
4	Introduction to Climate Modelling	Elective	3
5	Climate Change and Public Health	Elective	3

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

Sd/
Capt Pradeep Kumar Padhy (retd.)
Registrar

Enclosures:-
Annexure 1
Annexure 2
Annexure 3
Annexure 4
Annexure 5
Annexure 6
Annexure 7
Annexure 8

Distribution:-

Electronic Copy
1. Vice-Chancellor, TERI University
2. All members of the Academic Council
3. Website

Printed Copy
4. Registrar, TERI University

Annexure 1
(Refer to TU/AC 41.2.1)

PhD REGULATIONS -2017

Preamble

1. TERI University provides an environment that encourages academic excellence. The university offers PhD programs in wide range of areas including Natural resources management, Energy and Environment, Economics, Biotechnology and Social sciences etc.

Scope

2. This policy will be called "TERI University PhD Regulations-2017" and shall be applicable to the faculty members and PhD students of the university.

A. Eligibility criteria for admission to Ph.D. programme:

3. Subject to the conditions stipulated in these Regulations, the following persons are eligible to seek admission to the Ph.D. programme:

a. 02 yr M.Sc/MA or M Phil in a relevant field or equivalent. 01yr PG degrees may be accepted in exceptional cases.

b. In extremely exceptional cases the admission committee may consider an application from a candidate who possesses a BTech in a relevant field or equivalent. Only those who have a minimum CGPA of 8.0 on a 10 point scale or 75% marks should consider applying in this category. It may be noted that consideration under this category would be evaluated by an evaluation committee and would entail extended pre-Ph.D course work requirement.

c. Candidates (sponsored/non-sponsored) applying on part-time basis need to have a minimum work experience of 3 years in organizations approved by the Department Research Committee.

d. Additional requirements for full-time sponsored candidates

(i) Sponsored candidates are required to submit a sponsoring certificate from their employers on proper letterhead stating that for the period of his/her studies in the programme, the candidate would be treated as on duty with usual salary and allowances and that he/she will be fully relieved for the period of study for pursuing his/her study and the fee of the candidate will be paid by the sponsoring organization.

(ii) Candidates seeking admissions to Ph D programmes on the basis of study leave must show proof at the time of interview of the fact that they will be/have been granted study leave for a minimum period of three years.

e. Additional requirements for part-time (sponsored and non-sponsored) candidates

(iii) Non-sponsored candidates are required to submit a 'No Objection Certificate' at the time of interview from their employer stating that the candidate is permitted to pursue studies on a part-time basis and that:

aa. His/her official duties permit him/her to devote sufficient time for research;

ab. The candidate shall be provided access to the facilities in the field of research;

ac. He/she shall be permitted to attend classes at the University as required by the University.

B. Admission:

4. Admission will be made on the basis of a test/interview conducted by the University. Candidates may apply at any time throughout the year. Admission is subject to vacancies available in the relevant specializations. Categories of admission:

(a) Full time with assistantship/without assistantship

(b) Full time with UGC/CSIR/DBT/other research scheme scholarship

(c) Sponsored

(d) Part-time

C. Duration of the programme:

5. Ph.D. programme shall be for a minimum duration of three years, including course work and a maximum of six years. This may be waived by the Academic Council only in extremely exceptional cases when recommended by the Department Research Committee.

D. Extension criteria

6. This maximum time limit for submission of thesis may be extended by the Academic Council based on the recommendation of DRC as a special case for a period of 1 year (on a maximum of 2 occasions), after which the registration will stand cancelled. While recommending to the Academic Council, the DRC may consider one or more of the following criteria as accentuating Circumstances (based on the evidence produced by the candidate):

a. Medical exigency.

b. Forced break due to employment requirement (in case of part time candidates only).

c. Discontinuity in supervision (due to non-availability of supervisor).

d. Change in focus of research due to emergence of any new/unforeseen challenges in conducting research (e.g. security threat).

e. Candidate at an advanced stage of research requiring a defined time only after approval from DRC and SRC. The DRC in such caseshould consider research output achieved such as publication(s).

7. After 04 years (including Course work), the Supervisor has to justify as to why extra time is needed.

8. The University has to specify for part time students as to how many zero semesters could be permitted.

9. Full/Part time candidate may be allowed to convert his/her registration into Part/Full time on the recommendation of the SRC/DRC. This change will be allowed only once.

E. Allocation/Eligibility of Research supervisor:

10. As per UGC letter No. F. No. 14-4/2016(PS), following are the eligibility criteria to be a Research Supervisor/Co- Supervisor:

a. PhD supervisor has to be amongst the regular faculty of TERI University only and co- supervisor can be appointed from within or outside of the university, if necessary.

b. All Adjunct faculty members can act as co-supervisor.

c. Department concerned can appoint Co-supervisor from outside the Department/Faculty/university in case of topics of inter-disciplinary nature.

d. Any regular Professor should have at least five (5) research publications in refereed journals and any Associate / Assistant Professor with at least two (2) research publications in refereed journals in order to be recognized as Research Supervisor. Further, if there is limited number of referred journals in the particular discipline, these rules can be relaxed with a written explanation.

e. A faculty at the rank of Professor is allowed to supervise at most Eight (8) PhD Scholars, at a time. An Associate and Assistant Professor can supervise up to six (6) and four (4) PhD Scholars respectively, at a time.

11. Change of Research Supervisor:-

a. If a Research Supervisor takes up a short-term assignment outside TERI University, the candidate will be permitted to continue his / her research under the same Research Supervisor OR he/she may be permitted to change his / her Research Supervisor, after obtaining the approval of DRC. However, the duration of PhD, the area of research and the title of the study shall remain unaltered.

b. In case the Research Supervisor leaves TERI University permanently, he/she cannot continue to guide any scholars in TERI University. The candidate is encouraged to identify a potential supervisor in consultation with the DRC Chairperson/PhD Coordinator, and seek approval of DRC for such a change within a reasonable period, but not more than one month from departure of the former Supervisor from the University. The DRC can Suo

motu assign a new supervisor, if it feels so, which will be binding on the student. However, a Research Supervisor who has left TERI University can continue as a Co-Supervisor, if approved by the DRC.

c. A supervisor may request to relinquish a student in case he/she feels that a conflict of interest may arise or if there is a change of research topic outside his area of expertise. However, in such exceptional circumstances, the interest of the student is to be safeguarded and such a change must have the approval of the DRC.

d. In exceptional circumstances, a candidate wishing to have a change of supervisor can make an appeal to the Chairperson DRC with clear and specific reasons for the request. The Chairperson DRC on the merit of the case may recommend the matter for consideration to a Committee set up for this purpose comprising of both Deans and the Chairperson DRC. The decision of the Committee will be binding on all concerned. The Committee, if recommending a change of supervisor, will also make recommendations on the rights of the supervisor and the student for using the past-work.

F. Pre-PhD course requirements

12. The Pre-PhD course requirements shall be as follows:-

a. In order to overcome any deficiency in the breadth of fundamental training for advanced work, several courses are offered across disciplines taught at the University. Such courses would include those at Masters level or could be special ones created only for the doctoral student/s.

b. The courses will be offered by TERI University.

c. The credit assigned to the Ph.D. course work shall be a minimum of 8 credits and a maximum of 16 credits.

d. Four credits shall be assigned to one or more courses related to Research Methodology which could cover areas such as quantitative methods, such as statistics, computer applications, research ethics and review of published research in the relevant field, training, field work, etc. Other courses shall be advanced level courses preparing the students for Ph.D. degree.

e. The course requirement will be determined by the DRC (Department Research Committee)/ on the recommendations of the SRC (Student Research Committee) after considering the student's background in relation to the proposed topic of research.

f. Grades in the course work, including research methodology courses shall be finalized after a combined assessment by the SRC and the Department and the final grades shall be communicated to Registrar.

g. The minimum CGPA requirement will be 7.0.

h. The pre-PhD course work must be completed within the first two semesters and the first three semesters of joining the programme by full-time and part-time students, respectively.

G. Comprehensive examination

13. A student shall be formally registered/ admitted to a PhD programme only after s/he has cleared the comprehensive examination. Students will be permitted to take the comprehensive examination only after they have completed the pre-PhD course work as decided by the SRC and defined in F.12.d. Full-time and part-time students must clear the comprehensive examination within a period of 18 months and 24 months, respectively, from the date of joining. Every student, after having completed the comprehensive examination, must formally register for the PhD programme.

14. As part of the comprehensive examination the student shall submit a PhD research proposal document, prepared in consultation with the supervisor. The same should be submitted to the examination panel members at least one week in advance of the comprehensive examination. An external examiner may be part of the comprehensive examination panel if suggested by the SRC.

15. The student's evaluation will be based on an oral presentation and the accompanying write-up of the research proposal that should include its proposed title, introduction and literature review, rationale for research, aim, research objectives/questions, broad framework/tentative methodology, expected outcomes and proposed timeline. The presentation should also list the pre-PhD courses attended, grades scored and any other research-related activity undertaken.

16. There shall be a repeat of comprehensive examination decided by the SRC, in case of failure in 1st attempt or major change in focus of proposed research.

H. Attendance requirements for Ph D students

17. The attendance requirement for PhD students shall be as follows:-

a. A Ph D student, whether full-time or part-time, is expected to attend all classes in each course in which he/she is registered. In case his/her attendance is less than 75%, he/she will be debarred from the test/examination for the course and will be awarded an Ab. Grade.

Attendance requirement for PhD students with assistantship/scholarship

b. If a PhD student's attendance falls below 75% in any taught course(s) during a month, s/he will not be paid assistantship/scholarship for that month. Further, if his/her attendance again falls short of 75% in any course in any subsequent month in that semester, his/her assistantship/scholarship will be terminated. A research scholar, after having completed the course work, must attend to his/her research work on all the working days and mark attendance except when s/he has been sanctioned leave. The requirement of 75% attendance will apply as above on daily attendance except in cases where longer leave has been duly sanctioned within the leave entitlement of the student.

Note: For the above purpose, if 75% works out to be a number that is not a whole number; the immediate lower whole number will be treated as the attendance.

I. Grant of leave to Ph.D. students:-

18. The leave regulations for PhD students shall be as follows:-

a. During course work a full-time Ph.D. student, during his/her stay at the University will be entitled to leave for 30 days, including leave on medical grounds, per academic year. He/she will not be entitled to mid-semester breaks, summer and winter vacations. Leave beyond 30 days in an academic year may be granted to a Research Scholar in exceptional cases subject to the following conditions:

i. the leave beyond 30 days will be without assistantship/scholarship; and

ii. such an extension of up to additional 30 days will be granted only once during the programme of the scholar.

The leave will be subject to the approval of the Head of Department/ Dean/ Faculty/ Programme Coordinator concerned on the recommendation of the Supervisor

b. After completing the course work a full-time Ph.D. student during his/her stay at the University, will be entitled to leave for 30 days per academic year. He/she will not be entitled to mid-semester breaks, summer and winter vacations. In addition, a Ph.D. scholar who has completed his/her course work may be granted leave on medical grounds up to 10 days per academic year. Women research scholars will be eligible for maternity leave with assistantship for a period not exceeding 240 days once during the tenure of their programme.

c.

J. Research Committees and their functions:

19. The PhD degree of the University may be conferred on a student who fulfils all the requirements detailed in these rules.

a. Applications for PhD registration, that is, for entry to a course of study and research leading to a PhD degree, must be made to the University on the approved form. The date of registration is the date when candidate registers for Pre-PhD courses. However, in exceptional cases, the date of registration may be advanced by a maximum of six months by the Academic Council if it is convinced that the student has spent enough time on the research earlier.

b. The academic programme of all the PhD students in a Department/Centre will be coordinated by the DRC as per the rules and regulations of the University upon recommendation of the SRC.

c. The supervisor shall be appointed during the first semester. If desirable, the DRC/CRC, based on the recommendation of the SRC, may appoint Co-supervisor(s) (not exceeding two) from within or outside the University. Appointment of any Co-supervisor would not be permitted after the comprehensive examination of the student, except in cases where none of the supervisors is available to supervise for a year or more at a stretch.

d. In the event of the supervisor being unavailable for supervision the SRC will recommend to the DRC that another faculty member as per the provisions given in 11.a & b.

20. The progress of each student will be monitored by the SRC and the DRC/CRC. For this purpose, the following procedures will be followed. PhD research work will be given a course number as is done for other courses.

a. The DRC will coordinate the collection of progress reports, written and signed by the scholar and forwarded by the supervisor every semester.

b. An 'X' grade will be awarded along with comments for that semester if the progress is 'satisfactory'.

c. If the progress is 'unsatisfactory', a 'U' grade will be awarded along with comments. When a 'U' grade is awarded for the first time, a warning will be issued to the student. If his/her performance does not improve after the warning, the fellowship/assistantship may be withheld.

d. If there are two consecutive 'U' grades, the student will have to withdraw from the doctoral programme and his/her studentship will be terminated.

e. The progress of PhD research work will be discussed in the DRC/CRC as per the semester schedule.

f. The above process will continue until the synopsis of the thesis is submitted.

K. Evaluation and Assessment Methods, minimum standards/credits for award of the degree, etc.:

21. The procedure wrt the above shall be as follows:-

a. The student may submit his/her thesis at any time provided that s/he has completed the minimum period of registration and S/he has completed the course work requirement as prescribed by the DRC/SRC with a CGPA not below 7.0 and has also cleared the comprehensive examination, and S/he has submitted, at least two months earlier, the title and a synopsis of the thesis.

b. Upon satisfactory completion of comprehensive examination, and obtaining the marks/grade prescribed, Ph.D. scholar shall be required to undertake research work and complete the same within a reasonable time as stipulated by TERI University.

c. Prior to the submission of the synopsis, the scholar shall make a presentation in the Department before the SRC which shall also be open to all faculty members and other research scholars. The feedback and comments obtained from them may be suitably incorporated into the draft thesis in consultation with SRC.

d. Synopsis submission: On evaluating PhD work, SRC shall approve the Synopsis for submission to DRC.

e. Pre-submission defence: DRC shall call the student to present his/her PhD work through an oral presentation made to all faculty members and PhD students.

f. Ph.D. scholars must publish at least one (1) research paper in refereed journal which is direct outcome of their PhD research (review paper will not be counted as referred paper) and make two paper presentations in conferences/seminars before submission of the thesis

for adjudication, and produce evidence for the same in the form of presentation certificates and/or reprints.

g. The Academic Council shall evolve a mechanism using well developed software and gadgets to detect plagiarism and other forms of academic dishonesty. While submitting for evaluation, the thesis shall have an undertaking from the research scholar and a certificate from the Research Supervisor attesting to the originality of the work, vouching that there is no plagiarism and that the work has not been submitted for the award of any other degree/diploma of the TERI University where the work was carried out, or to any other Institution.

h. Examiners: The DRC shall evaluate and recommend the list of potential Indian and Foreign examiners to the Chairman, Academic Council.

i. The thesis shall be written in English in the specified format and shall contain a critical account of the student's research. It should be characterized by discovery of facts or a fresh approach towards the interpretation of facts and theories or a significant contribution to the knowledge of design or development, or a combination of them. It should bear evidence of the student's capacity for analysis and judgment, and also his/her ability to carry out independent investigation, design, or development. No part of the thesis, or supplementary published work, shall have been submitted for the award of any other degree. Three copies of thesis in soft cover have to be submitted in the prescribed format . In case of joint supervision, four copies of the thesis are required to be submitted. Additionally a soft copy of the thesis shall be submitted for the required plagiarism check. The DRC/ SRC shall deal appropriately with any case of plagiarism

j. On receipt of the title and synopsis of the thesis, the Chairman, Academic Council, will appoint a Board of Examiners for each student. The Board will consist of at least one internal examiner, members from the SRC and two external examiners, one from within India and one from abroad, who shall be an expert in the subject of the thesis. These external examiners shall be selected from a list of six to eight examiners to be recommended by the supervisor(s) through the DRC/CRC while forwarding the title and synopsis of the thesis. The student will be required to submit an updated synopsis, if more than nine months have passed before the submission of the thesis.

k.Each examiner will submit a detailed assessment report recommending to the Chairman, Academic Council, one of the following courses of action.

That the thesis be deemed satisfactory and that the student may defend his/her thesis orally before a committee constituted for the purpose and any members of the faculty and research students who wish to be present.

That the student may submit a revised thesis. In normal circumstances, s/he may submit the revised thesis within a period of one year from the date of communication in this regard from the Chairman, Academic Council.

However, in exceptional circumstances, this period may be extended by the Chairman by another one year; the total revision time, irrespective of the number of revisions allowed, will not exceed a period of two years.

22. In the event of disagreement between the external examiners, the Chairman, Academic Council, may, as a special case, appoint another external examiner, if the merit of the case so demands. The examiner will report independently to the Chairman, Academic Council.

a. The oral defence of the thesis shall be conducted by a committee consisting of the internal examiner(s) and one external examiner. If for some reasons, the external examiner for the oral examination is not available for the conduct of the oral defence, an alternative external examiner shall be appointed by the Chairman, Academic Council. It is recommended that the Pre-submission defence seminar is made at least 2 weeks before the oral defence by each doctoral candidate to all faculty members and PhD students.

b. On completion of all stages of the examination, the Oral Defence Committee shall recommend to the Chairman, Academic Council, one of the following courses of action.

i. That the degree be awarded.

ii. That the student should be examined further on another occasion in a manner they shall prescribe.

iii. That the degree shall not be awarded.

In case of (b. ii), the Oral Defence Committee shall also provide the student a list of all corrections and modifications, if any, suggested by the examiners.

23. The degree shall be awarded by the Academic Council, provided that:-

a. the Oral Defence Committee, through the Academic Council, so recommends;

b. the student produces a 'no dues certificate' from all concerned in the prescribed form and gets it forwarded by the supervisor along with the report of the Oral Defence Committee; and

c. The student has submitted three hard-bound copies of the thesis, after incorporating all necessary corrections and modifications in the version submitted earlier. The hard-bound copies of the PhD thesis, submitted after the viva voce examination.(One of the copies is to be kept at TERI University library.)

24. Candidates will be awarded PhD degree with the title of dissertation irrespective of the discipline or department of graduation.

25. The University shall develop appropriate methods so as to complete the entire process of evaluation of Ph.D. thesis within a period of six months from the date of submission of the thesis.

26. Treatment of Ph.D through Part-time:

Part-time Ph.D will be allowed provided all the conditions mentioned in the extant Ph.D Regulations are met. A member of the non-academic staff of the University, who satisfies the eligibility criteria, may be considered for admission to the degree as a part-time student, provided his/her application is duly approved by the Vice-Chancellor.

Note: Part-time candidates will be required to attend all classes of the pre-Ph D programme.

L. Award of Ph.D degrees prior to Notification of these Regulations, or degrees awarded by foreign Universities.

27. Award of degrees to candidates registered for the Ph.D programme on or before the date of Notification of these Regulations shall be governed by the earlier regulations under which initial admission has been granted.

M. Depository with INFLIBNET:

28. As mandated by UGC the following norms shall be followed:-

a. Following the successful completion of the evaluation process and before the announcement of the award of the Ph.D degree, the Librarian, TERI University shall submit an electronic copy of the Ph.D thesis to the INFLIBNET, for hosting the same so as to make it accessible to all Universities/Institutions/Colleges.

b. Prior to the actual award of the degree, a provisional Certificate shall be issued to the effect that the Degree has been awarded in accordance with the provisions of UGC Regulations, 2016.

---xxx---

Annexure 2
(Refer to TU/AC 41.3.1)

Programme Project Report (PPR)

1. Mission & Objectives
   - Mission: TERI University aspires to contribute globally by serving society as a seat of advanced learning and to promote learning through teaching and through creating and sharing knowledge
   - Objectives: To enhance the understanding and skill sets of professionals meeting the requirements of industry in the field of renewable energy by providing value based education

2. Relevance of the program with TU's Mission and Goals
   - TERI University was conceived to cater to the need of disseminating the vast reservoir of knowledge created by TERI, a not for profit, independent research institute recognized globally for its contribution to scientific and policy research in the realms of energy, environment, and sustainable development. Recognizing the growing need of professionals trained in various aspects of renewable energy such as technologies, policies and finance, an Open and Distance Learning programme was started in the year 2009, offering 2-year and 1-year Post Graduate Diploma in Renewable Energy. The curriculum was designed with inputs from sector experts and the OPEN University, UK.

3. Nature of prospective target group of learners
   - The programme is designed to enhance the knowledge of stakeholders across the energy value chain. These include policy makers/ regulators, investors, project designers, entrepreneurs, project managers, financiers and students. Most of the participants are mid-career professionals, who intend to increase their knowledge and skill-set in these areas.

4. Appropriateness of programme to be conducted in Open and Distance Learning mode to acquire specific skills and competence:
   - The programme has been designed keeping into account the evolving technological and policy landscape in the RE sector. The learning outcomes include design and analysis of RE technologies; critical assessment of energy policy; undertaking feasibility analysis of emerging business opportunities.

5. Instructional Design
   - The curriculum has been designed to meet the skilling requirements of both the students as well as the industry. Sector experts are involved in content design and development, besides dissemination of lectures. All the four semesters have weightage of 20 credits each (split into modules/ chapters) and are run for 20 weeks each. Most of the faculty members (both internal and external) are sector experts. Students use a dedicated portal to access the learning material, which is also shared in hard format (book). Face to

face interactions / webinar sessions are conducted at a regular frequency and recorded lectures are also made available to the students. Assignments, including case studies, need to be attempted after completion of a module (through the portal itself). Both the assignments and the end- semester exams carry a certain weightage in the final grades.

6. Procedure for admissions, curriculum transaction and evaluation
   - Admissions are opened twice a year for the summer and the winter batches respectively. The details with regard to the minimum educational eligibility, fee structure and the course structure are provided on an upfront basis. A Student Handbook (available on the University website) provides all information about the rules and regulations governing the Programme, which includes the marking scheme. The semester schedule is shared with the students before the start of the academic activity, detailing the activities planned during the semester.

7. Requirement of the laboratory support and Library Resources:
   - Students have an opportunity option to undertake experiments in the Power and Energy laboratories at the University Campus. Access to library is provided to the students. Being an emerging sector, latest news, policies and research reports are shared with the students on a regular basis. The students are invited to the workshops/ seminars organized at the University Campus.

8. Cost estimate of the programme and the provisions:
   - The cost estimate includes the following items –
     - Programme development - 40% [It includes development and designing of learning material, its review & updation, designing of assignments and examination papers]
     - Programme delivery - 30% [It includes programme management, dissemination of Learning Material like books & learning material, conducting webinars & lectures, conducting exams & assignments, result processing]
     - Programme maintenance - 30% [It includes maintaining hardware, software an, networking, its maintenance]

9. Quality assurance mechanism and expected programme outcomes
   - There is a mechanism for review and update the course content using both inhouse faculty members and sector experts. Feedback solicited from the participants and the industry experts are incorporated to enhance the overall efficacy of the Programme.

---xxx---

Annexure 3

(Refer to Item No 5)

Modification in the structure of MSc in Economics (with specialisation in environment and resources economics) Programme

A programme in MSc in Economics has been offered by the University since 2009. For the quality of students that it is able to attract and the cent percent placement record makes it one of the flagship programmes offered by the Department of Policy Studies as well as by the University. The present structure and outline of the programme is as follows:

Year	Courses	Credits	Duration*
First year			
1st semester	5 core courses of 4 credits	20	15 weeks
2nd semester	5 core courses of 4 credits	20	15 weeks
Second year			
3rd semester	1 core course of 4 credits + choice of 4 electives of 3 credits each + Thesis Proposal of 4 credits	20	15 weeks
4th semester	Master's Thesis of 20 credits + 2 elective subjects of 3 credits	26	15 weeks

Semester 1				
Course No.	Course title	Type	Number of credits	No. of lectures-tutorial-practical
MPE 142	Environment and economic development	Core	4	42-14-0
MPE 171	Quantitative methods	Core	4	40-7-18
MPE 121	Macro economics	Core	4	49-7-0
MPE 131	Microeconomics	Core	4	50-6-0
NRE 165	Introduction to sustainable development	Core	1	1-0-0
MPE 111	Constrained optimization and linear Algebra	Core	4	50-6-0

Semester 2				
Course No.	Course title	Type	Number of credits	No. of lectures-tutorial-practical
MPE 147	Game theory	Core	4	50-6-0
MPE 141	Indian economics and development	Core	4	45-11-0
MPE 144	Theory of environmental policy	Core	4	56-0-0
MPE 146	Economics of natural resources	Core	4	56-0-0
MPE 172	Econometrics	Core	4	50-0-12

Semester 3				
Course No.	Course title	Type	Number of credits	No. of lectures-tutorial-practical
MPE 175	Techniques of environmental valuation	Core	4	39-17-0
MPE 106	Thesis proposal	Core	4	
MPE 177	Time series and regression analysis	Elective	3	42-0-0
MPE 179	Advanced econometric	Elective	3	28-7-14
MPE 145	Economics of health and environment	Elective	3	37-5-0
MPD 127	Perspectives on development	Elective	1	14-0-0
MPE 128	Indian agriculture in a global setting	Elective	3	38-4-0
MPE 137	Microeconomics II	Elective	3	37-5-0

Semester 4				
Course No.	Course title	Type	Number of credits	No. of lectures-tutorial-practical
MPE 108	Master's thesis	Core	20	
MPE 192	Trade and the environment	Elective	3	42-0-0
MPE 125	Ecological Economics	Elective	3	28-14-0

For the last six years the programme outline and structure have remained unchanged. Since the last four months members of Masters Programme Executive Committee (MPEC) of this programme has been engaged with an internal review. The following are the salient features that have been identified in this process:

1. Overlap: There are considerable overlaps in the outlines of existing courses related to environment and resource economics. Contents in the three courses offered at present namely Theory of Environmental Policy, Techniques of Environmental Valuation and Natural Resource Economics can be accommodated within two courses, namely, Economics of Natural Resources and Economics of Environment.

2. Thesis: As of now, the Master's Thesis is a compulsory requirement of the programme. It has been observed that a sizeable proportion of the students (say, about a half) face challenges fulfilling this requirement. Some of them who are interested in non-research careers may be able to perform much better if they are allowed to exercise an option between writing a master's thesis and completing equivalent credits of coursework. The students exercising a research-oriented option may also find avenues to explore linkages with external organizations/experts, as they will not have to study any course in the fourth semester--this may help them in their career. With a rationalisation of students across thesis and non-thesis options it may be possible for the internal faculty to provide more effective supervision to the former group of students.

In the light of this, changes to the structure of the programme were recommended by the MPEC to be placed before the Board of Studies for its approval to be placed before the Academic Council. After due deliberation at the Board of Studies meeting and incorporating the suggestions of the honourable members of the BoS, the structure proposed stands as follows:

Outline:

			Credits
Semester 1	Microeconomics 1 (Core)		4
	Macroeconomics (Core)		4
	Constrained optimization and linear Algebra (Core)		4
	Quantitative methods (Core)		4
Semester 2	Microeconomics 2 (Core)		4
	Economic development in India (Core)		4
	Econometrics (Core)		4
	Environment and economic development (Core)		4
Semester 3	Economics of Environment (Core/Elective)*		4
	Economics of Natural Resources (Core/Elective)*		4
	Indian agriculture in a global setting (Elective)		4
	Research Methodology (Core)		4
	Advanced econometrics (Elective)		4
	Time series and regression analysis (Elective)		4
Semester 4	*Track Thesis*	*Track Coursework*	4
	Thesis (16 credits)	Ecological Economics (Elective)	4
		Labour Economics (Elective)	4
		Trade and the environment (Elective)	4
		Economics of health (Elective)	4

*Students must choose at least one of the two courses marked with (Core/Elective).

Salient features:

1. Instead of five core courses at present, for the first two semesters each, the students will be required to study four core courses.
2. In the third semester, students would compulsorily take the course on Research Methodology, choose at least one of the courses between Economics of Environment and Economics of Natural Resources and fulfil the remaining credit requirements from other (elective) courses.
3. In the fourth semester, a student would be able to exercise an option between a research track and a coursework track subject to fulfilling the requirements of the Research Methodology with a satisfactory grade (not below B). Those opting for the latter will be required to write and defend a master's thesis in their fourth semester. This component will be worth 16 credits alone. Such students would not be required to do any further coursework.
4. Students on the coursework track (either by choice or for not fulfilling the eligibility criterion) would undertake coursework worth 16 credits in the fourth semester.
5. Each of the courses offered in the Economics programme would be worth 4 credits each, excluding the final thesis component which would be worth 16 credits.
6. Student desirous to study elective courses offered in other programmes may continue to do so, as in the present, subject to prior approval of the Programme Coordinator.
7. All elective courses offered in the third and fourth semesters would have a term paper and an oral presentation component for evaluation, in order to ensure rigour and originality of thought.

---xxx---

Annexure 4
(Refer to TU/AC 41.6.1)

Course title Macroeconomics			
Course code: MPE 121	**No. of credits** 4	**L-T-P distribution** 56-0-0	**Learning hours** 56
Pre-requisite course code and title (if any) 10+2 level knowledge of Mathematics			
Course type Core		**Department** Policy Studies	
Course coordinator (s) Shantanu De Roy		**Course instructor (s)** Shantanu De Roy	
Contact details shantanu.roy@teriuniversity.ac.in			
Course offered in semester 1			

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 policy making at different points in time.

Course content	**L**	**T**
Module 1: Introduction - Classical theory of output, employment and money - Macroeconomic aggregates, circular flow of income, Simple Keynesian Model, IS-LM model - The "virtual", "real" and "real-real" levels of the economy	6	
Module 2: Keynesian Macroeconomics - The principle of aggregate demand - Determination of investment - Liquidity preference theory	18	
Module 3: Neo-classical Synthesis and Monetarism - IS-LM model - The role of monetary policy - A heterodox critique of monetarism	4	
Module 4: New Classical Approach - A mainstream critique of monetarism—rational expectations and neutrality of money	2	
Module 5: Real Business Cycle Theory -Explaining macroeconomic fluctuations from a mainstream perspective	2	
Module 6: New Keynesian Paradigm	18	

- Nominal price rigidity in the product market - Efficiency wage theories - Hysteresis - A mainstream critique of new classical economics - Macroeconomics without the LM curve - Relationship between output and inflation—Keynesian, Monetarist, New Classical and New Keynesian Phillips Curve		
Module 7: Dynamic Stochastic General Equilibrium Modelling - The basic three equation in New Keynesian DSGE model - Monetary policy in the basic three equation model - Extensions of the basic model: financial frictions, unemployment	6	
Total:	56	

Evaluation criteria

The course evaluates students on three grounds:
- **Test 1** (written exam)**:** 25%.
- **Test 2:** (written exam) 30%.
- **Test 3** (written exam)**:** 45%.

Learning outcomes

By the end of the course, students will:
- command a critical understanding of the key concepts regarding different schools of macroeconomic theory.
- Will be introduced to the plurality of macroeconomic thought.

Pedagogical approach

- Class interactions and discussions

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. (1937). The Principle of Increasing Risk. *Economica*, 16(4), pp. 440-447.
Keynes, J. M. (1935): *The General Theory of Employment, Interest and Money*, (Chapters 4, 11, 12, 13), Atlantic Publishers and Distributors, New Delhi.

Module 3:

Hicks, J. R. (1937). Mr. Keynes and the "Classics": A Suggested Interpretation. *Econometrica,* 5(2), pp. 147-159.
Minsky, H. P. (1976). The Conventional Wisdom: The Standard Interpretation of Keynes (Chapter 2) in *John Maynard Keynes*, McGraw-Hill Publishers.
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. 4-13.
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.

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.

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.

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 Delhi
- Dr. Rohit Azad, Assistant Professor, Centre for Economic Studies and Planning, JNU

Course title: Labour Economics			
Course code:	**No. of credits:** 3	**L-T-P:** 42-0-0	**Learning hours:** 42
Pre-requisite course code and title (if any): 10+2 level knowledge of mathematics.			
Faculty: Dr. Shantanu De Roy		**Department:** Department of Policy Studies	
Course coordinator: Dr. Shantanu De Roy		**Course instructor** Dr. Shantanu De Roy	
Contact details: shantanu.roy@teriuniversity.ac.in			
Course type: Elective		**Course offered in:** Semester 4	

Course description:

The course will begin with an introduction to the changes in the nature of work that has taken place with the advent of and changes in the nature of capitalism. Further it will offer an exposure to the macroeconomic theories of wage and analysis of labour markets. Subsequent component will incorporate political economy analysis of labour in the process of production in rural and urban locations with an emphasis of informalisation of labour in the latter. One of the primary focus in this course will be to locate the role of women in the process of capitalist production and accumulation. Lastly, the course will cover the impact of contemporary globalisation on labour and recent debates on flexibility of Indian labour laws, while incorporating the role of State.

Course objectives:

- Acquaint students with the contribution of labour in the process of capitalist development.
- Exposing students to diverse labour relations in urban and rural settings under capitalism.
- To enable students to understand the crucial role of women in the process of production.
- To understand the relationship between current phase of globalisation and labour while incorporating the role of Indian state.

Course contents

S. No	Topic	L	T	P
1	Meaning/concept of labour	2		
2	Labour markets and theories of wage -Classical, New Keynesian and Keynesian perspectives	6		
3	Agrarian relations and labour in rural India -Evolution of the class of agricultural labourers in India -Agrarian relations and labour contracts: A theoretical perspective -Non-farm sector and rural labour	10		
4	Urban informal labour -Migration from the villages to cities and the growth of informal workforce -Livelihood situation of urban informal labour	7		
5	Gender, caste and labour	7		

	-Accounting women's work -Impact of the policies of globalization on women's work			
6	State, globalisation and labour -The role of state in a globalised world and the emergence and growth of an informal sector -Labour market regulations and its impacts on employment and industrial performances	10		
	Total	**42**		

Evaluation criteria:

1. Test 1 (written exam) 20%
2. Test 2 (term paper) 30%
3. Test 3 (presentation) 20%
4. Test 4 (written exam) 30%

Learning outcome:

Students will develop a critical understanding of social relations of production and will locate labour in that perspective rather than locating labour simply as a factor of production.

Materials:

Optional textbooks:

1. Keynes, J. M. (1935). *The General Theory of Employment, Interest and Money*. Atlantic Publishers and Distributors (P) Ltd, New Delhi, India.
2. Akerlof, G. A and J. L. Yellen. (1986). *Efficiency Wage Models of the Labour Market*. Cambridge University Press.
3. Chakravarty, S. (ed.) (1990). *The Balance between Industry and Agriculture in Economic Development: Volume 3*, Manpower and Transfers. Macmillan Press, London.
4. Banerjee, D. and Goldfield, M. (eds.) (2007). *Labour, Globalisation and the State: Workers, Women and Migrants Confront Neoliberalism*. Routledge, London and New York.
5. Marx, K. (1976). *Wage, Labour and Capital & Value, Price and Profit*, International Publishers, New York.
6. Khera, R (2011). *The Battle for Employment Guarantee*, Oxford University Press, New Delhi.

Module I. **Meaning/concept of labour**

Bhattacharya, Sabyasachi (2014). Introduction, in Bhattacharya, S. (ed.), *Towards a New History of Work*, Tulika Books, New Delhi, India.

Edgell, Stephen (2012). The Transformation of Work: From Work as an Economic Activity to Work as Employment (Chapter 1) in *The Sociology of Work: Continuity and Change in Paid and Unpaid Work*. Sage Publications Ltd.

[Through these readings students will be able to understand the transformation of work with development of capitalism and related changes in production relations]

Module II. Theories of wage

Smith, Stephen (2003). Wage Determination and Inequality (Chapter 3) in *Labour Economics 2nd edition*, Routledge, London and New York.
[Pre-Keynesian understanding of wage determination in the labour market]

Shapiro, Carl and Joseph, Stiglitz (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.
[New-Keynesian understanding of wage determination in the labour market]

Keynes, J. M. (1935). Changes in Money Wages (Chapter 19) in *The General Theory of Employment, Interest and Money.* Atlantic Publishers and Distributors (P) Ltd, New Delhi, India.
[Keynesian understanding of wage determination in the labour market]

Marx, K. (1976). *Wage, Labour and Capital & Value, Price and Profit* (Chapter 2-7).
[Marxian understanding of wage determination and relation of wage-labour to capital]

Bowles, Samuel and Herbert, Gintis (1990). "Contested Exchange: New Microfoundations for the Political Economy of Capitalism", *Politics and Society*, 18(2).
[Analyses the political relationship between the employers and workers with a model of contested exchange]

Module III. Agrarian relations and labour in rural India

- **Evolution of the class of agricultural labourers**

Patnaik, Utsa (1983). "On the Evolution of the Class of Agricultural Labourers in India", *Social Scientist,* 11(7).
[This paper analyses economic processes that had led to the creation of agricultural labourers in India]

- **Rural labour relations in India**

Dreze, Jean. P. and Mukherjee, Anindita (1990). Labour Contracts in Rural India: Theories and Evidence, in Chakravarty, Sukhamoy (1990). *The Balance Between Industry and Agriculture in Economic Development: Volume 3, Manpower and Transfers*. Macmillan Press, London.

Mohan Rao, J (1999). Agrarian Relations and Unfree Labour in Byres, T. J. et. al (eds.). *Rural Labour Relations in India*, Routledge, London and New York.
[These two readings provide theoretical analysis of labour relations in rural India]

- **Labour and rural non-farm sector**

Himanshu et. al. (2011). *Non-Farm Diversification and Rural Poverty Decline: A Perspective From Indian Sample Survey and Village Study Data,* Working Paper no. 44. LSE Asia Research Centre. London, United Kingdom.
[This paper analyses occupational diversification in the rural areas of India and its importance in ensuring livelihood security to the workers]

Dreze, J. (2011). Employment Guarantee and the Right to Work, in Khera (ed.) *The Battle for Employment Guarantee*, Oxford University Press, New Delhi.
[Analyses history and the debates related to the NREGA]

Module IV: Urban informal labour

- **Types of Informalisation**

Standing, Guy (2011). The Pracariat (Chapter 1) in *The Precariat: The New Dangerous Class*, Bloomsbury Academic, London and New York.
[Students will be able to understand the emergence of informal sector workers across the world and its associated vulnerabilities].

- **Urban informal sector in India**

Breman, Jan (1996). "Inflow of Labour into South Gujarat (Chapter 3)", in *Footloose Labour: Working in India's Informal Economy* (1996), Cambridge University Press, London.
[Explains the widely prevalent phenomena of migration from villages to towns and conditions of employment of informal workers]

NCEUS (2007). "Towards Protection and Promotion of Livelihoods of Unorganised Workers (Chapter 12)", in the *NCEUS Report on Conditions of Work and Promotion of Livelihoods in the Unorganised Sector* (2007), Government of India, New Delhi.
[This government report analyses economic situation of informal workers and measures to enhance their livelihood security]

Module V: Gender, caste and labour

- **Gender and labour**

Banerjee, Nirmala (1999). "Analysing Women's Work Under Patriarchy" in Sangari, Kumkum and Chakravarti, Uma (eds.) (1999), *From Myths to Markets: Essays on Gender*, Indian Institute of Advanced Study, Shimla and Manohar Publishers and Distributors, New Delhi, India.

Banerjee, Nirmala (2004). "Globalization and Women's Work" in Bhattacharya, Malini (2004) (ed.), *Globalization: Perspectives in Women's Studies*, Tulika Books, New Delhi, India.
Beneria, Lourdes (1992). "*Accounting for Women's Work: The Progress of Two Decades",* World Development, 20(11), pp. 1547-1560.
[These papers will enable the students to understand the problems in measuring women's work. It will also enable them to understand women's work under patriarchy and globalization]

- **Caste discrimination and labour**

Thorat, Sukhadeo (2008). "Labour Market Discrimination: Concept, Forms and Remedies in the Indian Situation", *The Indian Journal of Labour Economics*, 51(1).
[This paper discusses types of discrimination that exist against vulnerable social groups in the Indian labour market]

Duraisamy, P and Duraisamy, Malathy (2017): "Social Identity and Wage Discrimination in the

Indian Labour Market", *Economic and Political Weekly*, 52(4).
[This paper explores the relationship between caste identity and wage discrimination in the Indian labour market]

Module VI: State, globalisation and labour

- **An overview of the relationship between the labour and state in contemporary globalisation**

Banerjee, Debdas and Goldfield, Michael (2007). Neoliberal globalization, labour and the state in Banerjee, Debdas and Goldfield, Michael (eds.) (2007), *Labour, Globalisation and the State: Workers, Women and Migrants Confront Neoliberalism*. Routledge, London and New York.
[Analyses the contemporary nature of capitalism and the role of state vis-à-vis labour]

- **Globalisation and informalisation of labour**

Sanyal, Kalyan and Bhattacharya, Rajesh (2009). "Beyond the Factory: Globalisation, Informalisation of Production and the New Locations of Labour", *Economic and Political Weekly*, 44(22).
[Analyses changes in the conditions of employment with the current phase of globalization]

Roy, Satyaki (2014). "Informality' and Neo-liberalism: Changing Norms and Capital's Control" in Kannan et al (eds.) *Labour and Development: Essays in Honour of Professor T. S. Papola*, Academic Foundation, New Delhi-215-234.
[This paper questions the notion of 'informality' as a transitory feature of capitalism]

- **Analysing labour market reforms in India**

NCEUS (2009). "Labour Law Reforms: Beyond a Narrow Agenda (Chapter 7)", in *The Challenge of Employment in India: An Informal Economy Perspective,* Government of India, New Delhi.

Bhattacharjea, Aditya (2006). "Labour Market Regulation and Industrial Performance in India: A Critical Review of the Empirical Evidence", *The Indian Journal of Labour Economics*, 49(2).
[These two readings questions the arguments that reforms in labour laws will be beneficial for the informal workers, lead to increase in employment and overall industrial development].

Additional information (if any):

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

Course reviewers:

Professor Sumangala Damodaran, School of Development Studies, Ambedkar University Delhi.

Dr. Satyaki Roy, Associate Professor, Institute for Studies in Industrial Development, Vasant Kunj, New Delhi.

---xxx---

Annexure 5
(Refer to TU/AC 41.7.1)

Course title: Competition Law and Policy			
Course code	**No. of credits:** 2	**L-T-P distribution:** 1.5 – 0 - 0.5	**Learning hours:** 28
Pre-requisite course code and title (if any): Infrastructure Law and Policy (MPL 157)			
Faculty	**Department of Policy Studies (Centre for Postgraduate Legal Studies)**		
Course coordinator (s)	**Course instructor (s)**		
Contact details			
Course type	Elective		
Course offered in	Semester 2		

Course Description

Competition law is aimed at protecting the process of competition within the market. Since the nineties, almost all developing countries have enacted competition laws in the lines of the laws of developed countries. This course is an attempt to address some of the issues in competition law that is of interest to countries like India. This course builds on the basic course on *Competition law* at the undergraduate level and the *Infrastructure Law and Policy* course offered in the I Semester.

Course objectives

1. To understand the need and rationale for competition law from a developmental perspective.
2. To critically examine some of the crucial issues like the interface with IPR laws, regulatory laws, environmental laws, and public procurement laws.
3. To critically analyse the emerging international competition law and its impact on developing countries.

Course content	**L**	**T**	**P**
Module 1: Introduction	**10**		**0**
Objectives of competition law and policy – Basic concepts: relevant market, anti-competitive agreements, abuse of dominant position and anti-competitive combinations – Evolution of Indian competition law Emerging International Competition Law – Extraterritorial application – WTO agreements - FTAs			
Module 2: Competition Law and Regulation	**4**		**4**
Role of sectoral regulators in competition issues – case studies of infrastructure sector			
Module 3: Competition Law and IPRs	**4**		**4**
Objectives: complimentary or contradictory? – Competition law remedies for IPR abuses: compulsory licensing – TRIPS provisions			

Module 4: Competition Law and other Government Policies	**4**		**4**
Competition law and public procurement – methods of public procurement – bid rigging, collusive bidding and cartelization Competition law and environmental policy – impact of environmental policy on competition: barriers to entry, collusion – Types of governmental interventions and its impact on competition Competition law and labour law – freedom of association and collective bargaining			
Total	**22**	**0**	**12**

Evaluation criteria

- Class participation : 10
- Term Paper : 25
- Presentations : 25
- Major Test : 40

Learning outcomes

By the end of the course, it is expected that the students would have:

1. Acquired a critical understanding of competition law and its impact on developing countries like India
2. Acquired the skills to contribute to the academic literature on competition law in the form of position papers, review articles etc.

Pedagogical approach

Predominantly based on classroom teaching. In addition, role play and moot courts will be used. A lot of emphasis will be given on self-study. For this, study materials for each module will be circulated in advance.

Materials

Suggested Readings

1. Kumar, A. (2007), *The Evolution of Competition Law in India*, in Vinod Dhall (ed.), Dhall, Vinod (ed.), *Competition Law Today: Concepts, Issues, and the Law in Practice*, New Delhi: Oxford University Press.
2. Government of India (2000), *Report of the High-Level Committee on Competition Policy and Law*
3. Singh, A. (1999*), Competition Policy, Development and Developing Countries*, South Centre
4. Sands, Philippe *et.al.* (2012), *Principles of International Environmental Law*, Third Edition, Cambridge: Cambridge University Press. Ch. 19.
5. Gallego, Beatriz C. (2010), ―Intellectual Property Rights and Competition Policy, in

Correa, Carlos M. (Ed.) *Research Handbook on the Protection of Intellectual Property under WTO Rules: Intellectual Property in the WTO*, Volume I, Cheltenham: Edward Elgar.

6. Korah, Valentine (2007), ―Competition Law and Intellectual Property Rights, in Dhall, Vinod (ed.), *Competition Law Today: Concepts, Issues, and the Law in Practice*, New Delhi: Oxford University Press.
7. Mazhuvanchery, Shiju (2010), "Indian Competition Act: A Historical and Developmental Perspective", *The Law and Development Review*, Vol. 3, No. 2, Article 8.
8. OECD (2006), *Environmental Regulation and Competition*, OECD Policy Roundtables, available at https://www.oecd.org/daf/competition/1920007.pdf
9. Nordic Competition Authorities (2010), *Competition Policy and Green Growth: Interactions and Challenges*, available at http://en.samkeppni.is/media/skyrslur-2010/competition_policy_and_green_growth_final_version.pdf
10. Rubiano, Camilo (2013), *Collective Bargaining and Competition Law: A Comparative Study on the Media, Arts and the Entertainment Sectors*, available at https://www.fim-musicians.org/wp-content/uploads/fim_study_competition.pdf
11. Vagstad, S. (1995), *Promoting fair competition in public procurement*, Journal of Public Economics, 58 (2), 283-307
12. Noonan, Chris (2008), The Emerging Principles of International Competition Law, Oxford: Oxford University Press.
13. Taylor, Martyn D. (2006), International Competition Law, Cambridge: Cambridge University Press.

Additional information (if any)

Student responsibilities

Course Reviewers:

1. Dr. Nitya Nanda, Fellow, TERI, New Delhi.
2. Prof. Bindu Ronald, Professor, Symbiosis Law School, Pune.

Course title: Hazardous Waste Law				
Course code	**No. of credits:** 2	**L-T-P distribution:** 1.5 – 0 – 0.5	**Learning hours:** 28	
Pre-requisite course code and title (if any): Environmental Law and Policy (MPL 155)				
Faculty	**Department of Policy Studies (Centre for Postgraduate Legal Studies)**			
Course coordinator (s)	**Course instructor (s)**			
Contact details				
Course type	Elective			
Course offered in	Semester 2			
Course Description				

With more than 40,000 industries engaged in hazardous activities, hazardous waste poses peculiar problems for a country like India. This elective course is an attempt to study the national and international framework on hazardous waste management. Radio-active waste and municipal waste in not covered in this course

Course objectives

1. To understand the national and international legal regime on hazardous waste management.
2. To critically examine some of the crucial issues in waste management like the international trade in hazardous waste, producers' liability etc.
3. To critically analyse the laws relating to e waste and bio-medical waste.

Course content	**L**	**T**	**P**
Module 1: Introduction	**10**		**0**
Definition of Hazardous waste International Legal framework: Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, 1989, Bamako Convention, 1991, EU Directive 2008/98/EC Legal Framework in India: Environment (Protection) Act, 1986 and the various Rules enacted under it			
Module 2: Management of Hazardous waste	**4**		**4**
Prevention, Minimization, Reuse, Recycling, Recovery and Safe disposal. Different methods of disposal and prohibition of disposal at certain sites Packaging and transport Liability: Extended producer liability The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.			
Module 3: International Movement	**4**		**4**
Proximity principle Obligations of the exporting and importing countries – Prior Informed Consent – Basel Ban Ship breaking industry in India: A case study – Hong Kong Convention – Role of Judiciary			
Module 4: E Waste and Household waste	**4**		**4**
E – waste: Definition – magnitude of the problem in India – Recycling industry The E-Waste (Management) Rules, 2016 – Coverage – Responsibility of manufacturer, producer, dealer, customer, dismantler, recycler – Liability Household hazardous waste The Batteries Management and Handling Rules, 2001			
Total	**22**		**12**

Evaluation criteria

- Class participation : 10
- Term Paper : 25
- Presentations : 25

• Major Test : 40
Learning outcomes By the end of the course, it is expected that the students would have: 1. Acquired a critical understanding of environmentally sound management of hazardous waste 2. Acquired the skills to contribute to the academic literature on the subject in the form of position papers, review articles etc.
Pedagogical approach Predominantly based on classroom teaching. In addition, role play and moot courts will be used. A lot of emphasis will be given on self-study. For this, study materials for each module will be circulated in advance.
1. Sands, Philippe et al (2012), *Principles of International Environmental Law*, Third edition, Cambridge University Press, Cambridge. 2. Divan, Shyam and Rosencranz, Armin (2001), *Environmental Law and Policy in India*, Second edition, Oxford University Press, New Delhi. 3. Kellenberg, Derek and Levinson, Arik (2014), "Waste of Effort? International Environmental Agreements", *Journal of the Association of Environmental and Resource Economists*, Vol. 1 (1/2): 135-169. 4. Johri, Rakesh (2008), *E-waste: Implications, Regulations and Management in India and Current Global Best Practices*, TERI Press, New Delhi. 5. Rousmaniere, Peter and Raj, Nikhil (2007), "Ship Breaking in the Developing World: Problems and Prospects", *International Journal of Occupational and Environmental Health*, Vol. 13 (4): 359-368. 6. Gidwani, Vinay and Corwin, Julia (2017), "Governance of Waste", *Economic and Political Weekly*, Vol. 52 (31): 44-54.
Additional information (if any)
Student responsibilities

Course Reviewers:

1. Dr. Suneel Pandey, Fellow, TERI, New Delhi.
2. Dr. Jacob Joseph, Assistant Professor, National University of Advanced Legal Studies, Kochi.

Course title: Water Resources law				
Course code	**No. of credits: 2**	**L-T-P distribution:** 1.5 – 0 – 0.5	**Learning hours:** 28	
Pre-requisite course code and title (if any): None				
Faculty	**Department: Department of Policy Studies (Centre for Postgraduate Legal Studies)**			
Course coordinator (s)	**Course instructor (s)**			
Contact details				
Course type	**Elective**			
Course offered in	**Semester 2**			

Course Description

This course is intended to introduce concepts, laws and policies relating to water at the national and international level. The course specifically covers water rights and human rights to water, legal aspects of ground water; national and international water sharing agreements and disputes; conflict resolution and liability.

Course objectives

1. To introduce the students to various concepts, laws relating to water at the international, and national level
2. To analyse issues relating to access, allocation and use of water resources and the need for regulation
3. To explore the causes for water conflicts, different methods of conflicts resolution and principles used in such resolution

Course content	**L**	**T**	**P**
Module 1: An Introduction to the Legal Framework on Water	**6**		
Rights over Water – Various doctrines - Riparian rights; Prior appropriation; territorial sovereignty; natural water flow, equitable apportionment; equitable utilization- Right of Water and Water Rights, Fundamental right to water - Access to Water – Gender and Class issues Ownership of water, state's power: Common law doctrines, Indian Easement Act, 1882; Various irrigation statutes, Doctrine of Public Trust - Human Right to Water - Constitutional Basis of Water regulation Lake protection in India – Wetland Rules – Case Studies			
Module 2: International Water Law	**4**		**4**
An overview of International water law: Diffused nature of International Water Law; Treaties at the global, regional and bilateral level; Soft law instruments Customary principles of international law in the field of water: limited sovereignty (equitable utilization), no harm, and peaceful resolution of disputes; Principles of polluter pays, prevention, precaution, sustainability and subsidiarity. UN Convention on the Law of the Non-Navigational Uses of International Watercourses, Helsinki Rules on the Uses of Waters of International Rivers;			
Module 3: Ground Water	**4**		**4**
Issues relating to ownership; State control; Various state laws; Model Ground Water Bill; Central Ground Water Commission Treaties and other instruments at the international level: United Nations Convention to Combat Desertification			

Regional Treaties; Non-Governmental instruments: Helsinki Rules, Berlin Rules, The Seoul Rules on International Ground waters [1986], International Law relating to Transboundary Aquifers: The Guarani Aquifer Agreement; ILC Draft Articles on the Law of Transboundary Aquifers				
Module 4: Reforms	4		**2**	
Reasons; National Water Framework Law; Decentralisation; Private participation;				
Module 5: Conflict Resolution and Liability	4		**2**	
Nature of conflicts; Different modes of dispute resolution National Level (Case Study India): Inter-State Water Disputes Act, 1956; Role of judiciary; Mullaperiyar dispute; Narmada Water Disputes Tribunal (NWDT) Liability: Nature; Tortious liability; Plachimada Tribunal Bill, 2011 International Tribunal: Kishanganga Arbitration				
Total	**22**		**12**	

Evaluation criteria

- Class participation : 10
- Term Paper : 25
- Presentations : 25
- Major Test : 40

Learning outcomes

By the end of the course, it is expected that the students will:

1. Demonstrate the ability to understand the existing legislative and policy framework governing the water sector and recognition of various rights associated with water.
2. Be able to critically appreciate and practically analyse various water laws and policies in thye national and International level.

Pedagogical approach

Predominantly based on classroom teaching and discussion. It is expected that the students come prepared with the readings, thus leading to a healthy discussion.

Materials

Suggested Readings

Books:

1. Iyer, Ramaswamy R. (ed). (2009). Water and the Laws in India. New Delhi: Sage.
2. Verghese, B G (2007). Waters of Hope.4th ed. New Delhi: India Research Press.

3. FAO. (1998). Sources of International Water Law. Rome: FAO Legal Service
4. Iyer, Ramaswamy R. (2003). Water Perspectives, Issues , Concerns, New Delhi: Sage.
5. Philippe Cullet, Sujith Koonan (eds.) (2017) Water Law in India: An Introduction to Legal Instruments, New Delhi, Oxford University Press India.
6. Nandita Singh, (2016). The Human Right to Water: From Concept to Reality, Springer.

Journal Articles

7. A Richards & N Singh, (2002), 'Inter-State Water Disputes in India: Institutions and Policies' 18/4 International Journal of Water Resources Development 611.
8. C.R. Bijoy, (2006). 'Kerala's Plachimada Struggle – A Narrative on Water and Governance Rights' 41/41 Economic & Political Weekly 4332-39
9. Daniel Aguilar, (2011). 'Groundwater Reform in India: An Equity and Sustainability Dilemma' 46 Texas International Law Journal 623
10. Jayanta Bandyopadhyay & Shama Perveen, (2004). 'Interlinking of Rivers in India - Assessing the Justifications', 39 Economic and Political Weekly 5307-16
11. M.P. Ram Mohan & K Chavaly, (2015). 'The Supreme Court of India and Inter-State Water Dispute: An Analysis of the Judgments on Mullaperiyar Dam', 17/6 *Water Policy* 1003
12. Phillipe Cullet (2012), 'Is Water Policy the new Water Law: Rethinking the Place of law in water sector reforms' 43/2 *Institute of Development Studies Bulletin* (
13. Phillipe Cullet, (2012) *Groundwater: Towards a new Legal and Institutional Framework*, International Environmental Research Centre <http://www.ielrc.org/content/w1201.pdf>
14. Vrinda Narain, (2010) 'Water as a Fundamental Right: A perspective from India' 34 *Vermont Law Review* 917

Additional information (if any)

Student responsibilities
Attendance, feedback, discipline, guest faculty etc

Course Reviewers:

1. Dr. Jacob Joseph, Assistant Professor, NUALS
2. Mr. Sujith Koonan, Senior Teaching Fellow, Department of Law, SOAS

---xxx---

Annexure 6
(Refer to TU/AC 41.8.1)

Course Title: Assessing Public Policy: Methods and Measurements			
Course code: PPS 191	**No. of credits:** 2	**L-T-P:** 28-0-0	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course Coordinator(s): Dr Nandan Nawn		**Course Instructor(s):** Dr Nirupam Datta	
Contact details: nandan.nawn@teriuniversity.ac.in			
Course type: Core		**Course offered in**: Semester 2	

Course Description: Assessing public policies contribute to a more informed decision making. This is more valid under conditions of uncertainty. Assessments can have multiple objectives: (a) identifying the causes of success or failure of an existing policy, (b) assessing the suitability of 'reforming' an existing public policy towards improving its efficacy, (c) comparing the effectiveness of an existing policy with a proposed one to achieve a given objective or a set of objectives, (d) estimating the impacts of an existing policy and other such.
A variety of methods are used for these purposes. This course will familiarise the students with the potentials and limitations of such methods towards this end.

Course objectives:

1. To familiarise with the nuances of a well-structured evaluation framework
2. To expose the students to the usefulness of impact evaluation through case studies carried out in Indian sub-continent.

Course content

Module	Topic	L	T	P
1	**Introduction to Impact Evaluation** Monitoring versus Evaluation Why Evidence-Based Policy Making Prospective versus Retrospective Impact Evaluation Efficacy Studies and Effectiveness Studies Complementary Approaches Ethical Considerations Regarding Impact Evaluation Impact Evaluation for Policy Decisions Deciding Whether to Carry Out an Impact Evaluation - Limitations and Possible Solutions	6		
2	**Theory and concepts** Developing a Results Chain Specifying Evaluation Questions Selecting Outcome and Performance Indicators Data requirements Causal Inference Counterfactuals Confounders	6		
3	**Method and practice – Applications and Limitations** Quantitative versus Qualitative Impact Assessments	6		

	Quantitative Impact Assessment: Ex Post versus Ex Ante Impact Evaluations Design and analysis of impact evaluations Randomized experiments Propensity Score Matching (PSM) Natural experiments and instrumental Variables (IVM) Regression Discontinuity Design (RDD) Panel data and 'difference-in-difference' (DID) Estimators			
4	**Case Studies** A. Environment and Development programmes B. Behaviour, Environment, and Health in Developing Countries C. Demand for Environmental Quality D. Impact of Highway on Firms	**10**		
		28	**0**	**0**

Evaluation criteria

A case study on identifying the steps for carrying out an impact evaluation for an existing programme/project in the health, education, infrastructure or environment.

Learning outcomes: 1. Effectively able to differentiate between association and causation

2. Application of appropriate impact evaluation framework and methodology depending on the problem at hand

3. Understanding of the limitations of different evaluation frameworks and methodologies and how to state the same in the study

4. How to set up logically the theory of change and gleaning out the other factors that can also affect the outcome from the treatment factor

5. How to select the treatment and control units for evaluation purpose

Pedagogical approach: Teaching means will include discussion, board based teaching and examination of case studies

Materials

Required text

Suggested readings

References

Shahidur R Khandker, Gayatri B. Koolwal, Hussain A. Samad, 2010, *Handbook on impact evaluation: quantitative methods and practices*. The World Bank, Washington DC

Paul J. Gertler, Sebastian Martinez, Patrick Premand, Laura B. Rawlings and Christel M. J. Vermeersch, 2016, *Impact Evaluation in Practice*, Second Edition, The World Bank, Washington DC

S K Pattanayak, 2009, 'Rough Guide to Impact Evaluation of Environmental and Development Programs', (SANDEE Working Papers, ISSN 1893-1891; 2009- WP 40)

S K Pattanayak and A Pfaff, 2009, 'Behaviour, environment and health in Developing Countries: evaluation and valuation', *Annual Review of Resource Economics*¸ 1, pp. 183-207

J Jalan and E Somanathan, 2008, 'The Importance of Being Informed: Experimental Evidence on the Demand for Environmental Quality', *Journal of Development Economics* 87, pp. 14–28

Saugato Datta 2008. *The impact of improved highways on Indian firms*. Washington, DC: World Bank.

Michael Moran Martin Rein Robert E. Goodin 2006, "The Oxford Handbook of Public Policy" New York. Oxford University Press.

Case Studies
Websites
Journals
Other readings

Additional information (if any): None

Student responsibilities
Attending classes, completing evaluations on time

Course reviewers
1. Pranab Mukhopadhyay, Professor, Goa University, Goa
2. Kalyan Das, Professor, Omeo Kumar Das Institute of Social Change and Development, Guahati

Course title: Public Policy Processes and Institutions			
Course code: PPS 194	**No. of credits:** 2	**L-T-P:** 28-0-0	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course Coordinator: Dr L N Venkataraman		**Course Instructor:** Dr L N Venkataraman	
Contact details: venkataraman.ln@teriuniversity.ac.in			
Course type: Core		**Course offered in:** Semester 2	

Course description: Since the intended participants in the course are experienced professionals, who already have been instrumental in formulating and implementing policies, the course will offer a theoretical base to public policy in general. It would also include broad discussion on institutions and the nature of the Indian state-so as to have a nuanced understanding of the policy making and the intersections of the Development Triad (i.e., State, Market and Civil Society).

Course objectives:
1. To underscore the intersectional importance of the Development Triad in the Public Policy Processes;
2. To discuss the influences of policy actors and stakeholders in the policy processes;
3. To understand the contextual factors and institutional nuances

Course contents

Module	Topic	L	T	P
1.	**Introduction** Nature of State and Policy Making in India; Constituent Assembly Debates; Directive Principles of State Policy; Concepts and Theories of Public Policy	9		
2.	**Policy Processes**	9		

	Policy cycles; Policy implementation in India; Issues and perspectives on service deliveries; Accountability & Decentralization			
3.	**Agents of Change** Governance models, principles and Networks; Theories on Institutions & New Public Management; Public Policy actors [Domestic and International]; Interests and Pressure groups (Bureaucracy; Media & Judicial activism) Development Triad (State: Civil Society and Market);	10		
Total		**28**	**0**	**0**

Evaluation criteria:	**Weightage (%)**
▪ Thematic presentations	25
▪ Group works	25
▪ Reviews (including Articles and Book)	50

Learning outcomes: At the end of the course, the participants would be able to (1) know the public policy process and; (2) be introduced to critically reflect on the actors and public policy institutions.

Pedagogical approach: Instructions will be facilitated through lectures, interactive sessions and critical readings. The sessions will be dealt considering relevant Policy perspectives where each Lecture will be moderated through either an assignment or group presentations or both by the participants. Thus, the learning expectation is to enhance critical and informed understanding.

Materials:

Required text

Suggested readings

Module 1

1. Birkland, T., (2005), *An Introduction to the Policy Process: Theories, Concepts, and Models of Policy Making*, M E Sharpe
2. Dye, T.R., (2002), *Understanding Public Policy*, Pearson Education, England
3. Hill, M., (2005), *The Public Policy Process*, Pearson Education, England
4. Kingdon, J.W., (2003), *Agendas, Alternatives and Public Policies*, Longman, New York.
5. Sabatier, P. (eds), (1999), *Theories of the Policy Process*, Westview Press, USA.
6. Stone, D., (2001), *The Policy Paradox: The Art of Political Decision Making*, Norton & Company
7. Morse, K., and Struyk, R.J., (2006), *Policy Analysis for Effective Development- Strengthening Transition Economies*, Lynne Reiner, US

8. Parsons, W., (1995), *Public Policy-An Introduction to the Theory and Practice of Policy Analysis*, Edward Elgar, UK

9. Weimer, D. L. and Vining, A.R., (2004), *Policy Analysis: Concepts and Practice*, Prentice Hall, USA

Module 2

10. North, D., (1990), *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, New York.

11. Ostrom, E., (1990), *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press, New York.

12. Zucker, L.G., (1987), "Institutional Theories of Organizations", *Annual Review of Sociology*, Vol.13, pp: 443-464.

13. Godbole, M., (2003), *Public Accountability and Transparency-The imperatives of Good Governance*, Orient Longman, New Delhi

14. Corbridge, S. and Harris, J., (2000), *Reinventing India: Liberalization, Hindu Nationalism and Popular Democracy*, Cambridge University Press.

15. Grindle. M.S. (ed), (1980), *Politics and Policy implementation in the Third World*, Princeton University Press, NJ.

16. Harris, J., (2006), *Power Matters-Essays on institutions, Politics and Society in India*, Oxford University Press, New Delhi.

17. Hill, M. and Hupe, P., (2009), *Implementing Public Policy-An Introduction to the Study of Operational Governance*, Sage Publications, London

18. Cheema, G. S., and Rondinelli, D.A. (eds), (1983), *Decentralization and Development: Policy Implementation in Developing Countries*, Sage Publications, Beverly Hills; London; New Delhi.

19. Hogwood, B.W., and Gunn, L.A., (1984), *Policy Analysis for the Real World*, Oxford University Press, New Delhi.

20. Mathur, Kuldeep (2013) *Public Policy and Politics in India: How Institutions Matter*, Oxford University Press, New Delhi.

21. Pressman, J. L. and Wildavsky, A., (1971), *Implementation*, California University Press,

Berkeley.

22. Thomas, John W. and Merilee S. Grindle (1990), "After the Decision: Implementing Policy Reforms in Developing Countries", *World Development*, Vol. 18, No. 8, (pp. 1163-1181).

Module 3

23. Barzelay, M., (2001), *The New Public Management-Improving Research and Policy Dialogue*, University of California Press and Russel Sage Foundation, New York.
24. Bashevkin, S., (1996), "Interest Groups and Social Movements", In Lawrence LeDuc, Richard Neimi and Pippa Norris (eds), *Comparing Democracies: Elections and Voting in Global Perspective*, Thousand Oaks, CA: Sage Publications.
25. Chatterjee, P. (eds), (1999), *State and Politics in India*, Oxford, New Delhi.
26. Lipsky M. (1980). *Street-level bureaucracy: Dilemmas of the individual in public services*, Russell Sage Foundation, New York.
27. Marsh, D., (1998), "The development of the policy network approach", In Marsh D (ed.). *Comparing Policy Networks*, Oxford University Press, Oxford.
28. Minogue, M., Charles P., and Hulme, D., (1998), *Beyond the New Public Management-Changing Ideas and Practices in Governance*, Edward Elgar, UK.
29. Turner, M., and Hulme, D., (1997), *Governance, Administration and Development-Making the State Work*, Palgrave, New York.

Case Studies

Websites

Journals

Other readings

Additional information (if any): None

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

Course reviewers

1. Dr. Suresh Babu, Zakir Husain Centre for Educational Studies, *Jawaharlal Nehru University*, New Delhi.

2. Prof. Vishal Narain, Professor, Public Policy and Governance, Management Development Institute, Gurugram.
3. Dr. Latika Gupta, Central Institute of Education, *University of Delhi*, New Delhi

Course title: Communities and Conservation			
Course code: PPS195	**No. of credits:** 2	**L-T-P:** 20-8-0	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course Coordinator(s): Dr Sudipta Chatterjee		**Course Instructor(s)**: Dr Sudipta Chatterjee	
Contact details: s.chatterjee@teriuniversity.ac.in			
Course type: Core		**Course offered in**: Semester 2	

Course Description

The course has been broadly designed for mid-career professionals in administrative services to provide them with a broad perspective of the interface between the science, policy and community involvement in biodiversity conservation. The course shall focus on the rationale for biodiversity conservation in face of global changes, highlighting the biodiversity significance of India. Providing a basic concept of ecosystem, the course delves into an understanding of the services it provides and need for monitoring and assessment for science based decision making. The role communities play in management of natural resources is very central to the course The course shall look into the enabling policy environment in India and the world. Course participants will identify a problem area *vis a vis* their respective area of work and develop a proposal for evaluation.

Course objectives

Reinforce the course participants with knowledge and information on communities and conservation in India.

Course content

Module	Topic	L	T	P
1.	**Natural History of India** Natural History of Landscapes of India. The evolutionary history.	1		
2.	**Biodiversity Significance of India** Concept of biodiversity, its significance, types and reasons for its depletion and reasons for conservation. What do we lose when we lose biodiversity? Global priorities for biodiversity conservation. Protected area network, Global trends The Living Planet Index, Global Biodiversity Outlook and biodiversity significance of India. Trends in Forest Cover in India.	2		
3.	**Ecosystems** The concept. Types, Natural and man-made (Artificial), Terrestrial and Aquatic. Functioning of ecosystems. Prioritization of biodiversity conservation in India. Ecosystem services, need for assessment, monitoring and management.	2		
4.	**Communities and Ecosystems** Community dependence on natural resources and strategies for natural resource conservation in different biogeographic zones of India.	2	2	

	Community Conserved Areas in India including sacred forests. Community institutions including Traditional institutions.			
5.	**Threats to Ecosystems** The development vs. conservation debate. Case studies on threats to ecosystems. Climate Change and Ecosystems and role of communities.	2	2	
6.	**Community strategies for Conservation** Role of communities in Conservation of Protected Area Network and Community Conserved Areas. Management Plans and Working Plans with focus on community participation in preparation of microplans Emerging approaches to conservation of ecosystems: Sustainable Forest Management, Payment for Environmental Services, Forest and Marine certification, REDD+ and Forest Landscape Restoration. Communities and Conservation of Trans boundary landscapes. Global Financial Mechanisms promoting communities and conservation. Initiatives in India: Learning experiences.	2	2	
7.	**Domestic legislations and Global Conventions for Sustainable Ecosystem** Enabling Policy environment in India for community participation in conservation. Village Forests, Joint Forest Management, Community Reserves and Conservation Reserves in Wildlife Protection Act, 1972. Litigations under the India's Biological Diversity Act, 2002. Forests Rights Act, 2006, Wildlife Action Plan (2017) and Wetland Rules 2010 and Draft rules 2016.. Enabling Global Policy Environment for Community Conservation: The Convention on Biological Diversity(CBD), The Ramsar Convention, Ecosystems and the UNFCCC, Land degradation and UNCCD, Convention on International Trade in Endangered Species (CITES), Convention on Migratory species (CMS). Role of communities in achieving Global Biodiversity targets.	3	2	
8.	**Challenges to community participation in conservation of Ecosystems** Proposal development and presentations on the same.	6		
	Total	**20**	**8**	**0**

Evaluation criteria: **Weightage (%)**

- 2 Minor Examinations 50%
- Presentation 30%
- Report 20%.

Learning outcomes:

The course participants would be able to integrate the learning in their respective areas of work and influence decision making.

Pedagogical approach:

The approach shall be to emphasize on Ecosystem approach to conservation and role of communities therein. Basic concepts and updated information on conservation and communities shall be complemented with relevant case studies for enhanced class room discussions.

Materials:

Suggested readings:

Module 1: Natural History of India. Pranay Lal
Module 2: Biodiversity significance of India : Setting priorities for biodiversity conservation in India. Ed (Shekhar Singh et al. 2001, WWF India.
The Living Planet Index, International, The Global Biodiversity Outlook and Forestry Outlook, FAO
Module 3: Ecosystems. Ecology by E.P Odum, Ecology by Begon
Module 4: Communities and Ecosystems: Community Conserved Areas , Neema Pathak Broom (Ed), Kalpaviksha, Pune. Publications of Kalpavriksha, New Delhi.
Module 5: Threats to Ecosystems; Through case studies.
Module 6: Community strategies for conservation: Vishwas and Savarkar (2005) Planning for Management Plans , National Working Plan Code (2014). Planning a Protected Area Network of India (2005) by Allen Rodgers and HS Panwar
Module 7:Domestic Legislations: Wildlife Protection Act (1972), Indian Forest Act (1927), Forests Right Act 1206, National Biodiversity Act 2002 and National Biodiversity Rules, 2014, National Wildlife Action Plan (2017), Draft Nation al Wetland Rules, 2016.

Case Studies: Biodiversity significance of North East India.
Piloting REDD+ in Garo Hills Meghalaya
National initiatives on conservation of sacred groves, Payment for Environmental Services and communities and conservation.
Eco-development at Periyar Tiger Reserve, Kerala.

Piloting Forest Plus in implementation of REDD+ in India
Websites: www.cbd.int; www.ramsar.org; www. unccd.org

Journals: The Indian Forester, Conservation Biology, Biological Conservation, Science

Other readings: The Global Biodiversity Targets (Aichi) , Criteria and Indicators for Sustainable Forest Management (Bhopal India Process), Principles , Criteria and Indicators of Forest and Marine Stewardship Councils

Additional information (if any): None

Student responsibilities:

Course Participants shall actively engage in classroom discussions and design a proposal on involving communities and conservation in a landscape they are familiar with. The proposal should provide the rationale and should be able to highlight urgency of its implementation and draw the attention of competent authorities.

Course reviewers

1. Prof Anand Kandya, HSG Sagar University, Madhya Pradesh
2. Ms Visheish Uppal, Livelihood Officer, WWF India, New Delhi

3. Dr Ram Prasad, Ex VC Barkatullah University and ex PCCF, State Forest Department, Govt. of Madhya Pradesh

Course title: Major policy issues - Education, health and infrastructure in India			
Course code: PPS192	**No. of credits:** 2	**L-T-P:** 24-4-0	**Learning hours:** 28
Department: Policy Studies			
Course coordinator: Mr Shri Prakash	**Course instructor:** Mr Shri Prakash, Dr Prashant Kumar Singh & Dr L N Venkatarman		
Contact details: shri.prakash@teri.res.in			
Course Type: Core	**Course offered in:** Semester 2		
Pre-requisite course code and title (if any): None			

Course Description

The Course is designed to provide an overview of major policy issues in three important sectors namely Education; Health and Infrastructure in India.

Course objectives

- To discuss current and future challenges in Education; Health and Infrastructure in India
- To critically review the national policy issues in Education; Health and Infrastructure since independence
- To discuss the successes and limitations of some of the key flagship programmes

Course content

Module	Topic	L	T	P
1.	**Education policy in India** 1. Political agendas of Education ▪ Policy actors (State; Market & Civil Society) ▪ Discrimination and Exclusion (Scheduled Castes; Scheduled Tribes & Gender) ▪ Regulatory regimes (School Inspectors; UGC / AICTE / NAAC) 2. Draft New Education policy (2016) **School Education** ▪ Universalization of Elementary Education ▪ Right to Education (RtE) ▪ Secondary Education ▪ Common School System **Higher Education** ▪ Humanities and Social Sciences in India ▪ Technical & Medical Education (NEET Reform)	9		
2.	**Health Policy** ▪ Recent trends and patterns of key demographic and health challenges of India. ▪ Demographic diversity of India: socioeconomic	9		

	and spatial dimensions. ▪ India's population/health policy since independence and key features. ▪ Importance of social determinants of health in India's context and its policy relevance. ▪ Policy cases: a) National Health Policy-2017 b) Janani Suraksha Yojana (JSY) c) Rashtriya Swasthya Bima Yojna (RSBY) and d) Integrated Child Development Services (ICDS)			
3.	**Infrastructure** This module will cover major issues relating to sustainable development of infrastructure in India focusing mainly on transport, energy and urban sectors. It will critically reflect about the policies of these sectors specifically in light of the gaps in implementations and implications on Governance based on case studies. Funding of infrastructure; Public versus. private investments; Growing role of public private participation in infrastructure development; Sustainability issues in infrastructure development - Land, forest and environmental concerns; Judicious use of natural resources; Regulating infrastructure in India; Role of regulation and regulatory agencies, civil society and national dialogues for planning and implementing infrastructure programs/projects	6	4	
	Total	**24**	**4**	**0**

Evaluation criteria:	**Weightage (%)**
▪ Article/Book Review	25
▪ Course-works (Individual & Group presentations)	25
▪ Major Examination	50

Learning outcomes

At the end of the course, the participants would be able to (1) know the policy issues in the three sectors; and (2) critically reflect on the development policies in India.

Pedagogical approach

Instructions will be facilitated through lectures, interactive sessions and critical readings. The sessions will be dealt considering relevant policy perspectives where each module will be followed by an assignment and group presentations by the participants. Thus, the learning expectation is to enhance critical and informed understanding.

Materials:

Required text:

Suggested readings:

Education Policy

1. University Grants Commission, (1964-66) *Indian Education Commission*, Government of India

2. Naik, J. P., (1979), "Equality, Quality and Quantity: The Elusive Triangle in Indian Education", *International Review of Education*, Vol. 25, No. 2/3, (pp. 167-185).

3. Kumar, Krishna (1991), *Political Agenda of Education*, Sage Publications, New Delhi.

4. Srivastava, Sanjay (1998), *Constructing Post-Colonial India: National Character and the Doon School*, Routledge, London.

5. Tilak, JBG (2012), "Higher Education Policy in India in Transition", *Economic and Political Weekly*, Vol. 47, Issue 13, (pp. 36-40).

6. Tilak, JBG (2010), "Neither Vision nor Policy for Education", *Economic and Political Weekly*, Vol. XLV, No. 13, (pp. 60-64).

7. Venkataraman, L N, (2016), "New Education Policy and the continuing contentions in India", *Economic and Political Weekly*, Vol. 51, No. 35, (pp. 47-50).

8. Venkataraman, L N, (2016), "Social Sciences in India: Premises and promises of Capability Approach" *Indian Journal of Human Development*, Vol. 10, No. 1, (pp. 1-11).

Health Policy

1. Balarajan, Y., Selvaraj, S. and Subramanian, S.V., 2011. Health care and equity in India. *The Lancet*, *377*(9764), pp.505-515.
2. Fan, V.Y. and Mahal, A., 2011. Learning and getting better: rigorous evaluation of health policy in India.
3. Homer, J.B. and Hirsch, G.B., 2006. System dynamics modeling for public health: background and opportunities. *American journal of public health*, *96*(3), pp.452-458.
4. Jehan, K., Sidney, K., Smith, H. and de Costa, A., 2012. Improving access to maternity services: an overview of cash transfer and voucher schemes in South Asia. *Reproductive health matters*, *20*(39), pp.142-154.
5. Nandi, A., Ashok, A. and Laxminarayan, R., 2013. The socioeconomic and institutional determinants of participation in India's health insurance scheme for the poor. *PloS one*, *8*(6), e66296.
6. National Health Policy 2017, Ministry of Health and Family Welfare, Govt. of India, 2017.
7. Patel, V., Parikh, R., Nandraj, S., Balasubramaniam, P., Narayan, K., Paul, V.K., Kumar, A.S., Chatterjee, M. and Reddy, K.S., 2015. Assuring health coverage for all in India. *The Lancet*, *386*(10011), pp.2422-2435.
8. Rao, K.D., Ramani, S., Hazarika, I. and George, S., 2013. When do vertical programmes strengthen health systems? A comparative assessment of disease-specific interventions in

India. *Health policy and planning*, *29*(4), pp.495-505.

Infrastructure

1. Delmon, Jeffrey. (2011) Public Private Partnership projects in Infrastructure: An essential guide for policy makers, Cambridge University Press
2. Piyush Joshi, (2003). Law relating to Infrastructure Projects (Second edition) LexiNexus Butterworths India New Delhi
3. Mehta, Pradeep S, (2009). Developing infrastructure through an ideal regulatory framework, CUTS Institute for regulation and Competition
4. Fay, Marianne and Toman, Michael (2010). Infrastructure and Sustainable development, World Bank
5. Shilling, John D (2007). The Nexus between Infrastructure and Environment, Evaluation brief 5. World Bank

Case Studies:

Websites:

Journals:

Other readings:

Additional information (if any): None

Student responsibilities:
1. Active participation in the processes of Learning;
2. Critical reflections for discourse creation;
3. Punctuality (according to the Course criterion).

Course reviewers
1. Dr. Latika Gupta, Central Institute of Education, *University of Delhi*, New Delhi
2. Dr. Suresh Babu, Zakir Husain Centre for Educational Studies, *Jawaharlal Nehru University*, New Delhi
3. Dr. Manoj Alagarajan, Associate Professor, Department of Development Studies, International Institute for Population Sciences (IIPS), Mumbai
4. Mr. Rajesh Kumar Rai, Senior Research Scientist, Society for Health and Demographic Surveillance (SHDS), Ministry of Health and Family Welfare, Govt. of West Bengal, Suri, West Bengal.
5. Mr. Sundar, Distinguished Fellow, TERI, New Delhi and former Secretary Transport, Government of India.
   Mr Sushant Misra, Adviser, Infrastructure, Ministry of Railways, New Delhi

Course title: Policy Perspectives on Water			
Course code: PPS 193	**No. of credits:** 2	**L-T-P:** 28-0-0	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course Coordinator(s): Prof Arun Kansal		**Course Instructor(s)**: Dr Punam Pandey	
Contact details: akansal@teriuniversity.ac.in			
Course type: Core		**Course offered in**: Semester 2	

Course Description

This course will introduce students to diverse perspective on water resource management. It examines the relations between water and development and explores this relation in the context of policy framework which is increasingly being influenced by conflict over resources. A prominent focus of this course is on discussing the trajectory of water management reforms in India and salience of various actions in bringing positives changes in its management.

Course objectives

1. To introduce students to principles and conceptual issues in the analysis of water scarcity and security
2. To provide familiarity with approaches and multi-dimensionality of water management

Course content

Module	Topic	L	T	P
1.	**Water as component of Ecosystem** Introduction to models and systems; Water and Climate; Water and Soil; Water and Vegetation.	5		
2.	**Overview of water situation in India** Introduction to Water Stress and Water Quality Index; Status and Trends of SW & GW exploitation and pollution; factors responsible- technical, policy and institutional factors.	5		
3.	**Water and Development** Water and Food; Water and Energy; Population, human settlement and water use; Water and Industry; Evolution of understanding of water security and governance Concepts of transboundary water Water access, ownership and rights	8		
4.	**Water management approaches and national strategies** River basin approach; Watershed approach; Community management; Economics, finance and private sector participation; Sectoral analysis of water management (Agriculture, Domestic, Industry, Power (thermal and Hydro)), interlinking projects	6		
5.	**Water Security and conflict management** Concept of water security, Regional consciousness and inter-state issues	4		
	Total	**28**	**0**	**0**

Evaluation criteria:	**Weightage (%)**
Class participation	25%
Class presentation	25%
Review papers	25%
Written exam	25%

Learning outcomes

At the end of the course, students would:

- Have the ability to understand the reasons for contestation over water resources, its management and governance
- Be able to understand, analyse issues regarding water governance and reforms in India taking into account social, economic and environmental parameters
- Be able to articulate the contemporary challenges that the water sector in India faces.

Pedagogical approach

This course has been designed wherein students will be able to read, discuss and write about work being discussed. The course will be run majorly as a discussion forum and it will be expected that student read beforehand the assigned reading and come prepared to the class to participate in the discussion. This will also give them an opportunity to reflect on author's approach, methods employed, and explanatory building blocks used to take forward the argument. Audio-visual tools like short documentaries that highlight the issues will also be used in the class.

Materials:

Required text

Suggested readings:

Note: Latest research papers, articles and topic-wise readings will be suggested in class.

1. Loucks, D.P., J.R. Stedinger, and D. A. Haith, (1981) *Water Resource Systems Planning and Analysis*, Englewood Cliffs, NJ, Prentice Hall.
2. Simonvic, S.P. (2009) Managing water resources: Methods and tools for a system approach, UNESCO Publishing, France.
3. Loucks,D.P. and J.S. Gladwell, (1999) *Sustainability Criteria for Water Resource Systems*, Cambridge, UK, Cambridge University Press.
4. Chorley, R. J. 1969. Water, earth and man: a synthesis of hydrology, geomorphology and socio-economic geography. London: Methuen young Books.
5. Ehrlich, P.R., Holdren, J.P., and Ehrlich A. H.1978. Ecoscience: population, resources, environment, 3rd ed. San Franscisco: W.H. Freeman.
6. Shaw E. M. (1994) Hydrology in Practice (3rd Edition), Chapman & Hall, London.

Case Studies

Websites

Journals

Other readings

Additional information (if any): None

Student responsibilities

The nature of the course demands that the students shall attend all lectures and have the habit of identifying and reading open e-learning resources.

Reviewers

1. Prof Ajay Temburkar, DoCE, VNIT, Nagpur
2. Dr A K Mishra, DoCE, NCU, Gurugram

Course title: Sustainable Urbanization			
Course code: PPS196	**No. of credits:** 2	**L-T-P:** 24-0-8	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course coordinator: Dr Shaleen Singhal	**Course instructor:** Dr Shaleen Singhal, other faculty members		
Contact details: shaleen.singhal@teriuniversity.ac.in			
Course Type: Core	**Course offered in:** Semester 2		

Course description

Urban centres have become the major hub for economic growth and proliferation. In 2008, more than 50% of the total world's population was living in urban areas and by 2050 this percentage is expected to reach 70%. Hence, urban areas are expected to accommodate this population growth in future. Cities require natural resources, energy, raw material, food and goods to sustain the daily life of their inhabitants and their economic activities. Due to rapid urbanization and population growth in cities in India, there exists a significant pressure on natural resources within city and its rural catchment. To progress on path of sustainability, cities are aiming to adopt policies and strategies that support in optimizing the use of resources, minimize climate change impact and facilitate development of a circular path that balances increasing consumption pattern with changes towards sustainable lifestyle. This calls for mainstreaming sustainable consumption and production (SCP) practices through predominant development sectors in cities. In context, this course examines the phenomenon of SCP relating to cities.

Course objectives

- To highlight the significance of sustainable consumption and production (SCP) and resource efficiency relating to cities in emerging economies such as India.
- To impart knowledge on strengths and weaknesses of existing city development policies and strategies and linkages to SCP with focus on key sectors (such as built environment, transport, basic services and industries).

Course content

Module	Topic	L	T	P
4.	**Introduction to SCP and cities** Phenomenon of SCP in relation to urban centres; discourse relating to resource efficient, smart and productive, and climate compatible cities Governance and policy planning and the role of local institutions in realizing transitions towards sustainable living and behavioral change Sectoral challenges and strategies, examples from Europe, Asia and India Life Cycle Thinking - approach and analysis for SCP	6		4
5.	**Planning and management for resource efficient and resilient cities** ▪ Urban sustainable development and redevelopment;	3		

	process of planning & management and role of key actors (as citizens, planners, politicians, officials, consultants, developers, contractors etc.) towards resource efficiency and decoupling. ▪ Strengths and weaknesses of existing city development and management policies (as JNNURM, Smart Cities Mission, UIDSSMT, CDPs, NUHHP etc.) ▪ Exemplars for integrated planning for sustainable urban development			
6.	**Sustainable construction and buildings** Overview of the building and construction sector of India: existing growth and future scenario Existing policies and regulations relating to energy and material consumption within building sector (as Sustainable Habitat Mission, Energy Conservation Building Code 2007, Construction and Demolition waste management rules etc.) Certification system for resource efficient buildings in India (as GRIHA and LEEDS)	4		
7.	**Sustainability in urban transport** Overview of the transport sector – scenarios and challenges for SCP Sustainable urban transport and policy linkages (as National Urban Transport Policy 2014, parking policy, congestion pricing etc.) Strategies and regulations for sustainability in transport (land use and transport planning; planning public transit integrated with non-motorised transport systems)	4		
8.	**Infrastructure and services** Focus on key services with potential of district systems and actions to contribute to SCP and resilience to climate change in cities: Municipal waste management - strengths and weaknesses of existing policies, regulations and novel initiatives; national and global best practices Water supply and Sanitation: water demand management; implications of initiatives as National Urban Sanitation Policy, Swachch Bharat Mission etc. on SCP in cities; indigenous exemplars Energy: Energy scenario of cities in India, current and future energy consumption and energy mix, appraisal of policy initiatives	4		4
9.	**Sustainable industrial development** Industrial ecology and development through symbiotic relationships Development policies and strategies and linkages to SCP	3		

	through industrial establishment in and around cities (Make in India, National Manufacturing Policy, SEZs, industrial parks etc.)			
	Total	**24**	**0**	**8**

Evaluation criteria:
Course assessment will be conducted through:

Test 1 (35%): Oral presentation on sector identification, rationale, preliminary analysis of data and relevant case examples

Test 2 (65%): Report on sectoral analysis and oral presentation. Detailed Life Cycle Analysis of identified sector. Oral presentation on LCA and a written report with assumptions and justifications.

Learning outcomes:
On successful completion of this course, the students shall

- Be able to appreciate the significance of sustainable consumption and production and resource efficiency in context of development in cities.
- Be able to examine city development sectoral policies and strategies and their linkages to sustainable consumption and production.

Pedagogical approach:
The course will be delivered through a mix of classroom lectures, brainstorming tutorial and presentation sessions, practicals and study visits.

Materials:

Required text:

Suggested readings:

1. Fedrigo, D. and Hontelez, J., 2010. Sustainable consumption and production. Journal of Industrial Ecology, 14(1), pp.10-12. Available at: https://pdfs.semanticscholar.org/8b0a/610799816ebe4373aad364c7e4ad5b355909.pdf
2. Lehmann, H. and Rajan, S.C., 2015. Sustainable Lifestyles. Pathways and Choices for India and Germany. Available at: https://www.researchgate.net/profile/Sudhir_Rajan/publication/289522018_Sustainable_Lifestyles/links/568e3f6108ae78cc0515575a.pdf
3. Low-Carbon Green Growth in Asia Policies and Practices: A Joint Study of the Asian Development Bank and the Asian Development Bank Institute. 2013. Available at: http://www.adb.org/publications/low-carbon-green-growth-asia-policies-and-practices
4. Rebitzer, G., Ekvall, T., Frischknecht, R., Hunkeler, D., Norris, G., Rydberg, T., Schmidt, W. –P., Suh, S., Weidema, B.P., and Pennington D.W., 2004. Life cycle assessment: Part 1: Framework, goal and scope definition, inventory analysis, and applications, Environment International, 30 (5): 701-720. Available at: http://www.sciencedirect.com/science/article/pii/S0160412003002459
5. Singhal, S. and Kapur, A. 2002. Industrial Estate Planning and Management in India - an Integrated Approach towards Industrial Ecology. Journal of Environmental Management, Elsevier.
6. Singhal, S. Berry, J. and McGreal, S. 2010. Linking regeneration and business with competitiveness for low carbon cities: lessons for India. In India Infrastructure Report 2010: Infrastructure

7. Smith, A. 2007. Sustainable cities. London: Franklin Watts.
8. Tukker, A., Cohen, M.J., Hubacek, K. and Mont, O., 2010. Sustainable consumption and production. Journal of Industrial Ecology, 14(1), pp.1-3. Available at: https://s3.amazonaws.com/academia.edu.documents/34557519/JIE_SCP_Editorial.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1507887160&Signature=4QPrIQ2BqPrVvtEePsF%2FmCORdsU%3D&response-content-disposition=inline%3B%20filename%3D2010_Editorial_Sustainable_Consumption_a.pdf
9. UNEP. 2015. District energy in cities: unlocking the potential of energy efficiency and renewable energy. Available at: http://districtenergyinitiative.org/report/DistrictEnergyReportBook.pdf
10. Vergragt, P.J., Dendler, L., de Jong, M. and Matus, K., 2016. Transitions to sustainable consumption and production in cities. Journal of Cleaner Production, 134, pp.1-12. Available at: http://www.sciencedirect.com/science/article/pii/S0959652616305054
11. Von Weizsäcker, E.U., de Larderel, J, Hargroves, K., Hudson, C., Smith, M., Rodrigues, M., 2014. Decoupling 2: technologies, opportunities and policy options. A Report of the Working Group on Decoupling to the International Resource Panel.

Case Studies:

Websites:

Intended Nationally Determined Contributions to UNFCCC; Online at: http://unfccc.int/focus/indc_portal/items/8766.php

SCP Clearinghouse

The Global SCP Clearinghouse is a unique one-stop hub dedicated to Sustainable Consumption and Production (SCP) and convened by the United Nations Environment Programme (UNEP) acting as the Secretariat of the 10 Year Framework of Programmes on SCP (10YFP on SCP);
Online at: http://www.scpclearinghouse.org/

SCP Policies and the 10 Year Framework Programme, UNEP; Online at: http://www.unep.org/resourceefficiency/Policy/SCPPolicies/tabid/55539/Default.aspx

SWITCH-Asia projects funded by the European Union; Available at: http://www.switch-asia.eu/projects/

UNEP's Resource Efficiency Programme; Online at: http://www.unep.org/resourceefficiency/Home/Society/tabid/55529/Default.aspx

UNIDO projects on cleaner production topics;

Available at: http://www.unido.org/en/where-wework/ asiaandthepacific/selected-projects.html

Journals:

Other readings:

1. Akenji, L. and Bengtsson, M., 2014. Making Sustainable Consumption and Production the Core of the Sustainable Development Goals, Sustainability, 6 (2014): 513-529. Available at: http://www.mdpi.com/2071-1050/6/2/513
2. Bhattacharya, S., Rathi, S., Patro, S.A. and Tepa, N., 2015. Reconceptualising smart cities: a reference framework for India. Bangalore: Center for Study of Science, Technology and Policy (STEP). Available at: http://niti.gov.in/writereaddata/files/document_publication/NITI%20Aayog%20Workshop%2002092015%20Presentation%20by%20CSTEP.pdf

3. Chiu, S.F., Ward, J. V., and Massard, G., 2009. Introduction to the special issue on Advances in Life- Cycle Approaches to Business and Resource Management in the Asia-Pacific Region, Journal of Cleaner Production, 17(14): 1237-1240. Available at: http://www.sciencedirect.com/science/article/pii/S0959652609001383
4. Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J.R., Mellouli, S., Nahon, K., Pardo, T.A. and Scholl, H.J., 2012, January. Understanding smart cities: An integrative framework. In System Science (HICSS), 2012 45th Hawaii International Conference on (pp. 2289-2297). IEEE. Available at: http://ieeexplore.ieee.org/abstract/document/6149291/?reload=true
5. Green Public Procurement in Bhutan (GPP Bhutan), 2015. Executive Summaries of Year 1 Activity Reports. Available at: http://gppbhutan.bt/project-publications
6. J.M., and Nathadwarawala, K.M., 2011. Sustainable Business Initiatives in the Context of Emerging Economies, In B. Unhelkar (Ed.), Handbook of Research on Green ICT: Technology, Business and Social Perspectives: 265-281. Available at: http://www.igi-lobal.com/chapter/sustainable-businessinitiatives- context-emerging/48433
7. Schandl, H. and West, J., 2010. Resource use and resource efficiency in the Asia–Pacific region. Global Environmental Change, 20(4), pp.636-647.
8. Shapiro, J.M., 2006. Smart cities: quality of life, productivity, and the growth effects of human capital. The review of economics and statistics, 88(2), pp.324-335. Available at: http://www.mitpressjournals.org/doi/abs/10.1162/rest.88.2.324
9. Sustainable Consumption and Production in the Proposed Sustainable Development Goals – A paper from the Inter-Agency Coordination Group (IACG) of the 10 Year Framework of Programmes on SCP (10YFP). June, 2014. Available at: www.unep.org/10yfp/Portals/50150/10YFP%20IACG.pdf
10. SWITCH-Asia Projects, Case studies. See: http://www.switchasia. eu/publications/?tx_switchasia_publications[category]=3&cHash=187075de03e4a5e1f168fb8a b798b9fb
11. UNEP 2013. Capacity Building and Policy Needs Assessment for Sustainable Consumption and Production. Available at: http://www.switch-asia.eu/fileadmin/user_upload/RPSC/policy-assessment/Needs-Analysis-Final-report.pdf
12. UNEP, 2014. The Business Case for Eco-Innovation.
13. UNEP, 2015. Indicators for a Resource Efficient and Green Asia and the Pacific – Measuring progress of sustainable consumption and production, green economy and resource efficiency policies in the Asia-Pacific region. Schandl, H., West, J., Baynes, T., Hosking, K., Reinhardt, W., Geschke, A., and Lenzen, M. United Nations Environment Programme, Bangkok. Available at: http://www.switch-asia.eu/fileadmin/user_upload/RPSC/Publications/Indicator-for-a-E_Lowresolution_.pdf
14. UNEP, 2013. City-Level Decoupling: Urban resource flows and the governance of infrastructure transitions. Summary for Policy Makers. Swilling M., Robinson B., Marvin S. and Hodson M.
15. Wuppertal Institute for Climate, Environment and Energy, 2013. Lighting: Energy Efficient Lighting for Sustainable Development.
16. Zhao, W. and Schroeder, P., 2010. Sustainable consumption and production: Trends, challenges and options for the Asia-Pacific region, Natural Resources Forum, 34(1): 4-15. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1477-8947.2010.01275.x/pdf

Additional information (if any): None

Student responsibilities

Attendance, feedback and discipline: As per University rules.

Course reviewers:

1. Mr Arab Hoballah, Team leader, SWITCH Asia SCP Facility, Bangkok, (Former Chief, Sustainable Lifestyles, Cities and Industry UNEP)
2. Prof. Shravan Acharya, Centre for the Study of Regional Development, JNU.

Course Title: Agriculture and Rural Development			
Course code: PPS 197	**No. of credits: 2**	**L-T-P:** 28-0-0	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course Coordinator: Dr Swarup Dutta		**Course Instructors:** Dr Swarup Dutta; Dr Shantanu De Roy & Dr Chubamenla Jamir	
Contact Details: swarup.dutta@teriuniversity.ac.in			
Course Type: Core		**Course Offered in:** Semester 2	

Course Description:

This course aims to analyse the performance of the agricultural sector since Independence, what had led to changes in performance of the sector and what accounts for these changes. It brings into focus the impact of agricultural performance on different sections of the rural population. In this backdrop the course also focusses on policy level developments that had impacted Indian agriculture in the pre-and post-reform period and the changing role of rural institutions to meet these challenges for a sustainable growth trajectory. The new trade policy regime, following the WTO Agreement on Agriculture, has necessitated major structural changes in the way countries support their agriculture. Against this background, it covers two of the major issues—food security and climate change—that has come up with changes in economic regimes at the domestic and global level.

Course objectives:

- Acquaint the students with the growth performance of Indian agriculture since Independence
- Understanding the impact of macro policy level changes on different sections of the rural population in India
- Understanding the impact of climate change on agriculture and its related impact on food security.

Course content

Module	Topic	L	T	P
1.	Understanding growth performance of Indian Agriculture- (Pre-and Post-Reforms); Implementation of Land Reforms in India- (The Case of West Bengal); Economic Differentiation in the rural areas	10		
2.	**Introduction to Rural Society** Social stratification and exclusion in rural India; Institutional Landscape for Rural Development and Agriculture	10		

	Green Revolution and its social impact; Influence of Globalization on agriculture; Agriculture and Biotechnology; Sustainable Rural Livelihood; Agrarian Crisis (Farmer Suicides in India)			
3.	**Agriculture and food security: Concepts** Types of agriculture; Food production systems; Food security concept; types of food insecurity **Agriculture and global development challenges** Agriculture production under various global development challenges; planetary boundaries; SDGs **Agriculture and climate change** Climate change and food security problems in global and regional (India) context **Sustainable agriculture systems** Methods and strategies for improving crop yield under climate and environment stress; sustainable agriculture types (including organic farming); subsistence agriculture; resource management systems	8		
		28	**0**	**0**

Evaluation criteria:	**Weightage (%)**
Term Paper (Module 1)	40%
Presentation (Module 2)	30%
Presentation (Module 3)	30 %

Learning outcomes:
Students will develop a critical understanding on the development of agricultural sector in India and on issues like food security and climate change that can impact the livelihood strategy of substantial sections of the rural population.

Pedagogical approach:
Class room discussions and interactions

Materials:

Required text:

Suggested readings:

References:

Module I:

Association for Democratic Rights (2000). *Suicides in rural area of Punjab*. AFDR Ludhiana.

Chand, R. (2004). India's national agricultural policy: a critique. Indian Journal of Agricultural Economics, 64(2) 164-187

Cleaver, H.M. (1972). The contradictions in the Green Revolution, *The American Economic Review*, 62(2): 177–86.

Gandhi, Vasant P. (1997). Technology, cost reduction and returns in agriculture: A study of wheat and rice in Punjab. *Vikalpa*, 22(2) April–June: 35–43.

Gill, A. (2000). *Rural credit markets—financial sector reforms and the informal lenders*. New Delhi: Deep and Deep Publication.

Gill, A. (2004). Interlinked agrarian credit markets: Case study in Punjab. *Economic and Political Weekly*, 39(83): 3741–3751.

Gill, A. and Singh, L. (2006). Farmer's suicides and response of public policy: Evidence diagnosis and alternatives from Punjab. *Economic and Political Weekly*, 41(26): 2762–2768.

Goldman, A. and Smith, J. (1995). Agricultural transformation in India and Northern Nigeria: Exploring the nature of Green Revolution. *World Development*, 23(2): 243–263.

Institute for Development and Communication. (1998). *Suicide in rural Punjab*. Chandigarh: IDC.

Iyer, K. Gopal and Manick, G.S. (2000). *Indebtedness, impoverishment and suicides in rural Punjab*. Delhi: India Publisher.

Manav, C. (2006). Debt drives Indian farmers to suicide. Inter Press Service.

Mearns, R. (1999). Access to land in rural India—policy issues and options. Policy

Nadkarni, M.V. (1988). Crisis of increasing costs in agriculture: Is there a way out? *Economic and Political Weekly*, 23(29): A114–A119.

Sainath P, (1996) Everybody loves a good drought. Penguin Publication.

Satish, P. (2006). Institutional credit: Indebtedness and suicides in Punjab. *Economic and Political Weekly*, 41(26): 2754–2761.

Singh, K., Singh, S., and Kangra, H.S. (2007). *Status of farmers left farming in Punjab*. A report by Punjab State Farmer's Commission in collaboration with Punjab Agricultural University, Ludhiana. Government of Punjab, Chandigarh.

Singh, S., Toor, M.S., and Sharma, V.K. (2005). *Magnitude and Determinants of Indebtedness in Punjab Agriculture*. Unpublished seminar paper. Patiala: Punjabi University.

Module II:

Mohan Rao, J. and Storm, Servaas (1998), "Distribution and Growth in Indian Agriculture", in Byres, Terence J., The Indian Economy: Major Debates since Independence, OUP.

De Roy (2017), "Economic Reforms and Agricultural Growth in India", *Economic and Political Weekly*, Vol 52, No.9.

Rawal and Mishra (2002), "Agrarian Relations in Contemporary West Bengal", in Ramachandran, V. K and Swaminathan, M. (2002) (eds.), *Agrarian Studies: Essays on Agrarian Relations in Less=Developed Countries*, Tulika Publishers, New Delhi.

De Roy (2016), "Changes in the Distribution of Cultivated Land and Occupational Pattern in Rural West Bengal", *Indian Journal of Agricultural Economics*, Vol. 71, no. 4.

Patnaik, Utsa (1990), *Agrarian Relations and Accumulation*: *The mode of production debate in India*, *OUP*, *1990*.

Module III

Grote U., 2014. Can we improve Global food security? A socio-economic and political perspective. Food Security, 6:187–200

Brindaban and Rabinge 2013, Megatrends in agriculture, Global food security. 1:99-105

Ecker O. and C. Breisinger. 2013. Revisiting food and nutrition security: A comprehensive overview, Journal of Agricultural Economics and Development, 2(7), 280-289.

Lal et al 2011. Climate change and food security. Springer Publications. Chapter 13, section 13.3 – 13.5, pp. 188-196.

Sirohi S. and Michaelowa A. 2007. Sufferer and cause: Indian livestock and climate change. Climatic Change 85:285–298

Foley et al 2011. Solutions for a cultivated planet. Nature 478: 337-342.

Nellemann, C., MacDevette, M., Manders, T., Eickhout, B., Svihus, B., Prins, A. G., Kaltenborn, B. P. (Eds). February 2009. The environmental food crisis – The environment's role in averting future food crises. A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal, http://www.grida.no/publications/rr/food-crisis/

Aggarwal et al 2004. Adapting food systems of the Indo-Gangetic plains to global environmental change: key information needs to Environmental Science n Policy 7: 487–498.

Egger n Dixon 2014_Beyond Obesity and Lifestyle A Review of 21st Century Chronic Disease Determinants

Regmi and Meade (2013). Demand side drivers of global food security, Global Food security, 2 (3): 166-171

Case Studies:

Websites:

Journals: **Other readings:**
Additional information (if any): None
Student responsibilities: Attendance, feedback, discipline: as per university rules.

Course reviewers

1. Dr. Mala Narang Reddy, Faculty (Guest), IIM-Amritsar, Punjab-05
2. Mr. V. Gunasekaran, Assistant Professor, Ramanujan College, University of Delhi-19

Course title: Public Management- Issues and Challenges with special reference to India			
Course code: PPS198	**No. of credits:** 2	**L-T-P:** 18-10-0	**Learning hours:** 28
Pre-requisite course code and title (if any): None			
Department: Policy Studies			
Course coordinator (s): Manipadma Datta		**Course instructor (s):** Manipadma Datta	
Contact details: manipadma.datta@teriuniversity.ac.in			
Course type: Core		**Course offered in:** Semester 2	

Course description

This course would take the students to a journey through the intriguing process of change world over in the organization and management of public services. It proposes to make them understand and recognize the underlying patterns and enduring trends in the area for thinking beyond traditional and orthodox views. The changing face and faces of public management would be the focus of discussion.

Course objectives

- Understanding basics of public service and its management;
- Evolution and changes in the area;
- Understanding the interface between public management and sustainable development goals;
- Addressing the issues and challenges to the area;
- Making policy contributions for desired changes.

Course content

Module	Topic	L	T	P
1.	Introduction: ▪ Ideas, definitions, assumptions; ▪ Administration to management- the journey to the evolution of New Public Management(NPM); ▪ Changing faces of public management; ▪ Cultural issues and factors; ▪ Hierarchist way;	3	2	

	▪ Individualist way; ▪ Egalitarian way; ▪ Fatalist way. • Indian context.			
2.	History and evolution: ▪ A concise history of public management; ▪ Combining cultural and historical perspectives; ▪ Public management and ethics.	3	1	
3.	Theoretical framework: ▪ Public-choice theory, ▪ Management theory, ▪ Classical public administration, ▪ Neoclassical public administration, ▪ Principal-agent theory, ▪ Property-rights theory, ▪ Neo-Austrian school, ▪ Transaction-cost economics approach.	3	2	
4.	Current Public Policy and Management Themes: ▪ Public-Private Partnerships (PPP) and hybridity; ▪ PPP evaluation of performance; ▪ Doctrine of decentralization in public management.	3	2	
5.	Public Management Reforms: ▪ Key debates; ▪ Trajectories of modernization and reforms; ▪ E-governance challenges; ▪ Politics of Public Management; ▪ Trade-offs, balances, limits, dilemmas, contradictions; ▪ A cross-country view.	4	2	
6.	An introduction to international scenario and the innovations in public management.	2	1	
Total		**18**	**10**	**0**
Evaluation criteria:	**Weightage (%)**			
▪	Assignments and presentations		50%	
▪	Term paper	50%		
Pedagogical approach The course will be delivered through class room lectures, group-discussions and case discussion.				

Materials

1. Ferlie, Lynn Jr et al (ed), The Oxford Handbook of Public Management, OUP, 2005.
2. Mishra and Ashok, Indian Public Management Case Studies for Good Governance, 2012.
3. Hood, C., The Art of the State, OUP, 2000.

Required text

Suggested readings

Case Studies

Websites

Journals

Other readings

Learning outcomes:

- Developing knowledge to adopt changes emerging in governance and administration;
- Acquiring skills to adapt to newer aptitudes required.

Student responsibilities

- Interaction with faculty;
- Sharing experiences.

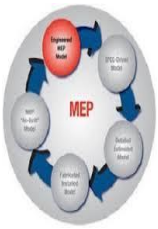
Course reviewers:

1. Dr. S. Bhattacharya, Director and Professor, Institute of Management Technology, Nagpur.
2. Prof Sonu Goyal, Dean International Relations and Exchange Program, IMI Delhi

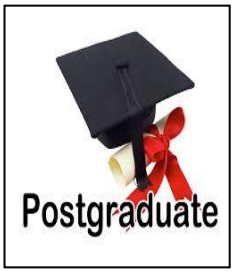
---xxxx--

Annexure 7
(Refer to Item No 10)

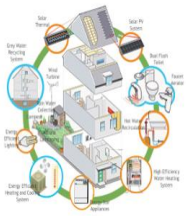
Proposal to start interdisciplinary M Tech programme in sustainable building design and management



Building Services



Constructi on



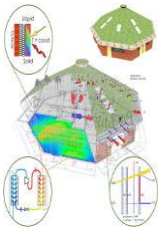
Building Energy Engineeri

Energy

Façade Engineeri

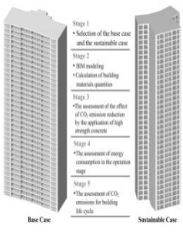
Facility Management

Building Physics



Environment ally Sustainable

Sustainabil ity



The background, context and need

The high rates of urbanisation will require more built up area and largest floor-space growth is expected in the commercial (office, hospitality, retail, hospitals) and residential sectors. Today's urban areas provide a disparate quality of life and quality of services to their populations, and they inflict a mostly adverse impact on natural

environment. The main challenge is to design and manage built environments for the future to provide shelter in ways that allow humans and nature to flourish.

Traditional building practices often overlook the interrelationships between a building, its components, its surroundings, and its occupants; and consume more of resources than necessary, negatively impacting the environment. Sustainable building refers to a building created by using processes that are environmentally responsible and resource-efficient throughout its life cycle and it is a win-win solution for the developer, occupier and the environment. This requires close cooperation of various stakeholders involved in the creation of a sustainable building comprising of the design team, the architects, the engineers and the client, at all stages of a project. The sustainable building concept takes into consideration the practices that would enhance the living standards of the occupants in an environment-friendly ambience. In simple terms, a sustainable construction or sustainable building which can function using an optimum amount of energy, consume less water, conserve natural resources, generate less waste and create spaces for healthy and comfortable living, as compared to conventional buildings, is termed as a sustainable building. Sustainability is not added on to conventional buildings but it lies in the approach of designing, constructing and maintaining & operating buildings.

Globally, there has been a lot of talk about sustainable buildings as a means to meet our environmental goals with minimum use of resources. At a time when climate change and high energy prices pose some of the greatest challenges, it is critical that construction of buildings be done taking into account a systems-based approach to meet the goal of sustainability and a healthy environment. India, too, has risen to the challenge and this movement has gained momentum in recent times. In a bid to encourage the sustainable building sector in the country policies are framed and being implemented but would need to evolve constantly.

Currently sustainable buildings in India account for less than 5% of the current stock of buildings pointing towards a huge potential. The main reason for this low percentage is absence of skilled professionals who can follow a truly interdisciplinary approach to the design, construct, operate and maintain sustainable buildings. It is also because of inadequate policies and regulations that tend to reward inefficiencies. Professionals in the built environment including urban planners, architects, building services engineers, facilities managers and performance assessors need to be trained to address the challenges through the acquisition of key practical skills of analysis and simulation in technical issues in sustainable building design, construction and intelligent operation and management. They should also be equipped to undertake techno-economic analyses so as to better inform both regulators and customers of residential, office, health and hospitality sectors where higher rate of growth is anticipated in near future.

The overall aim of the programme is to provide post graduates with the necessary academic training, knowledge, skills and personal qualities to pursue a career in sustainable building design & management within the construction sector. Post graduates will be able to assess and influence the integration of sustainable building design & management concepts at the building level, and will be able to communicate this effectively with clients and others.

About the program

The proposed M Tech programme will combine the technical design and engineering issues associated with the delivery of sustainable built environments with an appreciation for how such approaches can be justified in a commercially focused world. The programme considers passive (building fabric) and active measures (building services and renewable energy technologies) including waste management and recycling setting out what approach may be taken when considering design and management of sustainable buildings.

The programme will train students to apply their professional skills with a sustainability consciousness. The proposed integrated approach provides students with the knowledge to address sustainability issues without compromising building functionality or profitability. The programme integrates units from the architectural sciences, building services, facilities management, high-performance buildings & project management.

The aim of the course is to provide a coherent framework for the discipline and practice of design and management. Each module includes sessions delivered by leading practitioners & learned academicians. The course is continually informed not only by the latest developments in industry, but also by on-going international research. The students in this programme will enhance their design skills with specialist technical knowledge, and develop multidisciplinary understanding, via a curriculum of applied, engaged and contemporary courses. They will learn to harness technology to deliver optimal solutions, balancing the individual competing needs for environmental, economic & social sustainability.

The Programme will address students' expectations and will follow a logical sequence which would include subject knowledge, computer simulation tools and application. This programme has been developed with the help of academicians, practicing professionals and employers and would be inspired by professionals training courses generally rendered to on-the-job professionals. Courses are taught by experts in their fields, making sure that teaching content reflects cutting-edge knowledge in the industry. Our active Industry Advisory panel also includes senior construction professionals from renowned local and global consultants and contractors. Staffs within the Centre are actively engaged in a variety of research projects relating to building design, specification, management and operation, including links with policy-makers and international bodies.

The programme will fill existing professional gaps in designing & management of sustainable buildings and it will enhance students' future career prospects in the area of sustainable building design and management, in a competitive, growing market. It is also suitable for those looking to develop specialist knowledge and skills to allow them to their careers with emerging needs. Career opportunities are not be restricted to only to Sustainable building consulting & rating firms. Students will typically find employment in the areas e.g., environmental urban planning, architectural design, environmental engineering, facilities management, energy assessment, sustainable building assessment or energy policy etc.

Assessment will be facilitated via a mix of examination and assignments. There is equal balance of examination and assignments for on-campus and off-campus training.

Assignment would a mix of group and individual work, where the former contributes a key component of formative assessment necessary to develop students' communication and negotiating skills. Opportunities for formative assessment will be built into all courses, through mechanisms including feedback on presentations and coursework submissions. The Masters Research projects will give the background to a literature search task or empirical investigation, and report and critically evaluate its results. Formative assessment will be provided through discussions throughout the supervisory process.

Who should apply?

The M-Tech program in Sustainable Building Design & Management is aimed at graduates of architecture, civil, electrical & mechanical engineers or equivalent who wish to further develop their design skills to combine sustainability and low carbon technologies in sustainable building design & management .

The course structure

The programme will be spread over four semesters and will be developed to have class room, field training and research work. The programme involves three semesters of course work for 63 credits and one semester of research work for 18 credits each. The research work or dissertation is a major individual research project. Guidance will be given on choosing a research topic, research techniques and the style and presentation of the finished document. Classes in research skills are provided as part of the dissertation module. Students will have their own carefully selected dissertation tutor whose role is to help them plan and successfully execute this key part of the programme.

The student is required to earn a minimum of 75 credits over the two-year period with a minimum CGPA of 6.0 as academic requirement for this programme. The course work is distributed in programme in core and elective courses. The electives have been grouped into a group and the students is expected take at least one elective from each group in order to provide an opportunity to develop inter-disciplinary base and improved knowledge in their respective disciplines.

---xxx---

Annexures 8
(Refer to TU/AC 41.12.1)

1. Climate Change Vulnerability and Adaptation

Course title: Climate Change Vulnerability and Adaptation			
Course code:	**No. of credits:** 3	**L-T-P:** 24-14-08	**Learning hours:** 42
Pre-requisite course code and title (if any): None			
Department: Energy and Environment			
Course coordinator: Dr Chubamenla Jamir	**Course instructor:** Dr Chubamenla Jamir		
Contact details: chubamenla.jamir@teriuniversity.ac.in			
Course type: Core	**Course offered in:** Semester 2		

Course description

The course is designed to inform students about the factors influencing the vulnerability both the ecological and social systems to climate change and the various adaption options for building resilience to climate change. It introduces the students to the concepts of vulnerabilities, risk and adaptation to climate change and various tools and techniques for assessing vulnerabilities to climate change. The course will also expose the students to an array of adaptation options and how this can be incorporated into the regional developmental plan. The students, through the field study, will learn how to apply various tools and techniques for assessing vulnerabilities to climate change and to identify adaptation priorities.

Learning objectives:

- To introduce the students the various vulnerabilities to climate change, and an array of adaptation possibilities.
- To inform about the necessity to incorporate and consider the changing climate in various long-term planning and development activities.

Course content:

S. No	Topic	L	T	P
1.	Introduction to the concepts of vulnerability and adaptation	4		
2.	**Vulnerability** Vulnerabilities of different ecological and social systems, coastal vulnerability, issues for developing countries, refer to tipping points in the Earth System. Qualitative to semi-quantitative methods to assess vulnerabilities to climate change.	6	4	
3.	**Adaptation** Indicators of adaptation, problems of its operationalization. Discussion on prioritization of different adaptation options, to qualitative measures of decision support, and connections between adaptation and mitigation: trade-offs and mal-adaptation.	8	2	

	Potential adaptation options in key development sectors (Agriculture; Forestry; Cities; Water; Health; Energy). Factors influencing adaptation strategies (technical, institutional, financial) and constraints to developing strategies; consequences of adaptation strategies.			
4.	**Seminar** Explanation of exercise, how the system's perception of vulnerabilities can be developed with/unearth from stakeholders. Stakeholder dialogue on a case study – students will be divided into different stakeholder group and have a multi-stakeholder dialogue on a case study to decide on adaptation measures.	2	4	
5.	**Practical/ Field work** Interaction with planners, architects, officials from the authorities, locals, etc. and make their investigations and collect data, draw concept maps, etc. Later analyze results with different evaluation methods (network analysis, including a software solution), and to derive and test various adaptation means.	4	4	8
Total		**24**	**14**	**8**

Evaluation criteria

The evaluation policy is designed to verify the knowledge acquired by students during the course. Evaluation will be based on written tests, seminar paper and assignments.

- Test 1: 20%
- Test 2: 40%
- Seminar paper: 20%
- Assignments: 20%

Learning outcomes

After this course, students should have a profound view about climate vulnerability of different systems under the current climate change regime, different adaptation possibilities and conflicts of implementation.

Pedagogical approach

Lectures and discussion of assigned readings. Students would be required to do an assignment and presentation which will be evaluated by the course instructor.

Materials

Suggested readings

- Adenle A., Azadi H., Arbiol J., 2015. Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management, 161 (15): 261-275.
- Adger W. N., 2006. Vulnerability, Global Environmental Change 16 (2006) 268–281.
- Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213.
- Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change? Global Environmental Change—Human and Policy Dimensions 21: 25-33.
- Kelkar U., Kapil Kumar Narula, Ved Prakash Sharma, Usha Chandna (2008) Vulnerability and adaptation to climate variability and water stress in Uttarakhand State, India, Global EnvironmentalChange18: 564–574

- Khajuria A. and Ravindranath N.H. 2012, Climate Change Vulnerability Assessment: Approaches DPSIR Framework and Vulnerability Index, J Earth Science and Climate Change, 3:1.
- Orlove B., 2005. Human Adaptation to Climate Change: A Review of Three Historical Cases and Some General Perspectives, Environmental Science & Policy, 8(6): 589-600.
- Sovacool B.K., D'Agostino A.L., Meenawat H., Rawlani A., 2012. Expert views of climate change adaptation in least developed Asia. Journal of Environmental Management, 97 (30): 78-88.
- Tanner, T.M. and Horn-Phathanothai, D.L., 22014. Climate Change and Development, Routledge Perspectives on Development.
- Varma et al 2014_Climate change disasters and development: Testing the waters for adaptive governance in India. Vison 18 (4) 327-338.

Additional information (if any)

Student responsibilities

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

Course Reviewers

1. Dr. Mustafa Ali Khan, Team Leader IHCAP, Swiss Cooperation Office India, Embassy of Switzerland.
2. Dr. Thomas Tanner, Head of Adaptation and Resilience, Overseas Development Institute, India.
3. Dr Usha Mina, Associate Professor, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi.

2. Spatiotemporal Data Analysis

Course title: Spatiotemporal Data Analysis			
Course code:	**No. of credits:** 3	**L-T-P:** 26-12-8	**Learning hours:** 42
Pre-requisite course code and title (if any): Environmental Statistics			
Department: Energy and Environment			
Course coordinator: Dr. Neeti		**Course instructor:** Dr Neeti	
Contact details: neeti@teriuniversity.ac.in			
Course type: Elective		**Course offered in:** Semester 2	

Course description

The course is conceptualised to introduce students to statistical analysis in temporal and spatial domain. It leads students into analysis and interpretation of spatial and temporal data, using different tools. There has been tremendous growth of interest in the analysis of spatial data and the application of statistical methodologies for the same in recent times. The goal of the course is to familiarize the students with the basic techniques for use in further research. It will include physical interpretation of the results and limitations of applicability. The course would enable the students to analyse environmental data for improved decision-making, enabling efficient resource

management.

Course objectives

To create an overall idea about various statistical distributions and their properties.

- To understand basic time series components and means to compute them.
- To analyze a data with time series techniques
- To understand the concept of geostatistical modeling for spatial prediction
- To understand spatio-temporal models for gridded time series

Course content

S No	Topic	L	T	P
1.	Introduction: types of data, collection of temporal and spatial data, preparation of data	2	2	
2.	Time series: classification, components, concept of stationarity, decomposition of time series	3	2	
3.	Analysis for trend detection and slope estimation: Parametric approach - Linear Regression; Non-Parametric approach – Turning Point test, Man-Kendall Test, Pre Whitened Mann Kendall test, Theil and Sen's Median Slope	4		
4.	Autocorrelation analysis: Estimation of Autocorrelation coefficient, Correlogram, Moving Average process, Autoregressive Process, Autoregressive Integrated Moving Average Process, Cross correlation analysis	3	2	
5.	Change point detection and its various frameworks	2	2	
6.	Introduction to Geostatistics: Spatial continuity, Anisotropy axes, directional tolerance, variogram, relative variogram, correlogram, cross-variogram	2		2
7.	Estimation: Weighted linear combinations, Global and local estimation, point and block estimates	2		2
8.	Random function models in Geostatistics: Deterministic model, probabilistic models, random variables, parameters for random function	2	2	
9.	Ordinary kriging and block kriging, cokrigging	2	2	
10.	Spatio-temporal models and its applications: S- and T- mode Empirical Orthogonal Function, Canonical Correlation Analysis, Singular Spectrum Analysis, Contextual Mann-Kendall, Seasonal Trend Analysis	4		4
	Total	**26**	**12**	**8**

Evaluation criteria

- Test 1: 25%
- Test 2: 25%
- Test 3: 50%

Learning outcomes

After completion of this course students should be able to

1. Critically analyze a time series data and provide important findings based on them.
2. Execute Geostatistics model on spatial data for spatial prediction
3. Critically analyze time series data for spatial and temporal autocorrelation and then apply appropriate spatio-temporal model

Pedagogical approach
Lectures and Tutorials.

Materials

Required text

- Barnett V. (2004) *Environmental Statistics, Methods and Applications*, John Wiley & Sons, 293pp.
- Box G.E.P., Jenkins G.M. and Reinsel G.C. (2007) *Time Series Analysis Forecasting and Control*, 3e, Pearson Education, Delhi, 598pp.
- Isaaks E.H. and Srivastava R.M. (1989) *Applied Geostatistics*, Oxford University Press, New York, 561pp.
- Jolliffe, I. (2002). Principal component analysis. John Wiley & Sons, Ltd.

Suggested readings

- Anderson D.R., Sweeny D.J and Williams T.A. (2002) *Statistics for Business and Economics*, 8e, Thomson Asia Pte Ltd, Singapore, 885pp.
- Burrough P.A. and McDonnel R.A. (2007) *Principles of Geographical Information Systems*, 3e, Oxford University Press, New York.
- Chatfield C. (2003) *The Analysis of Time Series: An Introduction*, 6e, Chapman and Hall, London, 333pp.
- Conover W.J. (2006) *Practical Nonparametric Statistics*, John Wiley & Sons, 584pp.
- Daniel W.W. (2000) *Applied Nonparametric Statistics*, Houghton Miffin Company, USA, 510pp.
- Draper N.R. and Smith H. (1998) *Applied Regression Analysis*, 3e, Wiley & Sons, Inc., 706pp.
- Helsel D.R. and Hirsch R.M. (1992) *Statistical Methods in Water Resources*, 510pp.
- Longley P. and Batty M. (eds.) (1996) *Spatial Analysis: Modelling in a GIS Environment*, Geoinformation International, Cambridge, 392pp.
- McCuen R.H. (2003) *Modelling Hydrologic Change: Statistical Methods*, Lewis Publishers, Florida, 432pp.
- Van den Dool, H. M., S. Saha, and Åke Johansson. "Empirical orthogonal teleconnections." *Journal of Climate* 13.8 (2000): 1421-1435.
- Piegorsch W.W. and Bailer A.J. (2005) *Analyzing Environmental Data*, John Wiley & Sons, Ltd., 496pp.
- Ppal S. (1998) *Statistics for Geoscientists: Techniques and Applications*, Concept Publishing Company, New Delhi.
- Rao A.R., Hamed K.H. and Chen H.L. (2003) *Nonstationarities in Hydrologic and Environmental Time Series*, Kluwer Academic Publishers, Dordrecht, The Netherlands, 362pp.
- Reddy P.J. (1997) *Stochastic Hydrology*, Laxmi Publications (P) Ltd., Dew Delhi, 259pp.
- Webster R. and Oliver M.A. (2007) *Geostatistics for Environmental Scientists*, 2e, John Wiley and Sons Ltd., Chichester, England, 315pp.
- Zhang C. (2007) *Fundamentals of Environmental Sampling and Analysis*, John Wiley & Sons, Inc., 436pp.
- Hassani, Hossein. "Singular spectrum analysis: methodology and comparison." (2007): 239-257.

Suggested Software:
TerrSet (IDRISI) and R are required for teaching this course with remotely sensed dataset

Journals ▪ International Journal of Forecasting ▪ Journal of Time Series Analysis
Additional information (if any) In this course, R and TerrSet software will be used
Student responsibilities The students are expected to submit assignments in time and come prepared with readings when provided.

Course Reviewers

1. Dr. Nidhi, Department of Statsistics, Maths and Computer Applications, Faculty of Basic Sciences and Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar
2. Dr. Benoit Parmentier, Data Scientist, National Socio-environmental Synthesis Center, University of Maryland, Maryland, USA

3. Climate Change and Water

Course title: Climate Change and Water			
Course code:	**No. of credits:** 3	**L-T-P: 26**-8-16	**Learning hours:** 42
Pre-requisite course code and title (if any):			
Department: Energy and Environment			
Course coordinator: C K Singh	**Course instructor: C K Singh**		
Contact details: chander.singh@teriuniversity.ac.in			
Course type: Elective	**Course offered in:** Semester 2		

Course Description

Water, apart from supporting life on earth and valuable as a resource, plays a major role in affecting climate. Water cycling has a decisive impact on regional and global climate patterns. Global warming is changing the distribution and intensity of precipitation. With shifts in hydro-meteorological trends (dry regions becoming drier and wet areas wetter), increased variability and increased risk of extreme events in most regions. The importance of water resources will intensify under climate change as more frequent and intense climate extremes will increase variability in precipitation, soil moisture and surface water, eventually influencing water availability, food and energy production. Improved understanding of our water resources is needed to ensure more efficient and judicious allocation to improve access to water and reduce risks from climate change.

This course will focus on managing systemic risk and dealing with uncertainty due to climate change impacts on water resources, including monitoring known risks as well as reducing the unknown risks, through management solutions and policy interventions. The course will also focus on the identification of adaptation measures with emphasis on freshwater resources under climate change and the possible strategies to close the gap between water supply and demand to control and resolve future water resource conflicts.

Course objectives

1. To understand different processes and interplay between climate system and the global water cycle
2. To understand the climate change influences on water resources and the associated vulnerabilities and risks
3. To understand the concept of Integrated Water Resources Management in relation to climate change
4. To understand the necessity for integrated assessment, alternative policy and innovative management solutions, framework for water policy guidelines; building resilience; adaptation strategies and interventions needed in sustainable response to changing climate

Course content

SNo	Topic	L	T	P
1.	General Overview of Climate Change and Global Water Cycle: Climate variability, drivers of climate change; Observed and future changes in global patterns of precipitation and evaporation; Understanding the water cycle, global water distribution and quantitative and qualitative spatio-temporal changes	4	2	
2.	Hydrological Impacts of Climate Change and Variability: Estimating impacts of climate change on precipitation variability, extreme precipitation events, droughts, floods, evapotranspiration, soil moisture, surface and sub-surface water resources, runoff and river discharge, glacial hydrological regime, fluvial landforms	6	2	4
3.	Modelling Impacts on Hydrological Systems: Modelling climate-induced changes in hydrology; Water resource availability and demand, modelling runoff, flood frequency analysis, soil erosion; Socio-economic and environmental impacts; indicators of climate risks to water resources; vulnerability; Factors affecting the vulnerability of water resources	8	4	12
4.	Mitigation and Adaptation Strategies for water management: Scale dependent vulnerability- local, regional, global; Vulnerability assessment and adaptation framework – all intra-national governance levels, transboundary water resources; critical knowledge gaps Importance of IWRM for adaptation; Integrated drought management; Potential water resource conflicts, Implications for policy and sustainable development; Risk management	8		
	Total	**26**	**8**	**16**

Evaluation criteria

- Test 1: 20%
- Test 2: 20%
- Tutorial: 20%
- Test 3: 40%

Learning outcomes

1. Ability to perform risk assessment and suggest necessary policy interventions at various levels to improve resilience
2. Apply knowledge to design or modify water management plans as an adaptation to demand management in response to supply fluctuations in future

Pedagogical approach

Materials

Required text

1. Bates, B.C., Kundzewicz, Z.W., Wu, S. and Palutikof, J.P., Eds. (2008) *Climate Change and Water*, Technical Paper of the Intergovernmental Panel on Climate Change VI (IPCC), IPCC Secretariat, Geneva.
2. Vörösmarty, C.J., Green, P., Salisbury, J. and Lammers, R.B. 2000. *Global water resources: vulnerability from climate change and population growth*. *science*, *289*(5477), pp.284-288.
3. Xu, J., Grumbine, R.E., Shrestha, A., Eriksson, M., Yang, X., Wang, Y.U.N. and Wilkes, A., 2009. *The melting Himalayas: cascading effects of climate change on water, biodiversity, and livelihoods*. *Conservation Biology*, *23*(3), pp.520-530.
4. Immerzeel, W.W., Van Beek, L.P. and Bierkens, M.F., 2010. *Climate change will affect the Asian water towers*. *Science*, *328*(5984), pp.1382-1385.
5. Milly, P.C., Betancourt, J., Falkenmark, M., Hirsch, R.M., Kundzewicz, Z.W., Lettenmaier, D.P. and Stouffer, R.J., 2008. *Stationarity is dead: Whither water management?*. *Science*, *319*(5863), pp.573-574.
6. Arnell, N.W., 1999. *Climate change and global water resources*. *Global environmental change*, *9*, pp. S31-S49.
7. Arnell, N.W., 2004. *Climate change and global water resources: SRES emissions and socio-economic scenarios*. *Global environmental change*, *14*(1), pp.31-52.
8. Gosling, S.N. and Arnell, N.W., 2016. *A global assessment of the impact of climate change on water scarcity*. *Climatic Change*, *134*(3), pp.371-385.

Suggested readings

1. Aerts, J. and Droogers, P., Eds. (2004) *Climate Change in Contrasting River Basins: Adaptation Strategies for Water, Food, and Environment*. Wallingford, OX, UK Cambridge, MA, USA: CABI Pub.
2. Baba, A., Tayfur, G., Gündüz, O., Howard, K.W.F., Friedel, M.J. and Chambel, A., Eds. (2011) *Climate Change and its Effects on Water Resources: Issues of National and Global Security*. Dordrecht: Springer, pp. 303
3. Biswas, A. and Tortajada, C., Eds. (2016) *Water Security, Climate Change and Sustainable Development*. Singapore New York: Springer.
4. Dai, A., 2011: *Drought under global warming: A review*. Wiley Interdisciplinary Reviews: Climate Change, 2, 45-65.
5. Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, P.R. and White, L.L., Eds. (2014) *IPCC, 2014: Summary for Policymakers*. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

6. National Research Council, & Committee on Population (2012) *Himalayan Glaciers: Climate Change, Water Resources, And Water Security*. National Academies Press.
7. Pelling, M. 2011. *Adaptation to Climate Change: From Resilience to Transformation*. London and New York: Routledge.
8. Quevauviller, P., Borchers, U., Thompson, K.C. and Simonart, T., Eds. (2011) *The Water Framework Directive: Action Programmes and Adaptation to Climate Change*. Cambridge: RSC Publishing.
9. Shrestha, S. (2014) *Climate Change Impacts and Adaptation in Water Resources and Water Use Sectors: Case Studies from Southeast Asia*. Cham: Springer.
10. Taniguchi, M. and Holman, I.P., Eds. (2010) *Groundwater Response to Changing Climate*. Boca Raton Fla. London: CRC Press.

Case studies
Websites
http://www.waterandclimatechange.eu/
http://www.unwater.org/water-facts/climate-change/
Journals

9. Climatic Change
10. Global Environmental Change
11. Journal of Water and Climate Change
12. Nature Climate Change
13. Regional Environmental Change
14. Water (MDPI)
15. Water Resources Research

Additional information (if any)

Student responsibilities
Attendance, feedback, discipline, guest faculty etc

Course reviewers

1. Prof. S Mukherjee, SES, JNU
2. Dr. Javed Mallick, King Khalid University, Saudi Arabia

4. Introduction to Climate Modelling

Course title: Introduction to Climate Modelling			
Course code:	**No. of credits:** 3	**L-T-P:** 24-12-12	**Learning hours:** 42
Pre-requisite course code and title (if any): Environmental Statistics			
Department: Energy and Environment			
Course coordinator: Mr Saurabh Bhardwaj	**Course instructor:** Mr Saurabh Bhardwaj		
Contact details: saurabh.bhardwaj@teri.res.in			

Course type: Elective	**Course offered in:** Semester 2

Course Description:

On completion of this course, students should be able to understand fundamental principles of climate science depicted in the models, various types and usage of modelling activities, and basic programming required to obtain modelling skills. The lectures will lead to basic understanding of atmospheric processes, modelling framework under IPCC working papers and case studies involving usage of modelling into impact studies.

Course objectives

1. To understand the basic concepts on climate dynamics including basic forces at play and their balances and attribution.
2. To develop the conceptual understanding on forecasting techniques and their usages 3. To establish a basic understanding towards various climate modelling approaches and their differentiations.
4. To develop theoretical perspective towards IPCC projections and working group reports.
5. To develop computational understanding on basic programming to assist towards modelling exercises.

Course content

S No	**Topic**	**L**	**T**	**P**
1.	Fundamental Forces Pressure Gradient Force, Centrifugal Force, Gravity Force, Coriolis Force	4	2	
2.	Numerical Weather Prediction (NWP) Fundamental equations of fluid motion in rotating and non-rotating fluid in different coordinate system, Principle of Weather Forecasting, General Circulation of atmosphere and Ocean	4	4	
3.	Introduction to Climate Models a. Basics of models i. Concept of Parameterizations, time-stepping and resolution b. Framework and process of model simulations c. Types of Models d. Uncertainties and sensitivity e. Case Studies	8	4	
4.	Introduction to Climate processes a. Basic understanding on Climate Sciences b. Uncertainty c. IPCC and working Group 1 projections: Global to Regional aspects d. Case Studies – illustrations	6	2	
5.	Introduction to Linux operating system and FORTRAN programming	6		8
	Total	**28**	**12**	**8**

Evaluation criteria

- Test 1: 20%
- Test 2: 20%

- Test 3: 60%

Learning outcomes:
After the course the students should be:
1. Able to exhibit basic conceptual understanding on climate science and its dynamics 2. Conceptually explain the basic differences of various modelling techniques and their usage 3. Able to understand the IPCC projections and working group reports 4. Ideally be comfortable towards basic linux scripting and programming.

Pedagogical approach
Class room teaching with few hands-on exercises on programming

Materials
Required text
- Goosse H., Barriat P.Y., Lefebvre W., Loutre M.F. and Zunz V., Introduction to Climate Dynamics and Climate Modeling.
- James R.H. An Introduction to Dynamic Meteorology, International Geophysics Series
- Steven A. Ackerman and John A. Knox, Meteorology Understanding the Atmoshere

Suggested readings
- Geoffrey K.V. Atmospheric and Oceanic Fluid Dynamics: Fundamentals and Large-scale Circulation.
- Jacobson M.Z. Fundamentals of Atmospheric Modeling.
- McGuffie K. (Henderson-Sellers A., A Climate Modelling Primer, John Wiley & Sons.
- Taylor F.W. Elementary Climate Physics.
- Washington W.M. and Parkinson C.L.Introduction to Three-dimensional Climate Modeling

Websites
- IPCC (2001 & 2007) Working Group I Report "The Physical Science Basis"

Journals
- Geophysical Research
- Global Environmental Change
- Climate Dynamics
- Current Science

Additional information (if any)
Regular Assignment and reading will be given on weekly basis

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

Course reviewers
1. Dr. Madhusoodanan M.S., Associate Professor, Amrita University.
2. Prof A K Dimri, SES, JNU

Climate Change and Public Health

Course title: Climate Change and Public Health

Course code:	**No. of credits:** 3	**L-T-P:** 36-6-0	**Learning hours:** 42
Pre-requisite course code and title (if any):			
Department: Department of Energy and Environment			
Course coordinator: Dr Kamna Sachdeva		**Course instructor:** Dr. Prashant Kumar Singh	
Course type: Elective		**Course offered in:** Semester 2	

Course description

This course covers the public health effects of climate change from the perspectives of changing demographic and epidemiological transition and social and behavioural sciences. Attendees will learn how climate change impacts create risks for human health. The course will also address cross-cutting issues to climate change and health, and provide regional perspective to linkages between climate change and health in the context of South Asian countries.

Course objectives

- To build a strong perspective among students to the current public health challenges and its determinants of climate change.
- Describe global perspective to the major climatic risks to the human health and survival.
- To introduce students with the cross-cutting issues including food and nutrition, gender and social determinants of health and its linkages to climate change and public health.

Course Contents

Module	**Topic**	**L**	**T**	**P**
1.	**Introduction to Population Studies and Public Health** Basics of global demographic change; epidemiological transition; definition, scope and principles of public health; determinants of health.	4		
2.	**Climate Change and Public Health** Outlines some of the key issues related to climate change and health; direct and indirect effects of climate change on human health; what makes individuals and populations vulnerable to the effects of climate change	4		
3.	**Climate Sensitive Diseases and Mortality** Water stress, water- and foodborne diseases; vector borne diseases and climate change; air quality and human health; temperature extremes and its impact on mortality.	10	2	
4.	**Cross-Cutting Issues to Climate Change and Public Health** Climate change, food and nutrition; mental health, cognition and challenges to climate change; social determinants of health pathways for climate change; policy perspective: response, adaptation and mitigation to climate change in public health.	10	2	
5.	**Regional Perspective: Climate Change and Public Health in South Asia** This module discusses public health issues caused by climate change in south Asia: extreme temperature regions; malaria and dengue; urbanization and health (urban heat island; industrial pollution and heat stress etc.); adaption	8	2	

	responses to climate change on health.			
		36	**6**	**0**

Evaluation procedure

- Test1: 20%
- Assignment based presentation: 30%
- Test 2: 50%

Learning outcomes

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

- Understand the global demographic and epidemiological shift and its linkages to public health
- Understand climate change impact on health in the context of public health
- Understand emerging cross-cutting issues to climate change and public health

Pedagogical approach

Classroom teaching will involve power point presentations, case study analysis and assignment based seminar.

Materials

Suggested Readings

- Aleksandrowicz L, Green R, Joy EJM, Smith P, Haines A., 2016. The impacts of dietary change on greenhouse gas emissions, land use, water use, and health: a systematic review. *PLOS ONE*, 11: e0165797.
- Campbell-Lendrum, D., Manga, L., Bagayoko, M. and Sommerfeld, J., 2015. Climate change and vector-borne diseases: what are the implications for public health research and policy?. *Phil. Trans. R. Soc. B*, *370*(1665), p.20130552.
- Costello, A., Abbas, M., Allen, A., et al., 2009. Managing the health effects of climate change. *The Lancet*, *373*(9676), pp.1693-1733.
- Dhara, V.R., Schramm, P.J. and Luber, G., 2013. Climate change & infectious diseases in India: Implications for health care providers. *The Indian journal of medical research*, *138*(6), p.847.
- Frumkin, H., Hess, J., Luber, G., Malilay, J. and McGeehin, M., 2008. Climate change: the public health response. *American Journal of Public Health*, *98*(3), pp.435-445.
- Frumkin, H., McMichael, A.J. and Hess, J.J., 2008. Climate change and the health of the public. *American Journal of Preventive Medicine*, *35*(5), pp.401-402.
- Hess, J.J., Eidson, M., Tlumak, J.E., Raab, K.K. Luber, G., 2014. An evidence-based public health approach to climate change adaptation. *Environmental health perspectives*, *122*(11), p.1177.
- Kinney, P.L., 2008. Climate change, air quality, and human health. *American journal of preventive medicine*, *35*(5), pp.459-467.
- Luber, G. and McGeehin, M., 2008. Climate change and extreme heat events. *American journal of preventive medicine*, *35*(5), pp.429-435.
- McMichael, A.J., Woodruff, R.E. and Hales, S., 2006. Climate change and human health: present and future risks. *The Lancet*, *367*(9513), pp.859-869.
- Mekonnen MM, Hoekstra AY., 2011 The green, blue and grey water footprint of crops and

derived crop products. *Hydrol Earth Syst Sci*, 15: 1577–600.

- Pathak H, Pramanik P, Khanna M, Kumar A., 2014 Climate change and water availability in Indian agriculture: impacts and adaptation. *Indian J Agr Sci* 84: 671–9.
- Patz, J.A., Campbell-Lendrum, D., Holloway, T. Foley, J.A., 2005. Impact of regional climate change on human health. *Nature*, *438*(7066), p.310.
- Shindell, D., Kuylenstierna, J.C., Vignati, E., et al., 2012. Simultaneously mitigating near-term climate change and improving human health and food security. *Science*, *335*(6065), pp.183-189.

Additional information (if any)

Student responsibilities

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

Course Reviewers

1. Dr. Sanghmitra S. Acharya, Professor, Centre of Social Medicine and Community Heath, Jawaharlal Nehru University (JNU), New Delhi.
2. Dr. Sutapa Aggrawal, Professor, Public Health Foundation of India (PHFI), New Delhi.