

**TRIBHUVAN UNIVERSITY
INSTITUTE OF FORESTRY
KATHMANDU, NEPAL**



**CURRICULA
MASTER'S DEGREE PROGRAMS
July 2019**

**TRIBHUVAN UNIVERSITY
INSTITUTE OF FORESTRY
KATHMANDU, NEPAL**



CURRICULA

Master of Science in Forestry

Master of Science in Watershed Management

Master of Science in Natural Resource Management and Rural Development

Master of Science in Wildlife Management and Biodiversity Conservation

Master of Science in Community Forestry

Master of Science in Mountain Environment and Development Studies

July 2019

ACKNOWLEDGEMENTS

We feel honored to have responsibility of facilitating curricula review and development of M.Sc. programs of Institute of Forestry (IOF). We would like to express our sincere thanks to the Dean, IOF for entrusting us this responsibility. With the kind and sincere cooperation and assistance from many individuals and institutions, the curricula have been developed. Despite all our efforts to make it error free, there always exists room for improvement. We would highly appreciate if you could provide your comments and suggestions to Office of the Dean, IOF for further improvement in the curricula.

The Dean, Assistant Deans, Campus Chiefs, Subject Committee Chairs, concerned departments, individual faculties, academicians, professionals and different concerned organizations have contributed various types of supports and help to complete this work. We express profound gratitude to all the involved individuals and organizations for their meticulous comments, feedback and persistent help in this mission. At last, we would like to express our gratitude to Prof. Mohan Krishna Balla for editing the curricula.

Prof. Binod Prasad Heyojoo, Coordinator
Assoc. Prof. Yajna Prasad Timilsina, Member
Asst. Prof. Bishnu Prasad Devkota, Member Secretary
(M.Sc. Curriculum Review and Development Committee, IOF)

FOREWORD

Curriculum revision and improvement is dynamic process and includes the adoption, modification or deletion of specific programs or courses, the design and evaluation of proposed programs or courses, and the selection of compatible and appropriate instructional materials. The Institute of Forestry has revised the curricula of master's degree programs incorporating new and relevant courses of studies. The curriculum of M. Sc. in Forestry has been revised for the third time whereas M. Sc. in Watershed Management and M. Sc. in Natural Resource Management and Rural Development have been revised for the second time. The M. Sc. in Wildlife Management and Biodiversity Conservation curriculum has been revised for the first time. Realizing national and global needs of professionals in the field of mountain environment and sustainable development and providing training to professionals for managing and promoting community forestry in Nepal and across the globe, we have also introduced two new master's degree programs: M.Sc. in Mountain Environment and Development Studies, and M.Sc. in Community Forestry from this year.

I would like to thank M.Sc. curricula revision committee members viz. Prof. Binod Prasad Heyojoo-Coordinator, Assoc. Prof. Yajna Prasad Timilsina, Asst. Prof. Bishnu Prasad Devkota and Asst. Prof. Dr. Dhurba Bijaya G.C. for their hard work and coordination to accomplish the job. I duly acknowledge the Higher Education Project, Tribhuvan University and IOF-NORHED SUNREM project for the financial support in the curricula revision initiatives.

Prof. Krishna Raj Tiwari, PhD

Dean

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iv
FOREWORD.....	v
1. INTRODUCTION	1
2. MASTER’S DEGREE PROGRAMS.....	2
2.1 Name of programs	2
2.2 Objectives of programs.....	2
2.3 Program duration and academic session.....	4
2.4 Admission requirements	4
2.5 Student categories.....	5
2.6 Entrance examination	5
2.7 Evaluation and examination system	5
2.8 Medium and methods of instruction.....	6
2.9 Course codes.....	6
2.10 Credit system	6
2.11 Registration.....	6
2.12 Course structure.....	6
3. M. SC. FORESTRY COURSES	9
4. M. SC. WATERSHED MANAGEMENT COURSES	10
5. M. SC. NATURAL RESOURCE MANAGEMENT AND RURAL DEVELOPMENT COURSES.....	11
6. M. SC. WILDLIFE MANAGEMENT AND BIODIVERSITY CONSERVATION COURSES.....	12
7. M. SC. COMMUNITY FORESTRY COURSES	13
8. M. SC. MOUNTAIN ENVIRONMENT AND DEVELOPMENT STUDIES COURSES	14
9. DESCRIPTIONS OF COURSES	15

1. INTRODUCTION

The Institute of Forestry (initially named as Nepal Forestry Institute) was established in Kathmandu in 1947 AD (2004 B. S.). In 1957, the then Nepal Forestry Institute was shifted to Suping (Bhimphedi) in Makwanpur district and later to Hetauda in 1965. It was then incorporated into Tribhuvan University in July 1972 and was renamed as Institute of Forestry (IOF).

Institute of Forestry is a pioneer institution in Nepal that provides academic education in the field of forestry, biodiversity conservation and natural resource management. During 1970s, Institute of Forestry provided training and education to mid-level forestry professionals (Rangers). The academic program of Institute of Forestry was expanded to Bachelor of Science in Forestry in 1981 and in the same year, the Bachelor degree program was shifted to Pokhara. In 2001, IOF started Master degree program in forestry. Later in 2004, two additional master degree programs, M.Sc. Watershed Management and M.Sc. Natural Resource Management and Rural Development were launched. IOF started offering the PhD degree in forestry from 2004 and another Master degree program in Wildlife Management and Biodiversity Conservation in 2018. IOF has started two more M.Sc. programs namely, Community Forestry, and Mountain Environment and Development Studies in 2019.

At present, the Dean's office of IOF is in the premises of Tribhuvan University, Kirtipur, Kathmandu. In addition to other regular activities, the Dean's office has also responsibility of operating the PhD and M.Sc. (Wildlife Management and Biodiversity Conservation, Mountain Environment and Development Studies) programs in Kathmandu. IOF's two constituent campuses: Pokhara Campus and Hetauda Campus are implementing B.Sc. Forestry program and M.Sc. Programs. The Kathmandu Forestry College, an affiliated campus of the IOF is also implementing B.Sc. Forestry and M.Sc. NRMRD programs.

IOF has the mission to develop technically sound and competent, and socially compatible human resources in the field of forestry, biodiversity conservation and natural resource management. The objectives of the IOF are to design and implement educational programs that can address the needs and interest of the country in the area of forestry, produce competent professionals in the field of natural resource management, conduct research to address the practical problems of the society and develop IOF as the *center of excellence* in forestry and natural resources management education and research.

2. MASTER'S DEGREE PROGRAMS

2.1 Name of programs

M. Sc. Forestry
M. Sc. Watershed Management
M. Sc. Natural Resource Management and Rural Development
M. Sc. Wildlife Management and Biodiversity Conservation
M. Sc. Community Forestry
M. Sc. Mountain Environment and Development Studies

2.2 Objectives of programs

2.2.1 M. Sc. Forestry

The objective of the program is to produce well-trained and practically skillful human resources in the field of forestry to cater global needs. Specifically, the M.Sc. Forestry program will fulfill the following objectives:

- To produce high level technical manpower capable of providing services to various sectors (government, non-governmental, private) in the field of forestry.
- To produce self-reliant and skillful resource managers to plan, initiate and develop forestry- based enterprises and provide consultancy services to organizations.
- To provide knowledge and skill for conducting scientific research to address the problems and gaps in forestry.

2.2.2 M. Sc. Watershed Management

The objective of the program is to produce advanced human resource for leading integrated watershed management with strong technical competency of designing soil and water conservation measures, land productivity improvement and sustainable use and development of natural resources. The specific objectives of M.Sc. Watershed Management program are:

- To produce practically skillful technical manpower for analyzing, planning and implementing different approaches of watershed management intervention for climate change adaptation, land productivity and sustained water supply.
- To provide knowledge and skills for overcoming soil and water induced watershed degradation problems and build landscape ecosystem more resilient towards climate change and possible disasters.
- To produce skillful manpower for designing, planning, monitoring and evaluating soil and water conservation measures and conducting scientific research to address the problems.

2.2.3 M. Sc. Natural Resource Management and Rural Development

The objective of the program is to produce efficient natural resource managers to handle the changing environmental conditions. The specific objectives of M.Sc. Natural Resource Management and Rural Development program are:

- To provide theoretical and practical understanding on the relationship between conservation and development.

- To build capacity in planning and managing natural resources in conflicting situations.
- To empower with critical thinking and innovative practice in natural resource management.

2.2.4 M. Sc. Wildlife Management and Biodiversity Conservation

The objective of the program is to produce wildlife managers with advanced management and research techniques in the field of biodiversity conservation.

The specific objectives of the M.Sc. Wildlife Management and Biodiversity Conservation program are:

- To produce managers and researchers equipped with methods, tools and techniques for wildlife management and research.
- To provide high level manpower for providing service to various sectors in the field of biodiversity conservation.
- To provide ecological understanding of species for habitat and landscape level planning and management.

2.2.5 M. Sc. Community Forestry

The objective of the program is to produce academicians and managers in the field of community-based forest management that focuses on community forestry.

The specific objectives of the M. Sc. Community Forestry program are:

- To produce practically oriented human resources to provide expert services for community forestry management.
- To advance, disseminate and academicize the learnings of community forestry at national, regional and global level.
- To provide advance knowledge and skills for scientific research in community forestry addressing the existing and potential problems and gaps.

2.2.6 M.Sc. Mountain Environment and Development Studies

The objective of the program is to produce well-trained and practically equipped human resource, mountain specific professionals with environmentally and socially contextualized, multidisciplinary perspective and understanding of mountain environment and development.

The specific objectives of the M.Sc. Mountain Environment and Development Studies program are:

- To produce well-trained and practically equipped human resources in the field of Mountain studies to provide services according to the needs of various clients such as government, semi-government, NGOs and private sectors.
- To produce self-reliant and practically oriented resource managers to initiate their own enterprises and research in the field of mountain development, and also, provide consultancy services to other interested individuals and organizations.
- To develop professional relationships with various organizations, such as government, bilateral and multilateral forestry and natural resources related projects and donors in-country and also academic and research institutions abroad.

2.3 Program duration and academic session

All the M.Sc. Programs consist of four semesters in two academic years. First three semesters will have course works and the fourth semester is allocated for thesis work and seminars.

2.4 Admission requirements

I. Master of Science in Forestry

For admission in M.Sc. Forestry program, the candidates with at least a 4-years B.Sc. Forestry degree from Tribhuvan University or any university recognized by Tribhuvan University with a minimum of 50 percent marks in aggregate are eligible to apply.

II. Master of Science in Watershed Management (WM)

An applicant for admission in M.Sc. Watershed Management program must have at least a 4-years B.Sc. Forestry degree or B.Sc. Agriculture or B.Sc. Environmental Science or B.Sc. Environmental Management or B.E. (Civil Engineering or Agriculture Engineering or Environmental Engineering) or B.Sc. degree with major in any of the following subjects: Soil or Geology or Hydrology or Meteorology from Tribhuvan University or any university recognized by Tribhuvan University with a minimum of 50 percent marks in aggregate.

III. Master of Science in Natural Resource Management and Rural Development (NRMRD)

An applicant for admission in M.Sc. Natural Resource Management and Rural Development program must have at least 4-years B.Sc. Forestry degree or B.Sc. Natural Resource management or B.Sc. Environmental Science or B.Sc. Environmental Management or B.Sc. Agriculture or B.E. (Agriculture Engineering) from Tribhuvan University or any university recognized by Tribhuvan University with a minimum of 50 percent marks in aggregate.

IV. Master of Science in Wildlife Management and Biodiversity Conservation (WMBC)

An applicant for admission in M.Sc. Wildlife Management and Biodiversity Conservation program must have at least 4-years B.Sc. Forestry degree from Tribhuvan University or any university recognized by Tribhuvan University with a minimum of 50 percent marks in aggregate.

V. Master of Science in Community Forestry (CF)

An applicant for admission in M.Sc. Community Forestry program must have at least 4-years B. Sc. Forestry degree from Tribhuvan University or any university recognized by Tribhuvan University with a minimum of 50 percent marks in aggregate.

VI. Master of Science in Mountain Environment and Development Studies (MEDS)

An applicant for admission in M.Sc. Mountain Environment and Development Studies must have a 4-years B.Sc. Forestry or B.Sc. in General Science (Physics, Chemistry, Botany, Zoology, Geology, Meteorology) or B.Sc. Agriculture or B.Sc. Environmental Science or B.Sc. Environmental Management or B.E. (Civil Engineering or Agriculture Engineering or Environmental Engineering) from Tribhuvan University or any university recognized by Tribhuvan University with a minimum of 50 percent marks in aggregate.

Applicants from foreign countries who have studied undergraduate courses in English medium as mentioned for each program will be eligible for admission in these programs. Staff seat will be reserved only for permanent staff of Institute of Forestry who has B.Sc. degree in one of the above subjects as mentioned. Senior staff member will get priority. All applicants must pass the

entrance examination administered by Institute of Forestry to be eligible for admission in these programs.

2.5 Student categories

Two categories of students are envisaged in all the master's degree programs.

- Regular fee paying students, and
- Full fee paying students

Students must pay additional fee as determined by the respective campus administration for enrolling in GIS course. Similarly, students must pay additional fee determined by the campus administration for field visits if required. All selected students must arrange their own accommodation and the respective campus administration will not be liable to arrange the accommodation.

2.6 Entrance examination

All Nepalese applicants are required to appear in the entrance examination administered by Institute of Forestry. The syllabus for entrance examination covers B.Sc. level courses in General Science (Physics, Chemistry, Botany, Zoology and Geology), Forestry, Watershed Management, Natural Resource Management and subjects related to the specific program's students apply for admission. Entrance examination questions will be objective in nature. The entrance test will comprise questions from general knowledge, forestry and subject specific matters.

The merit list of applicants will be prepared based on their entrance examination scores. Foreign applicants will be selected based on their Bachelor level grades.

In case staff seats and foreign student seats remain vacant, these seats will be added to full fee paying category.

2.7 Evaluation and examination system

The evaluation system is based on internal assessment, practical exam and final examination. In order to complete the course of study, students should secure at least 40% in the theory, practical and internal assessment separately. The thesis of the student will be evaluated by the Research Assessment Committee (RAC) in grade basis.

Practical will be based on the field exercise, laboratory analysis and desk work. After the completion of each practical work, student will submit the practical report in the standard format provided. The practical will be evaluated based on student's attendance, submitted reports and viva. Field excursions (half to one day), field visit (at least one night halt), group work/assignment and presentation, case studies, individual assignments and term paper will be considered as the part of the internal assessment and will be evaluated by the responsible faculty. The responsible faculty will, in advance, notify the students the criteria of evaluation.

Students must appear in the final written examination scheduled at the end of the semester. Student cannot attend the final examinations without passing the internal assessment. After successful completion of the course, student's performance will be evaluated based on the following criteria:

Description Percentile

Distinction	80% and above
First Division	65 % to less than 80 %
Second Division	50 % to less than 65 %
Pass	40 % to less than 50 %
Fail	Less than 40%

2.8 Medium and methods of instruction

The medium of instruction will be English in all M.Sc. programs offered by Institute of Forestry. A faculty member or a visiting faculty will coordinate each course in a given semester. The Course Coordinator will have full responsibility for conduction of the particular course. The methods of instruction will comprise of lectures, tutorials, laboratory works, field work, group discussions, group and individual assignments as applicable.

2.9 Course codes

Each course is identified by a code consisting of three capital letters followed by three digit numbers. The letters denote the department offering the course and the digits denote the courses offered in the year. For example, the digit 7 and 8 indicate the first and second year respectively of the master's level course. The meaning of the course code is illustrated as follows:

FPE	Forest Products and Engineering
PWM	Park Recreation and Wildlife Management
SFB	Silviculture and Forest Biology
SFM	Social Forestry and Forest Management
WME	Watershed Management and Environmental Science

2.10 Credit system

The course curriculum is organized in the overall framework of credit system. Each course has a certain number of credits that indicate the weightage. The numbers of credit depend on the contact hours of the course and its work load. A course with one credit weightage will have at least 20 lecture hours or its equivalent work and carries 25 full marks. One lecture hour may normally require an hour of lecture, three to five hours of laboratory work or its equivalent of field practical work. A practical shift should contain a maximum of 20 students for an instructor. A graduate student will earn a total of 60 credits (minimum 45 credits of course work and 15 credits including two seminars and thesis work) in two academic years for successful completion of Master of Science degree program offered by the Institute of Forestry.

2.11 Registration

Each student must register for his/her courses in each semester. The student must attempt to complete the master's degree program in two years. The maximum time allowed for completion of any program will not exceed 5 years from the time of enrollment.

2.12 Course structure

The M.Sc. degree program of study is divided into four semesters in two academic years. In the first three semesters the courses consisting of core courses and elective courses of a total of 45 credits will be offered. In the fourth semester, a research- based thesis and two seminars (proposal and thesis defense seminar) will carry 15 credits. Thus, the two years courses carry 60 credits with 1500 marks. In addition to compulsory credits, student can enroll in extra

elective courses to earn 6 more credits. The extra elective courses are optional. At least 5 students should enroll in any elective and extra elective course to run it. The final fourth semester will completely focus on individual research work and seminars. The M.Sc. programs overview and courses offered in each program are presented below:

Table 1: Course overview

Semester	S.N.	Forestry	WM	NRMRD	WMBC	CF	MEDS
I	1	Silviculture and Forest Genetics	Soil Genesis and Geomorphology	Forest Ecology and Management	Wildlife Biology and Ecology	Political Ecology	Mountain Physical Dimension
	2	Advanced Forest Ecology	Land Evaluation and Land Use Planning	Conservation and Rural Development	Advanced Forest Ecology	Conservation and Rural Development	Human and Institutional Dimensions in Mountains
	3	Wildlife and Protected Area Management	Watershed Hydrology	Conflict Management in NRM	Wildlife and Protected Area Management	Conflict Management in NRM	Wildlife and Protected Area Management
	4	Forest Products Utilization	Climate Change: Science, Impact and Adaptation	Climate Change: Science, Impact and Adaptation	Climate Change: Science, Impact and Adaptation	Policy Analysis and Tenure Reform in NRM	Climate Change: Science, Impact and Adaptation
	5	Agroforestry	Agroforestry	Agroforestry	Conservation Biology	Agroforestry	Watershed Hydrology
II	1	Forest Governance and Community Forestry	Forest Governance and Community Forestry	Forest Governance and Community Forestry	Human Wildlife Interface Management	Forest Governance and Community Forestry	Forest Governance and Community Forestry
	2	Ecotourism Planning and Management	Soil and Water Conservation Engineering	Ecotourism Planning and Management	Ecotourism Planning and Management	Society and Forestry	Ecotourism Planning and Management
	3	Natural Resource Economics	Natural Resource Economics	Natural Resource Economics	Natural Resource Economics	Natural Resource Economics	Natural Resource Economics
	4	Forest Management	Wetland Ecology and Management	Economics of development and Finance	Wetland Ecology and Management	Forest Management	Mountain Farming and Rural Development
	5	Statistical Analysis and Data Management	Statistical Analysis and Data Management	Statistical Analysis and Data Management	Statistical Analysis and Data Management	Statistical Analysis and Data Management	Statistical Analysis and Data Management
III	1	Forest Protection	Forest Based Enterprise Development	Forest Based Enterprise Development	Forest and Wildlife Product Enterprise Development	Forest Based Enterprise Development	Forest Based Enterprise Development
	2	Biometrics	Watershed Management	Project Management	Wildlife Conservation and Management	Forest Resource Assessment and Planning	Watershed Management

	3	Research Methodology and Scientific Writing	Research Methodology and Scientific Writing	Research Methodology and Scientific writing	Research Methodology and Scientific Writing	Research Methodology and Scientific Writing	Research Methodology and Scientific Writing
	4 and 5	Remote Sensing and GIS Application in NRM*	Remote Sensing and GIS Application in NRM*	Remote Sensing and GIS Application in NRM*	Remote Sensing and GIS Application in NRM*	Remote Sensing and GIS Application in NRM*	Remote Sensing and GIS Application in NRM*
		Watershed Management*	Project Management*	Watershed Management*	Project Management*	Project Management*	Project Management*
		Urban Forestry and Landscaping*	Disaster Risk Management*	Disaster Risk Management*	Herpetology, Ornithology and Mammology*	Livelihood, Forests and Common Property Resource Management*	Disaster Risk Management*
		Forest Based Enterprise Development*	Bioenergy*	Bioenergy*	Rangeland Management*	Urban Forestry and Landscaping*	Rangeland Management*
IV	1	Thesis Proposal Seminar	Thesis Proposal Seminar	Thesis Proposal Seminar	Thesis Proposal Seminar	Thesis Proposal Seminar	Thesis Proposal Seminar
	2	Thesis	Thesis	Thesis	Thesis	Thesis	Thesis
	3	Thesis Defense Seminar	Thesis Defense Seminar	Thesis Defense Seminar	Thesis Defense Seminar	Thesis Defense Seminar	Thesis Defense Seminar
Extra Elective		Climate Change: Science, Impact and Adaptation**	Forest Ecology and Management**	Political Ecology**	Forest Management**	Silviculture and Forest Genetics**	Forest Ecology and Management**
		Human Wildlife Interface Management**	Conflict Management in NRM**	Forest Resource Assessment and Planning**	Agroforestry**	Bioenergy**	Agroforestry**

* Elective courses

** Optional courses (Optional course will be offered only if minimum 5 students enroll in the course paying additional fee as administered by respective campus.)

Note: Students who are interested and are eligible to undertake any additional courses of M. Sc program can enroll in the additional course. There should be minimum 5 students and convenient to respective campus for offering such courses. Students should pay additional fee for the courses as administered by respective campus. Marksheet will be provided for the additional course offered.

3. M. SC. FORESTRY COURSES

Semester	S.N	Course title	Course code	Credit hours	Page number
I	1	Silviculture and Forest Genetics	SFB 701	3	15
	2	Advanced Forest Ecology	SFB 702	3	18
	3	Wildlife and Protected Area Management	PWM 703	3	21
	4	Forest Products Utilization	FPE 704	3	24
	5	Agroforestry	SFB 705	3	28
II	1	Forest Governance and Community Forestry	SFM 751	3	72
	2	Ecotourism Planning and Management	PWM 752	3	75
	3	Natural Resource Economics	SFM 753	3	78
	4	Forest Management	SFM 754	3	81
	5	Statistical Analysis and Data Management	SFM 755	3	84
III	1	Forest Protection	SFB 801	3	105
	2	Biometrics	SFM 802	3	108
	3	Research Methodology and Scientific Writing	SFM 803	3	111
	4	Remote Sensing and GIS Application in NRM*	WME 804	3	114
	and 5	Watershed Management*	WME 805	3	117
		Urban Forestry and Landscaping*	SFM 806	3	121
		Forest Based Enterprise Development*	FPE 807	3	124
IV	1	Thesis Proposal Seminar	R&T 851	1	154
	2	Thesis	R&T 852	13	155
	3	Thesis Defense Seminar	R&T 853	1	157
Extra Elective	1	Climate Change: Science, Impact and Adaptation**	WME 709	3	38
	2	Human Wildlife Interface Management**	PWM 759	3	96
Total Credits				60+6	

*Elective courses

** Optional courses

4. M. SC. WATERSHED MANAGEMENT COURSES

Semester	S.N	Course title	Course code	Credit hours	Page number
I	1	Soil Genesis and Geomorphology	WME 706	3	30
	2	Land Evaluation and Land Use Planning	WME 707	3	33
	3	Watershed Hydrology	WME 708	3	35
	4	Climate Change: Science, Impact and Adaptation	WME 709	3	38
	5	Agroforestry	SFB 705	3	28
II	1	Forest Governance and Community Forestry	SFM 751	3	72
	2	Soil and Water Conservation Engineering	WME 756	3	87
	3	Natural Resource Economics	SFM 753	3	78
	4	Wetland Ecology and Management	WME 757	3	90
	5	Statistical Analysis and Data Management	SFM 755	3	84
III	1	Forest Based Enterprise Development	FPE 807	3	124
	2	Watershed Management	WME 805	3	117
	3	Research Methodology and Scientific Writing	SFM 803	3	111
	4 and 5	Remote Sensing and GIS Application in NRM*	WME 804	3	114
		Project Management*	SFM 808	3	127
		Disaster Risk Management*	WME 809	3	130
		Bioenergy*	FPE 810	3	133
IV	1	Thesis Proposal Seminar	R&T 851	1	154
	2	Thesis	R&T 852	13	155
	3	Thesis Defense Seminar	R&T 853	1	157
Extra Elective	1	Forest Ecology and Management**	SFB 710	3	41
	2	Conflict Management in NRM**	SFM 712	3	48

Total Credits

60+6

*Elective courses

** Optional course

5. M. SC. NATURAL RESOURCE MANAGEMENT AND RURAL DEVELOPMENT COURSES

Semester	S.N	Course title	Course code	Credit hours	Page number
I	1	Forest Ecology and Management	SFB 710	3	41
	2	Conservation and Rural Development	SFM 711	3	44
	3	Conflict Management in NRM	SFM 712	3	48
	4	Climate Change: Science, Impact and Adaptation	WME 709	3	38
	5	Agroforestry	SFB 705	3	28
II	1	Forest Governance and Community Forestry	SFM 751	3	72
	2	Ecotourism Planning and Management	PWM 752	3	75
	3	Natural Resource Economics	SFM 753	3	78
	4	Economics of development and Finance	SFM 758	3	93
	5	Statistical Analysis and Data Management	SFM 755	3	84
III	1	Forest Based Enterprise Development	FPE 807	3	124
	2	Project Management	SFM 808	3	127
	3	Research Methodology and Scientific Writing	SFM 803	3	111
	4 and 5	Remote Sensing and GIS Application in NRM*	WME 804	3	114
		Watershed Management*	WME 805	3	117
		Disaster Risk Management*	WME 809	3	130
		Bioenergy*	FPE 810	3	133
IV	1	Thesis Proposal Seminar	R&T 851	1	154
	2	Thesis	R&T 852	13	155
	3	Thesis Defense Seminar	R&T 853	1	157
Extra Elective	1	Political Ecology**	SFM 715	3	59
	2	Forest Resource Assessment and Planning**	SFM 815	3	149

Total Credits

60+6

*Elective courses

** Optional course

6. M. SC. WILDLIFE MANAGEMENT AND BIODIVERSITY CONSERVATION COURSES

Semester	S.N	Course title	Course code	Credit hours	Page number
I	1	Wildlife Biology and Ecology	PWM 713	3	52
	2	Advanced Forest Ecology	SFB 702	3	18
	3	Wildlife and Protected Area Management	PWM 703	3	21
	4	Climate Change: Science, Impact and Adaptation	WME 709	3	38
	5	Conservation Biology	PWM 714	3	55
II	1	Human Wildlife Interface Management	PWM 759	3	96
	2	Ecotourism Planning and Management	PWM 752	3	75
	3	Natural Resource Economics	SFM 753	3	78
	4	Wetland Ecology and Management	SFM 757	3	90
	5	Statistical Analysis and Data Management	SFM 755	3	84
III	1	Forest and Wildlife Product Enterprise Development	FPE 811	3	136
	2	Wildlife Conservation and Management	PWM 812	3	139
	3	Research Methodology and Scientific Writing	SFM 803	3	111
	4 and 5	Remote Sensing and GIS Application in NRM*	WME 804	3	114
		Project Management*	SFM 808	3	127
		Herpetology, Ornithology and Mammalogy*	PWM 813	3	142
		Rangeland Management*	WME 814	3	146
IV	1	Thesis Proposal Seminar	R&T 851	1	154
	2	Thesis	R&T 852	13	155
	3	Thesis Defense Seminar	R&T 853	1	157
Extra Elective	1	Forest Management**	SFM 754	3	81
	2	Agroforestry**	SFB 705	3	28

Total Credits

60+6

*Elective courses

** Optional course

7. M. SC. COMMUNITY FORESTRY COURSES

Semester	S.N	Course title	Course code	Credit hours	Page number
I	1	Political Ecology	SFM 715	3	59
	2	Conservation and Rural Development	SFM 711	3	44
	3	Conflict Management in NRM	SFM 712	3	48
	4	Policy Analysis and Tenure Reform in NRM	SFM 716	3	63
	5	Agroforestry	SFB 705	3	28
II	1	Forest Governance and Community Forestry	SFM 751	3	72
	2	Society and Forestry	SFM 760	3	99
	3	Natural Resource Economics	SFM 753	3	78
	4	Forest Management	SFM 754	3	81
	5	Statistical Analysis and Data Management	SFM 755	3	84
III	1	Forest Based Enterprise Development	FPE 807	3	124
	2	Forest Resource Assessment and Planning	SFM 815	3	149
	3	Research Methodology and Scientific Writing	SFM 803	3	111
	4 and 5	Remote Sensing and GIS Application in NRM*	WME 804	3	114
		Project Management*	SFM 808	3	127
		Livelihood, Forests and Common Property Resource Management*	SFM 816	3	151
		Urban Forestry and Landscaping*	SFM 806	3	121
IV	1	Thesis Proposal Seminar	R&T 851	1	154
	2	Thesis	R&T 852	13	155
	3	Thesis Defense Seminar	R&T 853	1	157
Extra Elective	1	Silviculture and Forest Genetics**	SFM 701	3	15
	2	Bioenergy**	FPE 810	3	133

Total Credits

60+6

*Elective courses

** Optional course

8. M. SC. MOUNTAIN ENVIRONMENT AND DEVELOPMENT STUDIES COURSES

Semester	S.N	Course title	Course code	Credit hours	Page number
I	1	Mountain Physical Dimension	WME 717	3	66
	2	Human and Institutional Dimensions in Mountains	SFM 718	3	68
	3	Wildlife and Protected Area Management	PWM 703	3	21
	4	Climate Change: Science, Impact and Adaptation	WME 709	3	38
	5	Watershed Hydrology	WME 708	3	35
II	1	Forest Governance and Community Forestry	SFM 751	3	72
	2	Ecotourism Planning and Management	PWM 752	3	75
	3	Natural Resource Economics	SFM 753	3	78
	4	Mountain Farming and Rural Development	WME 761	3	102
	5	Statistical Analysis and Data Management	SFM 755	3	84
III	1	Forest Based Enterprise Development	FPE 807	3	124
	2	Watershed Management	WME 805	3	117
	3	Research Methodology and Scientific Writing	SFM 803	3	111
	4 and 5	Remote Sensing and GIS Application in NRM*	WME 804	3	114
		Project Management*	SFM 808	3	127
		Disaster Risk Management*	WME 809	3	130
		Rangeland Management*	WME 814	3	146
IV	1	Thesis Proposal Seminar	R&T 851	1	154
	2	Thesis	R&T 852	13	155
	3	Thesis Defense Seminar	R&T 853	1	157
Extra Elective	1	Forest Ecology and Management**	SFB 710	3	41
	2	Agroforestry**	SFB 705	3	28

Total Credits

60+6

*Elective courses

** Optional course

9. DESCRIPTIONS OF COURSES

Course Title: **SILVICULTURE AND FOREST GENETICS**

Course Code: SFB 701

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course provides necessary advance knowledge and skills of silviculture for the management of different types of forests for different purposes.

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

- Understand Forest genetics and Tree improvement
- Carry out Plantation forestry and Natural regeneration techniques
- Apply Silvicultural Systems in various types of forests.
- Understand Growth function, dynamics of forest stand and individual trees.
- Utilize silvicultural techniques to manage different types of forests.

UNIT 1: PLANTATION SILVICULTURE (5)

- 1.1 Introduction and scope of plantation in Nepal
- 1.2 Plantation in the tropics
- 1.3 Plantation of difficult sites (saline and alkaline soil, water logged area, salt affected site, cold desert, and denuded hills)
- 1.4 Reasons of failure of plantation
- 1.5 Selection of planting stock for plantations

UNIT 2: FOREST GENETICS (5)

- 2.1 Genetic material, gene expression and interaction, gene techniques
- 2.2 Hybridization, mutation and polyploidy
- 2.3 Speciation
- 2.4 Population genetics
- 2.5 Pollination, problems faced in forest genetics

UNIT 3: TREE IMPROVEMENT (6)

- 3.1 Methods for tree improvement and its application
- 3.2 Selection, selection methods, selection for several traits, recurrent selection,
- 3.3 Seed orchards: importance and scope, establishment, management
- 3.4 Vegetative propagation techniques of five main tree species
- 3.5 Plant tissue culture and gene transformation

UNIT 4: INTERACTION OF SITE FACTORS (5)

- 4.1 Liebig's Law of Minimum
- 4.2 Shelford's Law of Tolerance
- 4.3 Principal of dynamism, principal of thermodynamics
- 4.4 Combined concept and vegetation
- 4.5 Modification of site factors through silvicultural practices

UNIT 5: INFLUENCES OF FORESTS ON THEIR ENVIRONMENT (6)

- 5.1 Forest and climate, forest and precipitation
- 5.2 Forest and local temperature, forest and global warming

- 5.3 Forest and wind, forest and humidity
- 5.4 Forest and frost, forest and snowfall, forest and evapo-transpiration

UNIT 6: HARDINESS AND TOLERANCE (4)

- 6.1 Drought condition
- 6.2 Water tappers, water savers, water stores
- 6.3 High temperature
- 6.4 High salt concentration

UNIT 7: SILVICULTURE SYSTEM (6)

- 7.1 Silvicultural systems
 - 7.1.1 High forest system
 - 7.1.2 Coppice system
- 7.2 The essence of a silvicultural system
- 7.3 Conversion
- 7.4 Application of silviculture system in different physiographical regions of Nepal (focus on some species)

UNIT 8: SILVICULTURAL MANAGEMENT OF FOREST (APPLICATION OF SILVICULTURAL SYSTEMS) (6)

- 8.1 User group forest (hill and Terai), government forest (hill and Terai)
- 8.2 Forest on public/ private land
- 8.3 Multiple use forest management – for timber production, fuelwood production, NTFPs production, wildlife and recreation
- 8.4 Development of river damaged land through regeneration
- 8.5 Effects of application of silvicultural systems on
 - 8.5.1 Soil and water conservation, soil nutrients
 - 8.5.2 Wildlife and wildlife habitat
 - 8.5.3 Recreation

UNIT 9: QUANTITATIVE SILVICULTURE (5)

- 9.1 Growth function – empirical, exponential, allometry and Backman's growth function
- 9.2 Growth cycle and phases, co-relation between size and plant population
- 9.3 Probability of individual tree mortality, models of tree mortality and yield for un-thinned forest stands
- 9.4 Dynamics of uneven aged forest
- 9.5 Plant geometry and self-thinning stand structure and allometry of trees during self-thinning of pure stand.

PRACTICALS (12)

Excursion (8): Students will visit nearby appropriate site for observing silvcultural trial plots to study different silvicultural systems. Students are required to prepare and submit field diary in accordance to instruction from the tour in charge.

Term paper presentation (4): Each student will prepare and present a term paper based on literature review on the topic assigned by the course coordinator of the course.

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- Wright, J. (2012). Introduction to Forest Genetics. Elsevier Science, Amsterdam.
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Course Title: **ADVANCE FOREST ECOLOGY**

Course Code: SFB 702

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course provides advance knowledge and skills of forest ecology, forest and environmental interaction, forest influences and forest ecosystem modeling.

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

- Understand with forest ecology, forest ecosystem, structural and functional aspects of forest ecosystem.
- Acquire analytical knowledge and skills necessary in forest ecology.
- Plan and implement the forest ecosystem development for managing the forest ecology of the country.

UNIT 1: FOREST ECOLOGY (4)

- 1.1 Fundamental concept of forest ecology
- 1.2 Forest ecosystem - The function, structure and major components of forest ecosystem
- 1.3 Forest ecosystem biomass

UNIT 2: COMMUNITY ECOLOGY (4)

- 2.1 Community, characteristics of a community
- 2.2 Raunkiaer's life form
- 2.3 Composition, structure, origin and development
- 2.4 Units of vegetation classification
- 2.5 Main concepts in classification of the community

UNIT 3: VARIABILITY AND DIVERSITY (5)

- 3.1 Variation and diversity due to genotype, phenotype and environment interactions
- 3.2 Speciation
- 3.3 Quantitative analysis of tree diversity
 - 3.3.1 Alpha (α), beta (β) and gamma (γ) diversity
 - 3.3.2 Important value index (IVI)
 - 3.3.3 Simpson's diversity index (D)
 - 3.3.4 Shannon diversity index (H_s)

UNIT 4: FOREST AND ENVIRONMENTAL INTERACTIONS (4)

- 4.1 Positive interaction: concept, mutualism, commensalisms, proto co-operation
- 4.2 Negative interaction: competition, antagonism, ammensalism, parasitism and predation
- 4.3 Plant microbe- animal's interrelationship
- 4.4 Synecology in different forest types
- 4.5 Succession and its types

UNIT 5: FOREST INFLUENCES (5)

- 5.1 Effects of forests on soil, vegetation, physiography, local and micro-climate
- 5.2 Litter production, accumulation, decomposition and nutrient cycling
- 5.3 Carbon sequestration and greenhouse effect, carbon foot print, carbon pool
- 5.4 Measuring influences
 - 5.4.1 Environmental and physical parameter to measure forest influences
 - 5.4.2 Vegetation mapping

UNIT 6: THE ECOSYSTEM PERSPECTIVE (6)

- 6.1 The ecosystems approach to problem solving
- 6.2 Concepts of systems analysis and simulation
- 6.3 Methods of system analysis
 - 6.3.1 Concept of model formulation
 - 6.3.2 Quantitative specification of model
 - 6.3.3 Model evaluation and use

UNIT 7: ECOLOGY AS FOUNDATION FOR SUSTAINABLE FOREST MANAGEMENT (6)

- 7.1 Sustainable forest management and social-ecological systems
- 7.2 Ecological and silvicultural strategies for sustainable forest management
 - 7.2.1 Stand level sustainability: The concept of “ecological rotations”
 - 7.2.2 Landscape level sustainability: The concept of the shifting mosaic

UNIT 8: DISTURBANCE AND STAND DEVELOPMENT (4)

- 8.1 Conceptual stages of stand development
 - 8.1.1 Stand initiation stage
 - 8.1.2 Stem exclusion
 - 8.1.3 Understory initiation stage
 - 8.1.4 Old growth stage
- 8.2 Disturbance and effects on forest development
 - 8.2.1 Kinds of major disturbances
 - 8.2.2 Abiotic
 - 8.2.3 Biotic
 - 8.2.4 Trees responses to disturbances
- 8.3 Application to management

UNIT 9: APPLICATION OF SIMULATION MODELS IN FOREST ECOLOGY (6)

- 9.1 Population dynamics, effects of density independent and density dependent factors
- 9.2 Effects of age-specific natality and mortality
- 9.3 Effects of fluctuating environmental conditions
- 9.4 Effects of competition and frequency of ecological disturbance
- 9.5 Effects of foraging and thermoregulation

UNIT 10: APPLICATION OF ECOLOGICAL PRINCIPLES IN NATURAL RESOURCE (FOREST) MANAGEMENT (4)

- 10.1 Wildlife management: effects of habitat fragmentation on the management of endangered animal species
- 10.2 Rangeland management: effects of stocking density and frequency of brush control on rangeland productivity
- 10.3 Forest management: Effect of timber harvest on the relative abundance of wildlife species.

PRACTICALS (12)

Fieldwork and Report Writing (8): Students will visit nearby appropriate site for vegetation analysis by quadrant method to determine minimum size and number of the quadrant by various methods and will observe silvicultural trial plots to study different silvicultural systems. Students will use field data to calculate species diversity, evenness and similarity indices, concentration of

dominance, etc. as instructed by the instructor or course coordinator. Students are required to prepare and submit reports.

Presentation (4): Students will present their work among the students.

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Course Title: **WILDLIFE AND PROTECTED AREA MANAGEMENT**

Course Code: PWM 703

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course aims to offer a broad landscape level perspective of biodiversity conservation, wildlife and protected area management

Specific objectives: After the completion of this course, students will be able to:

- Understand different types of diversity and their issues and management.
- Understand current policies and approaches to biodiversity conservation, wildlife and protected area management.
- Analyze, evaluate and prepare holistic management plan of protected areas.
- Develop capability to collaborate research activities linking with management.
- Gain knowledge and skills in different wildlife and habitat monitoring techniques.
- Understand the human dimensions in biodiversity conservation measures.

UNIT 1: INTRODUCTION (6)

- 1.1 Concept and significance of biodiversity
- 1.2 Status of biodiversity at global, Hindu Kush Himalayan (HKH) region and Nepal
- 1.3 Biodiversity, ecosystem services and poverty alleviation
- 1.4 Status and importance of major wildlife species (fauna) in Nepal
- 1.5 History of Protected Area Management (global and Nepalese context)
- 1.6 Different global and Nepalese approaches/models of landscape conservation

UNIT 2: CONCEPT, THREATS, MANAGEMENT, KEY GAPS AND ISSUES IN BIODIVERSITY CONSERVATION IN NEPAL (6)

- 2.1 Forest biodiversity
- 2.2 Rangeland/grassland biodiversity
- 2.3 Agro-biodiversity
- 2.4 Wetland biodiversity
- 2.5 Mountain biodiversity
- 2.6 Urban biodiversity

UNIT 3: POLICY, LEGISLATION AND MULTILATERAL ENVIRONMENTAL AGREEMENTS AT GLOBAL AND NATIONAL LEVEL (7)

- 3.1 Silent features of global and regional conventions and treaties (CITES, CITESMIKE, CBD, IUCN, RAMSAR, GTF, GTI, UNESCO World Heritage Convention, conservation strategy, MEA, South Asian Wildlife Enforcement Network (SAWEN), Asian Protected Areas Partnership (APAP)
- 3.1 National level strategies: NBS/NBSAP, All species action plans
- 3.2 Critical analysis of Acts and regulations related to environment, biodiversity, protected area, forests of Nepal

UNIT 4: WILDLIFE AND HABITAT MANAGEMENT (7)

- 4.1 Population management: meta population, island biogeography, species recovery plans, Ex-situ and in-situ conservation for example, translocation/reintroduction, wildlife farming, measures to curb poaching (role of the army, community based anti-poaching operations, park-based anti-poaching units, wildlife crime investigation)

- 4.2 Habitat management: Landscape ecology (eco-region, biomes, biodiversity hotspots, corridor and connectivity, habitat restoration plans, grazing and fire management, management of rangeland, wetland, invasive species)
- 4.3 Island Biogeography theory with emphasis on its practical implications

UNIT 5: MONITORING BIODIVERSITY (7)

- 5.1 Population monitoring (mammals, birds, herpeto-fauna, fishes, insects)
 - 5.1.1 Direct method: direct counts, vantage point sampling, sweeping techniques, flushing
 - 5.1.2 Indirect method: camera trapping surveys, DNA- based surveys, sign- based surveys, telemetry studies
 - 5.1.3 Data analysis: capture/recapture techniques, presence/absence analysis, ecological niche factor analysis
- 5.2 Habitat monitoring - habitat selection/resource selection, habitat suitability assessment techniques, carrying capacity assessment, animal food habit studies, habitat occupancy modeling
- 5.3 Data management (archiving) in policy making

UNIT 6: PROTECTED AREA (PA) MANAGEMENT (8)

- 6.1 Development of PA
 - 6.1.1 Classification and extent of PA coverage (regional and Nepal)
 - 6.1.2 International and national criteria, guidelines, categories and practices for PA design
 - 6.1.3 PA and community development
 - 6.1.4 Buffer zone and conservation area management
 - 6.1.5 Management effectiveness of protected areas
- 6.2 Human wildlife interface
 - 6.2.1 Different incidents of human-wildlife conflict
 - 6.2.2 Human-wildlife conflict mitigation approaches (BZ, conservation areas, community forests)
 - 6.2.3 Compensation schemes for wildlife damages in Nepal
 - 6.2.4 Wildlife rescue and orphanage management

UNIT 7: PLANNING AND SUSTAINABILITY OF PROTECTED AREA MANAGEMENT (4)

- 7.1 Planning model: conventional planning and modern planning
- 7.2 Procedures for preparation of management plan of PAs in Nepal
- 7.3 Financing and sustainability of the protected areas

PRACTICALS (15)

Field Visit and Exercises (15)

The students will visit to a protected area to study:

- Wildlife monitoring techniques (6 hours)
 - a. Transect survey
 - b. Sign- based survey
- Different management activities (6 hours)
 - a. PA (MIS, smart patrolling, effectiveness of CBAPU/ RRT, preparation and implementation of management plan)
 - b. Breeding centers
- Study on going activities of molecular lab, wildlife veterinary hospital and wildlife museum (3 hours)

All students will prepare, submit and present report for each exercise for evaluation by the instructor.

REFERENCES

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Course Title: **FOREST PRODUCTS UTILIZATION**

Course Code: FPE 704

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course provides knowledge on appropriate technology for forest harvesting and proper utilization of timber- based forest products and familiarizes the value chain analysis of forest products.

Specific objectives: After completion of this course, the students will be able to:

- Understand forest harvesting planning.
- Understand the Reduced Impact Logging.
- Understand different uses of wood.
- Prepare value chain map of timber.
- Review policy and practices related to timber sector, forest harvesting and product utilization.

UNIT 1: HARVESTING PLANNING (5)

- 1.1. Forest harvesting plan and planning process
- 1.2. Reduced impact logging (RIL)
 - 1.2.1 Concept and application of RIL in harvesting planning
 - 1.2.2 Opportunities and challenges of RIL
 - 1.2.3 Role of harvesting plan for sustainable forest management
- 1.3. Application of ergonomics in harvesting

UNIT 2: HARVESTING PRACTICES (5)

- 2.1. Timber harvesting: methods and techniques
- 2.2. Timber Grading: national and international system
- 2.3. Logs transportation and storage: national and international system
- 2.4. Opportunities and challenges in timber harvesting

UNIT 3: STRUCTURE AND CHARACTERISTICS OF WOOD (8)

- 3.1. Gross and minute structure of wood
- 3.2. Wood structure in relation to end use of wood
- 3.3. Wood properties
 - 3.3.1. Physical, chemical and mechanical properties
 - 3.3.2. Wood strength, factors affecting wood strength
 - 3.3.3. Wood property in relation to end use of wood
 - 3.3.4. Timber joints
- 3.4. Wood and water relationship

UNIT 4: WOOD DEFECTS AND TREATMENT (6)

- 4.1. Wood defects: causes and types
- 4.2. Detecting wood defects: manual and mechanized methods
- 4.3. Wood seasoning: significance, methods
- 4.4. Wood treatment: physical and chemical, application in national context
- 4.5. Alternative uses of defected wood

UNIT 5: WOOD- BASED INDUSTRIES IN NEPAL (6)

- 5.1. Wood- based industries (global and Nepalese context)

- 5.2. Major wood-based industries in Nepal (sawmill, furniture, handicraft, composite products, cutch and katha)
- 5.3. Prospects and problems of wood-based industries in Nepal
- 5.4. Prospect of utilization of under used species in Nepal
- 5.5. Private sector involvement and investment in wood-based industries in Nepal

UNIT 6: TIMBER VALUE CHAIN (5)

- 6.1. Value chain of major timber products in Nepal
- 6.2. Challenges and opportunities in timber value chain in Nepal
- 6.3. Case studies on timber value chain analysis

UNIT 7: TIMBER MARKETING AND TRADE (8)

- 7.1. Timber marketing and trade analysis: global and national scenario
- 7.2. Opportunities, issues and challenges in sustainable supply of timber in Nepal
- 7.3. Problems and prospects of timber product marketing
- 7.4. Strategy for sustainable timber supply; reducing timber import in Nepal
- 7.5. Wood legality verification
 - 7.5.1. International initiatives: convention on international trade in endangered species of wild fauna and flora (CITES), international timber trade agreement (ITTA), forest law enforcement, governance and trade (FLEGT), chain of custody certification from forest stewardship council (FSC), program for the endorsement of forest certification (PEFC), others
 - 7.5.2. National initiatives: legal provision for transporting, exporting

UNIT 8: TIMBER SECTOR POLICY ANALYSIS (5)

- 8.1. National forest policy review: acts, policies, and plans (provision, opportunities, policy duplication, contradictions)
- 8.2. Provincial and local forest policy review: acts, policies, and plans (provision, opportunities, policy duplication, contradictions)
- 8.3. National policy review on timber and allied sector in Nepal (forest, industrial, trade, export import, labor, etc.)

PRACTICALS (12)

Excursions (6): Students will be taken to nearby forest-based enterprise for value chain study. Students are required to prepare and submit field report in prescribed format to the instructor.

Field and Lab work (6): Students will be taken to field and lab for identifying wood species and wood defects through anatomical structure. Students are required to prepare and submit study report in prescribed format to the instructor.

REFERENCES

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Course Title: **AGROFORESTRY**

Course Code: SFB 705

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course will provide advance knowledge of agroforestry and make students able to utilize the knowledge and skills in agroforestry research and development.

Specific objectives: After the completion of this course, students will be able to:

- Be familiar with agroforestry practices and their role in farming and forest system.
- Understand and describe agroforestry systems to contribute to rural livelihood and environment.

UNIT 1: INTRODUCTION AND DESCRIPTION OF AGROFORESTRY SYSTEM (6)

- 1.1 Definition, system and classification of agroforestry systems
- 1.2 Agroforestry science and practices
- 1.3 Farming systems in Nepal

UNIT 2: MANAGEMENT OF AGROFORESTRY SYSTEMS (8)

- 2.1 Indigenous knowledge on agroforestry and its utilization
- 2.2 Land management (nursery techniques, soil management and nutrient management)
- 2.3 Management of tree resources (selection, plantation, management and silvicultural operation)
- 2.4 Management of crops and livestock (selection, plantation and management)
- 2.5 Tree-crop interactions
- 2.6 Case study (selection and designing of appropriate AF system for land use system)

UNIT 3: AGROFORESTRY, ENVIRONMENT AND CLIMATE CHANGE (8)

- 3.1 Introduction (linkage of agroforestry with environment)
- 3.2 AF system and carbon sequestration potential, and perspectives
- 3.3 Climate change adaptation in farming system through AF
- 3.4 Agroforestry and ecosystem services
 - 3.4.1 Theory of ecosystem services and agroforestry
 - 3.4.2 Potential and challenges of AF for biodiversity conservation
 - 3.4.3 Analysis of ecosystem services trade-off and synergy

UNIT 4: AGROFORESTRY AND LIVELIHOOD (6)

- 4.1 Agroforestry and sustainable livelihood framework (conceptual background, linkage, importance)
- 4.2 Rural poverty, poverty dynamics and contribution of AF for food security
- 4.3 Contribution of agroforestry to livelihood in different agro-ecological zones
- 4.4 Identification and promotion of appropriate agroforestry practices for livelihood improvement

UNIT 5: AGROFORESTRY AND ENTERPRISE DEVELOPMENT (8)

- 5.1 Introduction
- 5.2. Enterprise development through agroforestry
- 5.3 Agroforestry beneficiaries (private, government, business, cooperative, etc.
- 5.4 Domestication and commercialization of high value agroforestry crops (NTFPs and MAPs)

- 5.5 Agroforestry innovation, product diversification and green growth (new products, employment, agro-tourism, certification of agroforestry products, etc.)

UNIT 6: AGROFORESTRY RESEARCH AND DEVELOPMENT (6)

- 6.1 Agroforestry diagnosis and design
- 6.2 Current trend in agroforestry research and development
- 6.3 Action research and agroforestry methods

UNIT 7: CHALLENGES AND OPPORTUNITIES (6)

- 7.1 Legal policies related to agroforestry (land use policy, forest act, agroforestry policy)
- 7.2 Subsistence vs. commercialization of AF (issues and challenges)
- 7.3 Agroforestry in the changing context (local, regional, national and global)
- 7.4 Trees outside forests (AF options for abandoned and underutilized land/ public land)

PRACTICALS (12)

Excursion (4): At least one excursion visit to three nearby agroforestry farm, agro- based enterprise and research trial plots. Students are required to prepare and submit field tour report in accordance to instruction from the tour-in-charge.

Exercise (8): After completion of theory classes and excursions, students in groups will carry out exercise on developing a simple agroforestry model. Students are required to prepare report and present the work among the students.

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Course Title: **SOIL GENESIS AND GEOMORPHOLOGY**

Course Code: WME 706

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course aims to impart in- depth knowledge and understanding of soil origin for plant growth and the earth's landscape.

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

- Understand origin of soil and their classification.
- Conduct soil survey and interpret survey information.
- Understand landforms and their classification along with the factors affecting the formation and change in landforms.
- Understand the processes undergoing in the earth's crust, at the surface, in the hydrosphere, and atmosphere leading to the modifications of the landforms.

UNIT 1: INTRODUCTION TO SOIL GENESIS (6)

- 1.1 Historical development
- 1.2 Perspective on the origin of the science of soil genesis
- 1.3 Some fundamental concepts of soil genesis
- 1.4 A soil as an anatomical specimen
- 1.5 A soil as an open system
- 1.6 Methods of soil genesis studies
- 1.7 Morphology of soils
- 1.8 Soil micro-morphology
- 1.9 Soil composition and characterization

UNIT 2: SOIL FORMATION AND DEVELOPEMENT PROCESS (4)

- 2.1. Soil environment
- 2.2. Soil forming factors in relation to Nepalese context
- 2.3. Soil developing processes
- 2.4. Land form and its development

UNIT 3: SOIL PROPERTIES AND ITS ROLE IN SOIL FERTILITY/PLANT GROWTH (6)

- 3.1 Physical properties
- 3.2 Chemical properties
- 3.3 Biological properties

UNIT 4: PRINCIPLE AND HISTORICAL DEVELOPMENT OF SOIL CLASSIFICATION (6)

- 4.1 Nepalese traditional soil classification and nomenclature
- 4.2 Modern system of soil classification
- 4.3 FAO/UNESCO soil classification system
- 4.4 USDA seventh approximation system of soil classification
- 4.5 Soil orders available in Nepal and their distribution

UNIT 5: SOIL MAPPING AND INTERPRETATION (10)

- 5.1 Soil and landform
- 5.2 Kinds and levels of soil survey

- 5.3 Characteristics and identification of soil mapping units, mapping legends, mapping and taxonomic units
- 5.4 Different soil mapping approaches (FAO, ISRI and National land use plan)
- 5.5 Familiarization of digital soil mapping
- 5.6 Application of GIS, GPS and remote sensing in soil survey
- 5.7 Soil scanning system and soil index
- 5.8 Soil fertility mapping using GIS
- 5.9 Interpretation and use of soil survey/ reports

UNIT 6: APPROACH, APPLICATION AND MORPHOLOGICAL EVOLUTIONARY SYSTEM (6)

- 6.1 Fundamental concept of geomorphology
- 6.2 Geomorphologic systems: outline of geomorphic processes and geomorphic scale
- 6.3 The cycle of erosion
- 6.4 Denudation chronology
- 6.5 Strategies for inferring landform evolution and new evolutionary concepts
- 6.6 Application of geomorphology in watershed management

UNIT 7: MOUNTAIN ENVIRONMENT AND HILL SLOPE (4)

- 7.1 Evolution and classification of hill slope
- 7.2 Origin of hill slope and hill slope erosion
- 7.3 Large scale landslide, flash flood, landslide dam and GLOF resulting landforms
- 7.4 Soil formation in hill slope and its role in plant growth

UNIT 8: FLUVIAL PROCESSES AND LANDFORMS (4)

- 8.1 River morphology
- 8.2 Fluvial erosion
- 8.3 Fluvial depositional landforms
- 8.4 Soil of fluvial landforms and plant growth

UNIT 9: AEOLIAN PROCESSES AND LANDFORMS (2)

- 9.1 Aeolian environments
- 9.2 Aeolian sand movement, wind abrasion and aeolian bed forms
- 9.3 Cold and hot desert
- 9.4 Soil of aeolian landforms and plant growth

UNIT 10: GLACIAL PROCESSES AND LANDFORMS (4)

- 10.1 Types of glaciers
- 10.2 Erosion by glaciers
- 10.3 Deposition by glaciers
- 10.4 Landforms of glacial deposition
- 10.5 Geomorphological effects of former glacier expansion
- 10.6 Soil of glacial landforms and plant growth

UNIT 11: CLIMATIC GEOMORPHOLOGY (4)

- 11.1 Climate influence upon geomorphic processes
- 11.2 Humid tropical landforms
- 11.3 Tropical wet-dry landforms
- 11.4 Arid and semi- arid landforms
- 11.5 Cold region landforms
- 11.6 The geomorphic effects of climatic change

PRACTICALS (4)

Excursion (4): Students will be taken to nearby site to examine soil and geomorphological features. The students will examine: a) Parent materials of soils, b) Landform relief and drainage, c) Identification and nomenclature of soil horizon, d) Soil colour, e) Soil texture, soil structure, and consistency, f) Soil reaction and its classes, g) Special feature of soil formation, h) Organic matter and plant roots, i) Vegetation, j) Land use, k) Soil mapping, l) Geomorphic features. Students are required to prepare and submit brief report in prescribed format to the instructor.

Term paper: Students will prepare and submit term papers in given topics.

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Course Title: **LAND EVALUATION AND LAND USE PLANNING**

Course Code: WME 707

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course helps students to understand, identify and evaluate different land uses and assess suitability of lands for different uses. Students will also be able to assess the sustainability of land use plan.

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

- Understand nature and scope of land evaluation and land use planning.
- Understand land classification, soil survey and mapping.
- Understand framework for land evaluation (detail procedure of land evaluation).

UNIT 1: LAND RESOURCES AND LAND DEGRADATION (6)

- 1.1 Land resource and land use
- 1.2 Land degradation
- 1.3 Land degradation and future insecurity
- 1.4 Land degradation assessment tools
- 1.5 Issues of land degradation in different physiographic region of Nepal

UNIT 2: LAND CLASSIFICATION SYSTEMS (8)

- 2.1 Concept, approaches and practices
- 2.2 Land capability and land suitability classification
- 2.3 Soil survey and mapping
- 2.4 USDA, FAO systems of land classification
- 2.5 Traditional, LRMP and recent land classification systems of Nepal

UNIT 3: NATURE, PRINCIPLES AND BASIC CONCEPTS OF LAND EVALUATION (12)

- 3.1 Objectives of land evaluation
- 3.2 Concept of land evaluation
- 3.3 Principles of land evaluation
- 3.4 Levels of intensity and approaches for land evaluation
- 3.5 Nature of the framework for land evaluation
- 3.6 Land attributed for land evaluation (land, land use, land characteristics, land qualities and diagnostic criteria, requirements and limitations, land improvements, land suitability and land capability)
- 3.7 Land evaluation procedure
- 3.8 Economic and social analysis
- 3.9 Presentation of results and reports

UNIT 4: LAND USE PLANNING (8)

- 4.1 Concept and principles
- 4.2 Process of land use planning
- 4.3 Land use planning for development and protection of infrastructure
- 4.4 Spatial planning through mapping socio economic parameters
- 4.5 Suitability criteria for different land uses (forest, agriculture, pasture, urban, industrial and wildlife)
- 4.6 Land use planning success model (case study)
- 4.7 Land use planning policy and practices in Nepal

UNIT 5: SUSTAINABLE LAND USE PLANNING (6)

- 5.1 Concept and approaches of sustainable land use planning
- 5.2 SDG and land use planning
- 5.3 General land use plan for protected and productive area
- 5.4 Sustainability criteria for different land uses
- 5.5 Monitoring and evaluation of sustainable land use plan

PRACTICALS (20)

Field exercise/tour (8): Students will spend at least two days in nearby appropriate site for fieldwork to perform socioeconomic survey and detail soil survey with soil sampling. Students will prepare report as instructed by the instructor /course coordinator

Lab work, report writing and presentation (8): After fieldwork, students will carry out routine soil analysis in the laboratory to determine soil texture, pH, OM, N., P. and K., and prepare land evaluation report for the specified land use and make presentation in the group.

Term paper (4): Each student will prepare a term paper based on literature review on the topic assigned by the course coordinator on the recent issues on wetland ecology and management.

REFERENCES

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Course Title: **WATERSHED HYDROLOGY**

Course Code: WME 708

Credit Hours: 3

Lecture Hours:60

Full Marks: 75 (Theory: 45, Internal Assessment: 15, Practical: 15)

General objective: This course provides concept and skill on application of hydrological knowledge for watershed characterization, planning, designing development project and understanding on implication of land use practices on hydrological regime.

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

- Develop understanding on hydrological cycle and different hydrological processes.
- Apply hydrological knowledge and skill on watershed management planning and development.
- Learn basic techniques for analysis and integration of hydrologic data, and prediction of hydrologic phenomena using models.
- Perform hydrologic analysis and interpretation of different watershed management activities, forest and land use land cover and climate change impacts at watershed scale.
- Understand the role of forest and cryosphere for water supply.

UNIT 1: INTRODUCTION TO WATERSHED HYDROLOGY (6)

- 1.1 Concept of watershed and hydrological cycle
- 1.2 Scope of watershed hydrology
- 1.3 Hydrological processes
- 1.4 Hydrological characteristics of watersheds
- 1.5 Land use land cover and its implication on hydrology

UNIT 2: WATER BALANCE COMPONENTS (8)

- 2.1 Water balance equation
- 2.2 Precipitation, interception and its measurements
- 2.3 Rainfall data analyses (average precipitation, missing precipitation, consistency)
- 2.4 Evaporation, evapotranspiration and its measurement (water balance, energy balance, remote sensing)
- 2.5 Infiltration and hydrological soil characteristics
- 2.6 Soil water movement

UNIT 3: WATER FLOW (8)

- 3.1 Surface and ground water flow
- 3.2 Stream flow measurements
- 3.3 Stream flow response to watershed characters
- 3.4 Hydrograph analysis
- 3.5 Peak flow, frequency and return period analysis
- 3.6 Sediment flow and its estimation

UNIT 4: WATERSHED HYDROLOGICAL MODELLING (8)

- 4.1 Concept and scope of watershed hydrological modelling
- 4.2 Types of watershed hydrological models
- 4.3 Model selection, simulation, calibration, validation and sensitivity analysis
- 4.4 Rainfall -Runoff model
- 4.5 SWAT Model
- 4.6 Erosion Model (RUSLE, RMMF)

UNIT 5: HYDROLOGICAL ROLE OF FORESTS (4)

- 5.1 Forest hydrology concept
- 5.2 Hydrological functions of forests
- 5.3 Impacts of forest management on hydrological processes
- 5.4 Vegetation management for sustained water yield
- 5.5 Monitoring forest cover changes and hydrological implication at watershed scale

UNIT 6: CRYOSPHERE (4)

- 6.1 Components of cryosphere
- 6.2 Permafrost
- 6.3 Glacier mass balance
- 6.4 Impact of climate change on snow hydrology and downstream consequences
- 6.5 Glaciers observations and monitoring

UNIT 7: WATER QUALITY (4)

- 7.1 Water quality concept
- 7.2 Physical, chemical and biological pollutants
- 7.3 Water quality criteria and standard
- 7.4 Water quality monitoring (rapid assessment, biological indicators, physio-chemical)
- 7.5 Water quality index (WQI)
- 7.6 TMDL approach of water quality management

PRACTICALS (18)

Exercises (18): Students will perform following field base observations / measurements and lab works for different analyses, specifically:

- Discharge measurement of spring and stream
- Rainfall measurement with rain gauge/rainfall data analysis
- Infiltration experiment
- Water quality and sediment analysis of stream water
- Rainfall-runoff-stream flow relationship
- Hydrograph analysis
- Familiarization with hydrological model (SWAT, HEC RAS)

Students are required to submit their fieldwork and practical work reports as instructed by the course coordinator/teacher

REFERENCES

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Course Title: **CLIMATE CHANGE: SCIENCE, IMPACT AND ADAPTATION**

Course Code: WME 709

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course aims to provide knowledge on causes and consequences of global environmental change, management issues and response at different levels with understanding of underlying science, policy, future strategy and international negotiations.

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

- Understand climate change and global environmental issues.
- Assess major impact on climate change.
- Acquaint policy and program of adaptation/mitigation measures at national and international level.
- Analyze the climatic data and future prediction.

UNIT 1: GLOBAL ENVIRONMENTAL ISSUES (4)

- 1.1 Global environmental view
- 1.2 Physical environmental issue (global warming, pollution, ozone depletion, acid rain)
- 1.3 Biological environmental issue (loss of biodiversity, deforestation)
- 1.4 Socio-economic issues (industrialization, urbanization, migration)
- 1.5 Environmental issues of mountain (case study of HKH region)
- 1.6 Ethical analysis of the global climate dilemma

UNIT 2: UNDERSTANDING CLIMATE SCIENCE (10)

- 2.1 Overview of climate variability and climate science
- 2.2 Natural climatic variations in the holocene: Global change in recent history
- 2.3 Climate dynamics, climate change and climate prediction
- 2.4 Chemical and physical aspects of the climate system
- 2.5 Paleoclimate variability
- 2.6 Climate change at global, regional and local levels
- 2.7 Source of climate change
- 2.8 Global scenario of greenhouse gas emission (emission by country and sector)
- 2.9 Climate change assessment parameters and indicators
- 2.10 Climate models (GCM, RCM)
- 2.11 Facts and debates on climate change (IPCC reports and ICIMOD HIMAP)

UNIT 3: IMPACTS OF CLIMATE CHANGE (8)

- 3.1 Climate change impacts on different sectors (agriculture-food security, water resources-too much and too little water problems, forest and biodiversity –wildlife habitat risk, timber quality, pasture management, gender and livelihoods vulnerability)
- 3.2 Impacts on ecosystem and services in high mountain areas
- 3.3 Himalayan glacier retreat and its implication
- 3.4 Ecosystem and social vulnerability assessment tools

UNIT 4: CARBON POOLS, FLUXES AND CLIMATE CHANGE MITIGATION (6)

- 4.1 Carbon sources and sinks
- 4.2 Global carbon budget, carbon cycle, CO₂ emission and atmospheric concentration
- 4.3 Land use change and carbon fluxes
- 4.4 Role of forest on carbon sequestration

- 4.5 Carbon assessment: stock and process-based approach
- 4.6 Carbon pool management and climate change mitigation

UNIT 5: CLIMATE CHANGE ADAPTATION (8)

- 5.1 Planned and self-adaptive measures
- 5.2 Local/regional/national/international adaptation strategies
- 5.3 Indigenous knowledge and practices
- 5.4 Alternative energy and clean energy technology
- 5.5 Climate smart agriculture
- 5.6 Climate friendly development planning
- 5.7 Determinants of adaptation
- 5.8 Community and ecosystem-based adaptation
- 5.9 Building ecosystem and community resilience

UNIT 6: NATIONAL AND INTERNATIONAL INITIATIVES (6)

- 6.1 UNFCCC and COP
- 6.2 IPCC reports
- 6.3 Kyoto protocol
- 6.4 Bali action plan
- 6.5 Sustainable Development Goal (SDG) in the context of climate change
- 6.6 REDD+
- 6.7 NAPA, LAPA and CAPA
- 6.8 Climate change policy in Nepal
- 6.9 Environmental laws and regulation, environmental management with decentralization

UNIT 7: ENVIRONMENT AND SOCIETY (5)

- 7.1 Human perspectives on environmental issues
- 7.2 Future security and sustainability
- 7.3 Ecological footprint and environmental justice
- 7.4 Societal transformation in response to global environment and climate change
- 7.5 Climate change politics and environmental governance
- 7.6 Environmental consideration in development planning
- 7.7 Climate change and livelihoods resilience

PRACTICALS (13)

Exercise (9)

- Students analyze long-term temperature and rainfall data to assess annual trend of temperature and rainfall, seasonal variability of rainfall, wet year, dry year, etc.)
- Students will do exercise on climate vulnerability assessment using suitable tools.

Students are required to prepare and submit the exercise work report as instructed by the course coordinator/teacher.

Term Paper (4): Students will prepare and submit term papers on given topics with review of related scientific articles.

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Course Title: **FOREST ECOLOGY AND MANAGEMENT**

Course Code: SFB 710

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course will provide advance knowledge and skills in the fields of forest ecology and forest management and will help to apply these knowledge and skills for the sustainable management of forests for perpetual provisioning of forest resources and other ecosystem services (e.g. climate regulation, purification of water and air, biodiversity conservation).

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

- Understand forests as ecosystems.
- Recognize dynamic nature of forest ecosystems.
- Understand concepts of forest growth and productivity and be able to regulate them.
- Understand concepts of silvicultural interventions and major silvicultural systems and be able to design and apply silvicultural systems.
- Appreciate concept of sustainable forest management.
- Understand process of forest management planning and scope of multiple use forest management and ecosystem- based forest management, and status quo of forest management in Nepal.

UNIT 1: UNDERSTANDING FORESTS AS ECOSYSTEMS (10)

- 1.1 Concept of forest ecosystems
- 1.2 Attributes of forest ecosystems
 - 1.2.1 Biodiversity of forest ecosystems
 - 1.2.2 Functions of forest ecosystems (e.g., climate regulation, biogeochemical (nutrient) cycling, hydrological cycling)
 - 1.2.3 Structure of forest ecosystems
- 1.3 Interrelationships between biodiversity function and structure

UNIT 2: FORESTS AS DYNAMIC SYSTEMS/FOREST DYNAMICS (5)

- 2.1 Disturbances in forest ecosystems
 - 2.1.1 Abiotic disturbances (e.g., fire, wind, flood, landslide, drought, volcanic activity, climate change)
 - 2.1.2 Biotic disturbances (e.g., pest and/or disease outbreak, invasion, human)
- 2.2 Forest succession
 - 2.2.1 Concept of forest succession
 - 2.2.2 Types and stages of forest succession
 - 2.2.3 Causes and mechanisms of succession
 - 2.2.4 Seral communities and climax

UNIT 3: FOREST GROWTH AND PRODUCTIVITY (8)

- 3.1 Concept and methods of determination of growing stock
- 3.2 Concept and types of increments
- 3.3 Concept and importance of yield regulation
 - 3.3.1 Sustained yield
 - 3.3.2 Site quality
 - 3.3.3 Yield table
 - 3.3.4 Yield regulation in plantation and natural forests

UNIT 4: SILVICULTURAL TREATMENTS (5)

- 4.1 Site treatment
 - 4.1.1 Disposal of logging slash
 - 4.1.2 Treatment of forest floor and competing vegetation
- 4.2 Regeneration methods (natural and artificial regeneration methods)
- 4.3 Post establishment treatments
 - 4.3.1 Release operations in seedling and sapling stands
 - 4.3.2 Pruning and lopping
 - 4.3.3 Thinning
 - 4.3.4 Improvement cutting
 - 4.3.5 Salvage and sanitation cutting
 - 4.3.6 Prescribed burning

UNIT 5: APPLICATION OF SILVICUTURAL SYSTEMS (8)

- 5.1 Major silvicultural systems
 - 5.1.1 Clear felling system
 - 5.1.2 Seed tree system
 - 5.1.3 Shelter wood system
 - 5.1.4 Selection system
 - 5.1.5 Coppice systems
- 5.2 Factors to be considered while designing and applying a silvicultural system

UNIT 6: SUSTAINABLE FOREST MANAGEMENT (8)

- 6.1 Concept of sustainable forest management
- 6.2 Criteria and indicators of sustainable forest management
- 6.3 Concept of normal forest and implication to forest management
- 6.4 Concept of ecological rotation and implication to forest management

UNIT 7: FOREST MANAGEMENT PLANNING (6)

- 7.1 Concept, importance and scope of management plan
- 7.2 Steps of forest management planning
- 7.3 Concept, scope and practicality of multiple use forest management
- 7.4 Concept, scope and practicality of ecosystem-based forest management: closer to nature management
- 7.5 Forest management in Nepal: *Status quo* (Community Forestry, Private Forestry, Leasehold Forestry, Collaborative Forest Management and Scientific Forest Management)

PRACTICALS (10)

Excursion (5): Students will visit nearby appropriate site for observing and understanding: Succession; Ecological effects of forest management practices (e.g., logging) and approaches to mitigating impacts; Effects of silvicultural interventions on forest growth and productivity. Students are required to prepare and submit field report in accordance to instruction of the tour-in-charge.

Exercise (5): Students in groups will carry out assessment of forest management plans to assess effectiveness, opportunities and issues. Students are required to prepare report and make presentation among the students.

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Course Title: **CONSERVATION AND RURAL DEVELOPMENT**

Course Code: SFM 711

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The aim of the course is to enable students to understand concept, theory and relationship between conservation and development and the relationship between natural resources and livelihood of rural people.

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

- Understand concept and theories of rural development.
- Appreciate fundamental concepts and paradigms development with specific reference to rural development.
- Understand diverse issues related to the relations of natural resources and rural development.
- Understand the differences and implications of different actors, contexts, approaches and strategies to rural development.
- Analyze different approaches of rural development programs in Nepal.

UNIT 1: RURAL COMMUNITY AND CHANGING DYNAMICS (8)

- 1.1 Rural context and changing dynamics
- 1.2 Rural communities and complexities
- 1.3 Dimensions of diversity in rural communities
- 1.4 Social exclusion and discrimination in rural communities
- 1.5 Social structure of rural communities (stratification with respect to leadership, class, ethnicity, caste, gender etc.)
- 1.6 Social processes in rural communities i.e. social cohesion/integration/conflict (class, ethnic, caste, gender, etc.)
- 1.7 Community organizations (formal, informal, networks)
- 1.8 Socio-political context of community development

UNIT 2: DEVELOPMENT THEORIES AND APPROACHES (10)

- 2.1 Development theory
 - 2.1.1 Paradigm of development and shifts in development thinking
 - 2.1.2 Trends in development theories
 - 2.1.3 Conservation and development
 - 2.1.4 Concept and evolution of Sustainable Development
 - 2.1.5 Sustainable development goals (SDGs)
- 2.2 Development Approaches
 - 2.2.1 Classical
 - 2.2.2 Populist
 - 2.2.3 Neo-liberal
 - 2.2.4 Livelihood
- 2.3 Theories
 - 2.3.1 Development strategies and poverty alleviation
 - 2.3.2 Dependency theory
 - 2.3.3 Modernization theory
 - 2.3.4 Neo-liberalization
 - 2.3.5 Environmentalism

- 2.3.6 Sustainable development
- 2.3.7 Feminist theory

UNIT 3: ACTORS, CONTEXT AND SUSTAINABLE LIVELIHOOD STRATEGIES (12)

- 3.1 Rural Development Actors
 - 3.1.1 Social structure and relations (gender, class, age, ethnicity)
 - 3.1.2 Institutions (rules and customs, land tenure, market in practice)
 - 3.1.3 Organizations, their policies and practices (governmental, non-governmental, private voluntary, community-based, civil society)
- 3.2 Changing contexts
 - 3.2.1 Socio-economic and political trends (political situation, macro-policies, economic trend)
 - 3.2.2 Natural and social shocks/vulnerability (natural hazards and calamities, political conflicts, diseases/epidemics)
- 3.3 Assets/Resources/Capitals
 - 3.3.1 Human
 - 3.3.2 Social/political
 - 3.3.3 Natural
 - 3.3.4 Physical
 - 3.3.5 Financial
- 3.4 Sustainable livelihoods strategies
 - 3.4.1 Natural resource-based strategies in relation to different types of capitals
 - 3.4.2 Non-natural resource-based Strategies
- 3.5 Sustainable livelihood approaches
 - 3.5.1 Mobilization and building human, natural, social, physical, financial capital
 - 3.5.2 Local resource mobilization (micro-finance, IGA, saving/credit, off-farm employment, enterprise development)
 - 3.5.3 Local institution building (human resource capacity building self-help groups)
 - 3.5.4 Integrated conservation and development project (ICDP) approach
- 3.6 Livelihood Outcomes
 - 3.6.1 Livelihood security (food security, income stability, social inclusion-empowerment)
 - 3.6.2 Environmental sustainability (sustainable natural resources management - agriculture, forestry, water, energy)

UNIT 4: INSTITUTIONAL CHALLENGES FOR RURAL DEVELOPMENT (4)

- 4.1 National policy making and legislation
- 4.2 Good governance at state, province and local level institutions
 - 4.2.1 Compliance to rule of law
 - 4.2.2 Roles and responsibility and accountability
 - 4.2.3 Transparency
 - 4.2.4 Decentralization/devolution
- 4.3 Power balance (representation and participation in decision/policy making)

UNIT 5: POLICIES FOR RURAL DEVELOPMENT (4)

- 5.1 Global issues, local action - the impact of IFIs, conventions, conferences on rural poverty
- 5.2 Decentralization and the role of state/province/local government
- 5.3 National, province and local policymaking, legislation, by laws, plans, programs and the influence of macro-economic policies, plans and programs.

UNIT 6: STRATEGIES AND APPROACHES TO RURAL COMMUNITY DEVELOPMENT (6)

- 6.1 Strategies

- 6.1.1 State (government) led
- 6.1.2 Non-government led
- 6.1.3 Market led
- 6.1.4 Gender
- 6.1.5 Community led (social mobilization, e.g. community forestry)
- 6.2 Approaches
 - 6.2.1 Rights- based approach
 - 6.2.2 Participatory (bottom-up)
 - 6.2.3 Blue print (top-down and conventional development planning)
 - 6.2.4 Dissemination of information technology (extension)
 - 6.2.5 Integrated, holistic, systemic, synergy
 - 6.2.6 Sectoral approach
 - 6.2.7 Indigenous local knowledge and initiatives

UNIT 7: NATURAL RESOURCE MANAGEMENT AND SUSTAINABLE DEVELOPMENT (8)

- 7.1 Management of natural resources and agriculture for rural community development
 - 7.1.1 NRM and RD (e.g. community forestry)
 - 7.1.2 Conservation and development (biodiversity, buffer zone, conservation area)
 - 7.1.3 Agriculture, food security and challenges of RD
 - 7.1.4 Linking political ecology with NRM
 - 7.1.5 Poverty and environment linkage
 - 7.1.6 Agroforestry
 - 7.1.7 Livestock/fishery/farm-fodder linkages
 - 7.1.8 Ecotourism and RD
 - 7.1.9 Climate change and new challenges of RD
- 7.2 NRM linkage
 - 7.2.1 Sustainable agriculture identification/rural productivity and natural resource use
 - 7.2.2 Agriculture-environment-poverty nexus
 - 7.2.3 Population and resources
 - 7.2.4 Rural - urban linkages

PRACTICALS (8)

Excursions (8): Students will visit the nearby sites to study biodiversity- based livelihood program, in-situ conservation of agro-biodiversity, watershed management project, ICDP project and community-based natural resource management. Students will prepare, present and submit the field reports of each field exercise conducted during the excursions.

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Course Title: **CONFLICT MANAGEMENT IN NRM**

Course Code: SFM 712

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course aims at building the capacity of students to plan and manage natural resources in an area where conflicts exist.

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

- Understand the concept, theory and dimensions of conflicts.
- Learn knowledge and skills for managing natural resources effectively.
- Develop well-articulated views on policy towards conflict management.

UNIT 1: INTRODUCTION (8)

- 1.1 Concept and theory of conflict
- 1.2 Examining the history of conflict
- 1.3 Type of conflict
- 1.4 Level of conflict
- 1.5 Characteristics and dynamics of conflict
- 1.6 Causes of conflict (Historical and ongoing– ethnicity, religious, uneven development, problem of representation, exploitation and exclusion, competition for resources, environmental degradation)
- 1.7 Impact of conflict

UNIT 2: THEORY OF CONFLICT MANAGEMENT (10)

- 2.1 Concept of conflict management
- 2.2 Conflict Resolution School
- 2.3 Complementary School
- 2.4 Conflict Transformation School

UNIT 3: UNDERSTANDING CONFLICT IN NRM (10)

- 3.1 Concept of natural resource conflicts (Introduction, types, trends, issues, causes consequences)
- 3.2 Perspectives on the relationship between natural resources and conflict (resource scarcity hypothesis, resource abundance and resource curse hypothesis and resource distribution hypothesis)
- 3.3 Nature and types of natural resource conflicts (land, water, forest)
- 3.4 Issues of conflicts in governing natural resources in Nepal
 - 3.4.1 Population - Environment - Poverty Linkage
 - 3.4.2 Social dimensions of conflicts in NRM (poverty, gender, governance aspects)
 - 3.4.3 Local, sub-national, national and global
- 3.5 Natural resource management policies (review of acts and regulations related to NRM), sources and arenas of conflicts
- 3.6 Case analyses of conflicts in NRM (Global, regional national and local)

UNIT 4: CONFLICT ANALYSIS APPROACH (10)

- 4.1 Conflict dynamics approach

- 4.1.1 Basic need approach
- 4.1.2 Rational calculation approach
- 4.1.3 Triple R and Triple M approach
- 4.2 Conflict mapping techniques
- 4.3 Public participation: theory and practice
- 4.4 Stakeholder relationships
 - 4.4.1 Identification of stakeholder and their interest
 - 4.4.2 Exploring stakeholder power and relations

UNIT 5: CONFLICT MANAGEMENT (8)

- 5.1 Basic principle of managing conflict
- 5.2 Conflict resolution
- 5.3 Conflict management strategies
 - 5.3.1 Compromise
 - 5.3.2 Force
 - 5.3.3 Collaboration
 - 5.3.4 Withdrawal
 - 5.3.5 Consensus
 - 5.3.6 Accommodation
- 5.4 Indigenous and traditional mechanisms for conflict resolution
- 5.5 Role of mediation in conflict management

UNIT 6: PARTNERSHIP BUILDING AND GOVERNANCE FOR CONFLICT MANAGEMENT (6)

- 6.1 Role of partnership building and governance for conflict management
- 6.2 Application of governance models in conflict management
 - 6.2.1 Rule of law
 - 6.2.2 Participation
 - 6.2.3 Transparency
- 6.3 Actors, agencies and organizations in natural resource based interactions and conflicts

PRACTICALS (8)

Excursion (4): Students will visit the nearby site to study the conflict in natural resources such as water, land and forests.

Group exercise and presentation (4): Based on the knowledge gained during the excursion, students will analyze the conflicts related to natural resources and make presentation of the findings among the students and faculties.

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Course Title: **WILDLIFE BIOLOGY AND ECOLOGY**

Course Code: PWM 713

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory 60, Internal Assessment: 15)

General objective: The aim of the course is to make students understand the biology of wildlife species, their better management, the ecology and adaptation of different species and their niche they occupy in the ecosystem.

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

- Acquire knowledge on habitat, diet and nutritional requirements of various wildlife.
- Understand the adaptation of different species in the niche they occupy within the ecosystem.
- Understand wildlife health management for conservation purposes.

UNIT 1: INTRODUCTION TO WILDLIFE BIOLOGY AND ECOLOGY (4)

- 1.1 Concept and principle of wildlife biology
- 1.2 Animal adaptations in zoo-geography of Nepal
- 1.3 Niche theory
- 1.4 Concept of wildlife ecology

UNIT 2: ANIMAL BEHAVIORAL ECOLOGY (6)

- 2.1 Definition and scope of behavior ecology
- 2.2 Feeding ecology of herbivores, carnivores, insectivores and omnivores
- 2.3 Movement and ranging pattern of wildlife
- 2.4 Reproductive ecology
- 2.5 Habitat specialists/generalists
- 2.6 Habitat selection and preference
- 2.7 Animal migration and dispersion

UNIT 3: ANIMAL POPULATION ECOLOGY (6)

- 3.1 Definition and scope
- 3.2 Population size and vital rates
- 3.3 Population growth: Lotka-Volterra model
- 3.4 Social structure and composition
- 3.5 Population dynamics
- 3.6 Life history traits

UNIT 4: SPATIAL ECOLOGY (6)

- 4.1 Definition and scope
- 4.2 Effect of spatial variation on species and ecosystem
- 4.3 Relevance of spatial ecology to conservation
- 4.4 Concept of home range and territory
- 4.5 Temporal and spatial variation in food resources
- 4.6 Concept of carrying capacity

UNIT 5: BIOLOGY OF SPECIES (6)

- 5.1 General introduction of protected species (DNPWC)
- 5.2 Biology of some protected mammals, birds and reptiles of Nepal (nomenclature, morphology, habitat, special characters, behavior, threats and conservation measures)

UNIT 6: WILDLIFE HEALTH (5)

- 6.1 Wildlife disease in Nepal
- 6.2 Wildlife health monitoring and evaluation (Problems and solutions)
- 6.3 Ecology of diseases and maintenance of infection
- 6.4 Infectious and non-infectious diseases of wild animals

UNIT 7: WILDLIFE DISTRIBUTION AND ADAPTATION IN HIGH ALTITUDES (6)

- 7.1 High altitude environment: low air pressure, cold temperature, atmospheric aridity, high wind velocity, light (solar insolation), snow cover, biotic factors, local condition and micro-climate, valleys, seasonality
- 7.2 Biogeographical affinities
- 7.3 High altitude mammals and bird's distribution and diversity
- 7.4 Wildlife depletion in the Himalayas (Anthropogenic and climatic stress)
- 7.5 Need for conservation
- 7.6 High altitude adaptations
 - a) Structural (morphological) adaptations
 - b) Functional (physiological) adaptations
 - c) Behavioral (ethological) adaptation

UNIT 8: WILDLIFE DISTRIBUTION AND ADAPTATION IN LOW ALTITUDES (6)

- 8.1 Low altitude environment: rainfall, flood, humidity, wind velocity, temperature, biotic factors, frost
- 8.2 Biogeographic affinities
- 8.3 Low land mammals and bird's distribution and diversity
- 8.4 Wildlife depletion in the low land (Anthropogenic stress and climatic stress)
- 8.5 Need for conservation
- 8.6 Low land adaptations
 - a) Structural (morphological) adaptations
 - b) Functional (physiological) adaptations
 - c) Behavioral (ethological) adaptation

PRACTICALS (15)

Field Exercises (15)

- Post mortem examination to see the condition of dead animal (3)
- Study of behavior of selected animals in and around campus premises or nearby forests (4)
- Visit to any protected area (high altitude/low altitude) to explore adaptation of animals and the problem for conservation of wild animals in the area to study habitat loss and degraded sites (8)

All students will prepare, submit and present report on each exercise for evaluation by the instructor.

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Course Title: **CONSERVATION BIOLOGY**

Course Code: PWM 714

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The aim of the course is to make students understand the field of conservation biology and enable them to make conservation decisions of local, national and international concern.

Specific objectives: After the successful completion of this course students will be able to:

- Understand the major approaches to conservation, including their differences and common threats.
- Demonstrate an understanding of the ecological principles upon which conservation are based.
- Understand how ecological principles are currently applied in conservation.
- Appreciate understanding of the social, political and economic factors that affect conservation.
- Demonstrate an understanding of basic conservation biology issues.

UNIT 1: INTRODUCTION TO CONSERVATION BIOLOGY (4)

- 1.1 Earth history and changes in species distributions
- 1.2 Conservation biology and its scope
- 1.3 Theory and concept of conservation biology
- 1.4 Global biodiversity
- 1.5 Conservation values and ethics
- 1.6 Ecological economics and nature conservation
- 1.7 Terminology (umbrella species, flagship species, key stone species, etc.)

UNIT 2: THREATS TO BIODIVERSITY AND ITS CONSEQUENCES (6)

- 2.1 Human population growth and its impact
- 2.2 Habitat fragmentation, degradation and loss
- 2.3 Global climate change
- 2.4 Overexploitation (harvest models)
- 2.5 Invasive species and disease
- 2.6 Consequences of biodiversity loss
 - 2.6.1 Biodiversity and ecosystem functioning
 - 2.6.2 Biodiversity and ecosystem services
 - 2.6.3 Biodiversity valuation

UNIT 3: EVOLUTION AND EXTINCTION (5)

- 3.1 Evolutionary aspects of diversity
- 3.2 Speciation and evolution measures of diversity
- 3.3 Overexploitation, habitat destruction and extinction
- 3.4 Geological patterns of extinction
- 3.5 Current patterns of extinction
- 3.6 Colonization and extinction
- 3.7 Extirpation (local extinction)
- 3.8 Global climate change and extinction

UNIT 4: ASSESSING BIODIVERSITY (5)

- 4.1 The nature and function of biological diversity
- 4.2 Distribution and measuring of biodiversity (Shannon Wiener Index, Simpson Index)
- 4.3 Ecological economics of biodiversity, keystone species and resources (Direct use value, indirect use value and ethical value)

UNIT 5: CONSERVATION GENETICS (7)

- 5.1 Basic genetics review
- 5.2 Evolution and Population genetics
- 5.3 Heterozygosity and inbreeding
- 5.4 Genetic models in conservation
- 5.5 Reproductive molecular characterization
- 5.6 Planned genetic breeding
- 5.7 Establishment of gene bank and germplasm preservation
- 5.8 Molecular Markers; DNA and Protein Profiling
- 5.9 Wildlife forensics, bio-safety and bio-prospecting

UNIT 6: POPULATION BIOLOGY IN CONSERVATION (8)

- 6.1 Basic population growth models
- 6.2 Stochasticity and population decline
- 6.3 Social effects of population decline
- 6.4 Population viability and habitat analysis (PVHA)
- 6.5 Metapopulation analysis
- 6.6 Problems of small populations
- 6.7 Applied population biology
- 6.8 Establishing new populations
- 6.9 Ex-situ conservation strategies

UNIT 7: APPROACHES TO SOLVING CONSERVATION PROBLEMS (10)

- 7.1 Restoration ecology (principle, aim and practices)
- 7.2 Species, ecosystem and landscape approaches to conservation
- 7.3 Protected areas (establishing protected areas, designing networks of protected areas, managing protected areas)
- 7.4 Restoration of damaged ecosystems and endangered populations
- 7.5 Significance of ecological restoration in conservation.
- 7.6 Wildlife species recovery program: rhino, tiger, Gharial, swamp deer, wild water buffalo, black buck, vulture, etc.
- 7.7 Conservation outside the protected areas
- 7.8 Role of zoos, zoological gardens and botanic gardens in conservation
- 7.9 The integration of conservation science and policy
- 7.10 Government actions, conservation programs and international approaches in Nepal

UNIT 8: CONSERVATION AND HUMAN SOCIETIES (5)

- 8.1 Conservation for whom?
- 8.2 Conservation in human-modified landscapes
- 8.3 Political ecology of community-based biodiversity conservation approaches
- 8.4 Conservation and sustainable development at the local and national levels
- 8.5 An international approach to conservation and sustainable development

PRACTICALS (10)

Field Exercise (5): Students will visit nearest sites for identification of threats on biological diversity of local habitat, measuring and valuing biodiversity functioning and services, and molecular lab for genetic study. Each student will prepare separate report for each visit and submit for evaluation in prescribed format.

Group work (5): Students will study the case of protected area and landscape conservation models within Nepal, and conservation projects. Students will evaluate the conservation projects and make presentation of their findings among students and faculties. The students will also submit the case study report of the instructor for evaluation.

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Course Title: **POLITICAL ECOLOGY**

Course Code: SFM 715

Credit Hours: 3

Lecture Hours: 60

Full Mark: 75 (Theory: 60, Internal Assessment: 15)

General objective: The aim of the course is to introduce students to the field of political ecology and provide students a working fluency in materialist and post-structural approaches to issues of environmental politics, policy and management.

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

- Understand the concept of political ecology and trace its theoretical foundation with evolution.
- Provide an alternative explanation to the changing dynamics of human-society relations and the escalating issue of environmental degradation and differential impacts.
- Explain the challenges, problems and potential solutions within the political ecology approach.
- Examine cases of resource management and governance through political ecological perspective.

UNIT 1: ORIGIN AND CONCEPTS OF POLITICAL ECOLOGY (8)

- 1.1 Political ecology overview: concept, theoretical foundation
- 1.2 Alternative explanation to environmental degradation and consequences – political explanation to the environmental issues
- 1.3 Science/ecology in political ecology
- 1.4 Environmental science in political ecology
- 1.5 Himalayan political ecology
- 1.6 Eastern philosophy of political ecology

UNIT 2: POWER, POLITICS, SOCIAL CHANGE (8)

- 2.1 Power, representation and subjectivity
- 2.2 Theorizing power in political ecology
- 2.3 Power theories in political ecology
- 2.4 Power relation and its influence in NR policy making process
- 2.5 Knowledge/power nexus
- 2.6 Situated knowledges
- 2.7 Feminist perspective to power
- 2.8 Methodological precautions

UNIT 3: KEY THEME AND CORE CONCEPTS (6)

- 3.1 Colonialism and struggles over resources and representations
- 3.2 Discourses and production of nature
- 3.3 Privatization and Neoliberal conservation
- 3.4 Epistemology
- 3.5 Urban political ecology

UNIT 4: PROPERTY RELATIONS AND ARRANGEMENTS (6)

- 4.1 Common property resources
- 4.2 Property rights and private property
- 4.3 Community based forest management context in Nepal
- 4.4 Conservation of biodiversity and livelihoods

UNIT 5: POLITICAL ECOLOGY IN NEPAL FROM THE CONCEPT OF: (12)

- 5.1 Gender and feminist political ecology
- 5.2 PE and livelihood
- 5.3 Local ecological knowledge
- 5.4 Neoliberalisms
- 5.5 Climate change adaptation
- 5.6 Global environmental governance
- 5.7 Adapting to uncertainty building resilience
- 5.8 Science and technological studies and political ecology
- 5.9 Community-based conservation/natural resource management
- 5.10 Politics of community based participation
- 5.11 The promise and peril of participation methods/research
- 5.12 Agrarian political ecology
- 5.13 Political ecology in the Himalayas

UNIT 6: POLITICAL ECOLOGY IN PRACTICE (12)

- 6.1 Global commodities: contemporary land governance debates
- 6.2 Forest, water access and governance
- 6.3 Energy transitions
- 6.4 Infrastructure in the era of climate change
- 6.5 Adaptation: how can cities be climate-proofed?
- 6.6 Harder and softer paths
- 6.7 Biodiversity conservation
- 6.8 Top down vs. bottom up
- 6.9 State- vs. market-based

PRACTICALS (8)

Term Paper (8): Each student will be assigned the case study of biodiversity conservation, forest management and water resource management approach from the political ecology perspective to prepare a term paper. Each student will prepare and submit the term paper for evaluation by the instructor, and also present among the students and faculty.

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Course Title: **POLICY ANALYSIS AND FOREST TENURE REFORM IN NRM**

Course Code: SFM 716

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course aims to enhance the understanding of students on concept and practices of forest tenure reform in Nepal and the politics of policy process. Moreover, it will develop students' theoretical and practical knowledge on transfer of rights and its outcomes.

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

- Understand the concept and practices of policy analysis and forest tenure reform.
- Understand and analyze the politics of policy process.
- Understand and analyze the drivers and dynamics of forest tenure reform process.
- Understand the roles of institutions including social movements on forest tenure reform especially devolution of rights.
- Examine the outcomes of forest tenure reform in Nepal: ecological, social and economic.

UNIT 1: INTRODUCTION (12)

- 1.1 Definition and concept of policy and policy analysis
- 1.2 Importance of policy in shaping forest management outcomes
- 1.3 Evolution of forest policy in Nepal
 - 1.3.1 Centralised era up until 1970s
 - 1.3.2 Participatory and community- based approaches since 1980s
 - 1.3.3 Forest policy within Federal Nepal
- 1.4 Politics of policy process and its practical implications
 - 1.4.1 How power and knowledge shape policy agenda?
 - 1.4.2 How policies are translated into practices
 - 1.4.3 Policy in paper vs. policy in practice
- 1.5 Science and art of designing better policies
- 1.6 Policy analysis method
 - 1.6.1 Historical analysis
 - 1.6.2 Distributional justice: e.g. tax and subsidy
 - 1.6.3 Cost-benefit analysis
 - 1.6.4 Policy matrix
 - 1.6.5 Case studies on impacts

UNIT 2: FOREST TENURE AND TENURE SECURITY (10)

- 2.1 Concept and definition of forest tenure
- 2.2 Domains of tenure security
- 2.3 Principles, indicators and verifiers of forest tenure
- 2.4 State of forest tenure reform in global south
- 2.5 Evolution of forest tenure reform in Nepal
- 2.6 Existing tenure regimes in Nepal (Community Forestry, Collaborative Forest Management, Pro-Poor Leasehold Forestry, Buffer Zone Community Forestry, conservation areas, private forests, High Altitude Rangelands)

UNIT 3: THE TRANSFER OF FOREST RIGHTS (6)

- 3.1 Devolution of rights and management of community forests
- 3.2 From discourses to policy: the practical interface of legal and customary land and forest rights
- 3.3 Forest tenure and emerging global concern

UNIT 4: FOREST GOVERNANCE AND TENURE (8)

- 4.1 Principles of forest governance
- 4.2 Power dynamics under various tenure arrangements
 - 4.2.1 Relation between community and the state
 - 4.2.2 Power dynamics between communities
 - 4.2.3 Power dynamics within communities
- 4.3 Community networks and collective actions
- 4.4 Tenure reform and REDD+

UNIT 5: TENURE REFORM AND INSTITUTIONAL TRANSFORMATION (8)

- 5.1 Tenure reform and institutional transformation: bureaucratic, community, development partners, CSOs and private sector
- 5.2 Social heterogeneity and elite capture
- 5.3 Gender and social inclusion and forest tenure
- 5.4 Tenure reform in market context: subsistence to commercial exploitation, trade and enterprise
- 5.5 Tenure reform and civic movements

UNIT 6: OUTCOMES OF FOREST TENURE REFORM (6)

- 6.1 Ecological outcomes
- 6.2 Economic outcomes
- 6.3 Social and Institutional outcomes

PRACTICALS (10)

Case Study 1 (5): Students will conduct case study on current scenario, existing tenure arrangement and contestations on different tenure regimes. Students will submit the reports of the case studies to the responsible faculty for evaluation and present among the students and faculty.

Case Study 2 (5): Students will develop cases on different tenure regimes with each regime assigned to each group of students. Each group will prepare, submit and present the case study report among the students and faculties.

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Course Title: **MOUNTAIN PHYSICAL DIMENSION**

Course Code: WME 717

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course provides fundamental concept on how physical processes play role on evolution of mountains, present status of mountains and shaping their environment as well as challenges and opportunities generated by combination of physical processes for mountain development.

Specific objectives: After the completion of this course, students will be able to:

- Build fundamental concept understanding on mountain evolution through geological time.
- Understand geological and geomorphological processes of mountains.
- Develop knowledge on geological and hydro-meteorological hazards.
- Gather knowledge relating geological processes with mountain ecosystem.
- Gain knowledge on basic techniques for characterization of mountain physical processes.

UNIT 1: FUNDAMENTALS OF GEOLOGY (6)

- 1.1 Rock types
- 1.2 Constituents of rocks
- 1.3 Geological structures
- 1.4 Geological time scale

UNIT 2: MOUNTAIN EVOLUTION (8)

- 2.1 Dynamic earth and its internal structure
- 2.2 Plate tectonics
- 2.3 Mountain building processes
- 2.4 Characteristics of world mountains

UNIT 3: GEOLOGICAL AND GEOMORPHOLOGICAL PROCESSES IN MOUNTAINS (9)

- 3.1 Glacial processes
- 3.2 Fluvial processes
- 3.3 Aeolian processes
- 3.4 Igneous processes
- 3.5 Climate influence on geological processes shaping mountain environment
- 3.6 Role of processes in aggradation and degradation of mountains

UNIT 4: WORLD MOUNTAINS AND THEIR LANDFORMS CHARACTERISTICS (5)

- 4.1 Geological and physiographic settings of mountains of Asian, European, African, North and South American and Antarctica continents,
- 4.2 Characterization of HKH region

UNIT 5: GEOLOGICAL AND HYDRO-METEOROLOGICAL HAZARD (6)

- 5.1 Origin and types, and controlling factors
- 5.2 Impacts of hazards in mountain environment and mountain development
- 5.3 Cascading effects of hazards in mountains
- 5.4 Hazard, risk and vulnerability assessment

UNIT 6: RELATIONSHIP OF GEOLOGICAL PROCESSES SHAPING MOUNTAIN ECOSYSTEMS AND BIODIVERSITY (6)

- 6.1 Critical zone processes and their role in mountain environment
- 6.2 Bedrock geology and mountain ecosystem and landscape evolution
- 6.3 Abiotic environment and species richness

PRACTICALS (20)

Field exercise tour (12): Students will spend at least three days in nearby appropriate site for fieldwork to perform following task as instructed by tour-in-charge /course coordinator:

- Identification and understanding of rocks in hand specimen,
- Understanding of geological time scale, geological processes, critical zone processes, hazards and mountain evolution,
- Interpretation of processes transferring fluxes from abiotic to biotic environment, and
- Characterization of geological, hydro-meteorological hazards in the mountain.

Lab work, report writing and presentation (8): After fieldwork, each student will perform following tasks to prepare report, and make presentation as instructed by Tour in Charge /Course Coordinator:

- Preparation of cross-section from topographic map
- Use of geological maps of different mountainous regions
- Preparation of maps linking geology, geomorphology and ecology conditions
- Preparation of different types of maps relating current physical processes in mountains.

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Course Title: **HUMAN AND INSTITUTIONAL DIMENSIONS IN MOUNTAINS**

Course Code: SFM 718

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75(Theory: 60, Internal assessment: 15)

General objective: This course aims to make students understand the theories behind the human dimensions of mountain environmental changes.

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

- Understand population as the key human driving factor in mountains.
- Identify with relevant theoretical frameworks of mountain-human relations.
- Elaborate the key human driving factors in mountain environment.
- Explain the societal responses to changes in mountain environment.
- Discuss the human dimensions of key mountain environmental issues.
- Explain institutional and policies on mountain development.

UNIT 1: POPULATION AS THE KEY HUMAN DRIVING FORCE FOR MOUNTAIN CHANGE (6)

- 1.1 Malthus theory and Neo-Malthusians (Hardin, Erlich, Julian Simon, Club of Rome)
- 1.2 Nepal Neo-Malthusian Influence: Himalayan Theory of Environmental Degradation
- 1.3 Challenges to Malthusianism: Esterup, Ostrom, DTM, IPAT/IPATIC
- 1.4 Nepal mountain population change (1775-2011, patterns, depopulation, migration)

UNIT 2: THEORETICAL FRAMEWORKS OF MOUNTAIN-HUMAN RELATIONS (4)

- 2.1 Definitions and Nepal examples
- 2.2 Environmental Determinism, Human Ecology, Social Ecology, Cultural Ecology
- 2.3 Political Ecology, Political Economy, Feminist Political Ecology, Liberation Ecology, Discourse Theory

UNIT 3: MOUNTAIN HUMAN DRIVING FACTORS (12)

- 3.1 Poverty (subsistence agriculture, livelihoods, farming systems, small holdings)
- 3.2 Development (Development theory and economic growth, modernization, globalization, sustainable mountain development)
- 3.3 Technology (productive mountain technologies like potato, ploughing, terracing; green revolution, GMO, infrastructure and road access, external development/knowledge)
- 3.4 Institutions (traditional institutions like Kipat, Mana-paathi, community forestry, legal frameworks and national policies, international environmental conventions)
- 3.5 Culture (eastern vs western environmental ethics, animism, Hindu and Buddhist ecologies, religious forests, social capital, indigenous traditional knowledge (ITK))

UNIT 4: SOCIETAL RESPONSES TO MOUNTAIN ENVIRONMENTAL CHANGES (10)

- 4.1 Rational Choice Theory, bounded rationality of human decision makers
- 4.2 Hazards school: hazards, risks, adaptation, resilience, vulnerabilities
- 4.3 Mountain hazards and risks and societal responses to environmental changes
- 4.4 Mountain specificities and mountain development, NAPA/LAPA/KAPA, etc.
- 4.5 Sustainable mountain development, green economy and institutional frameworks

UNIT 5: INSTITUTIONAL ANALYSIS AND DEVELOPMENT (5)

- 5.1 Concept

- 5.2 Types of institutions
- 5.3 Importance of institutions
- 5.4 Explanation of policies: institutions vs. actors
- 5.5 Institutionalism in political studies / political economics

UNIT 6: INSTITUTIONS FOR SUSTAINABLE DEVELOPMENT IN MOUNTAIN REGIONS (5)

- 6.1 Institutions at the global level
- 6.2 Institutions at the regional level
- 6.3 Institutions at the national and sub- national level
- 6.4 Local level
- 6.5 Regional cooperation for mountain development in the HKH region

UNIT 7: POLICIES FOR MOUNTAIN DEVELOPMENT (6)

- 7.1 Policy formulation and revision related to mountain development
- 7.2 Key policy principals for sustainable mountain development
- 7.3 Key policy issues for sustainable mountain development
- 7.4 Why policies and instruments for mountain development?
- 7.5 International and national policies for mountain development (Agenda 21, IYM)
- 7.6 Environmental and natural resource policies and laws in the HKH

UNIT 8: CASE STUDY AND REFLECTION (4)

- 8.1 Case study of migration in the Hindu Kush Himalaya: drivers, consequences and governance
- 8.2 Institutional analysis
- 8.3 Analysis of policies and institutions for mountain development
- 8.4 Lessons and best practices

PRACTICALS (8)

Field excursion (4): Students will visit the nearby sites in the midhills (Kakani or Jhikhu Khola watershed in Panchkhal) to study population increase, erosion and terai floods with reference to data from Eric Eckholm (1976), Losing Ground and Jack Ives and Bruno Messerli (1989) *The Himalayan Dilemma*. After the field visit, students will submit the report in the standard format for evaluation.

Term paper (4): Each student will be assigned a term paper that may include forest change in the Himalayas, reviewing the Forest Censuses of 1964, LRMP (1978), NFI (1994) and FRA (2015) and other similar studies, concentrating on forest and tree change, the numbers, the methodology and human dimensions

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Course Title: **FOREST GOVERNANCE AND COMMUNITY FORESTRY**

Course Code: SFM 751

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course aims to enhance students' understanding of concept and theory of community-based forest management. Moreover, the course is designed to enhance students' understanding of principles and issues related to community-based forest management planning and implementation, and skills in the promotion and facilitation of community forestry processes as well.

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

- Understand the theory of common property resources.
- Understand the emergence of community forestry in the context of Nepal.
- Recognize the challenges in community forestry.
- Appreciate community-based forest management and good governance.

UNIT 1: CONCEPT AND ISSUES (8)

- 1.1 Common property resources: Concept
- 1.2 Theory of common property resource governance (Hardin, Ostrom, Agrawal)
- 1.3 Government forest management in Nepal
- 1.4 Community-based forest management in Nepal (different models)
- 1.5 Private forestry in Nepal

UNIT 2: FOREST GOVERNANCE (8)

- 2.1 Governance (concept and principle of good governance) and linkage with forestry
- 2.2 Concept and principle of forest governance
- 2.3 History of forest governance and administration (global, regional and national)
- 2.4 Concept, practice and issues of forest governance in Nepal
 - 2.4.1 Government managed forestry
 - 2.4.2 Community-based forestry
 - 2.4.3 Private forestry
- 2.5 Institutional perspective of forest management in Nepal

UNIT 3: DECENTRALIZATION IN FOREST GOVERNANCE (7)

- 3.1 Forest governance in Nepal
 - 3.1.1 Status, roles and responsibilities in three level of Government
 - 3.1.2 Challenges of decentralization in forest governance and its solutions
- 3.2 Localization, delocalization and its effect on forest governance
- 3.3 Decentralization and its various forms (conceptual framework)
- 3.4 Decentralization in forestry sector (trends in global, regional and national context)
- 3.5 Policies in decentralization (Decentralization Acts 2039, Forest Act 2049, Forest Policy 2071, Local Government Act 2075)
- 3.6 Linkage of forest decentralization with forest governance
- 3.7 Case analysis of forest governance model

UNIT 4: INSTITUTIONAL DYNAMICS OF FOREST GOVERNANCE IN NEPAL (8)

- 4.1 Institutions governing forest governance (identification, roles and contestation)
- 4.2 Shift in forest administration in changing context
- 4.3 Local group dynamics and its effect on forest governance

- 4.4 Role of different institutions in forestry sector (national, province and local)

UNIT 5: COMMUNITY FORESTRY IN REGIONAL AND GLOBAL CONTEXT (3)

- 5.1 Community forestry policy and practices from Asia/Africa/South America
5.2 Global climate change, local community and community forestry
5.3 Contribution of community forestry to global environment

UNIT 6: COMMUNITY FORESTRY IN NEPAL (10)

- 6.1 Evolution of community forestry in Nepal
6.1.1 Privatization, nationalization and participatory approaches in forestry
6.1.2 Basic premises of community forestry (use right and equity)
6.1.3 Challenges in community forestry (case studies from mid-hills and Terai focusing on conflicts at national and local level)
6.2 Stakeholders (government, non-government, civil society and private sector) in community forestry
6.3 Stakeholder analysis (role, responsibilities, authorities, accountability and effectiveness)

UNIT 7: COMMUNITY FOREST GOVERNANCE OUTCOMES (12)

- 7.1 Evolution and development of different community-based forest management regime
7.2 Forest management for livelihood and community development
7.3 Socio-economic and institutional empowerment
7.4 Climate change and ecosystem services
7.5 Disaster management
7.6 Commercialization and entrepreneurship development

PRACTICALS (4)

Term paper (4): Each student will be assigned a term paper based on secondary literature. The term paper should be presented among the students and faculties.

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Course Title: **ECO-TOURISM PLANNING AND MANAGEMENT**

Course Code: PWM 752

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The overall objective of this course is to build up the capacity of the students to plan and manage the tourism and recreation activities in natural areas without damaging the natural and cultural environment for the benefits of communities.

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

- Understand the philosophy, concept and evolution of eco-tourism.
- Overview the different tourism development models at destination, region and national level.
- Identify ecotourism potential and mobilise resources for ecotourism planning and management for biodiversity conservation and sustainable community development.
- Assess and manage social, economic and environmental impacts of eco-tourism.

UNIT 1: INTRODUCTION TO ECOTOURISM (6)

- 1.1 Definitions, scope and typologies of ecotourism
- 1.2 Evolution of ecotourism and sustainable tourism
- 1.3 Principles and characteristics of eco-tourism
 - 1.3.1 Eco-tourism as responsible tourism and its concept and practice by stakeholders
 - 1.3.2 Role of codes of ethics for responsible tourism development.
 - 1.3.3 Responsible tourism guidelines: Global Code of Ethics for Tourism (GCET).
 - 1.3.4 Codes of Conduct manual (CoC) and Corporate Social Responsibility (CSR) guidelines as destination level.

UNIT 2: STATUS, TREND AND DEVELOPMENT OF TOURISM (5)

- 2.1 Status of ecotourism in the world and Nepal
- 2.2 Tourism and ecotourism: Trends, issues and challenge
- 2.3 Quebec declaration and Oslo statement on ecotourism
- 2.4 Globalization of ecotourism: Asian and regional ecotourism practice, initiatives and joint projects
- 2.5 Case studies of international, regional and national ecotourism projects.

UNIT 3: ECOTOURISM POLICY AND ORGANIZATIONS (5)

- 3.1 Concept of tourism and ecotourism organizations
- 3.2 Organization policy versus tourism policy: global and national
- 3.3 Role of ecotourism promotion: UNWTO, TIES and ETS, NTB, DNPWC, NTC and local organizations (GOs, NGO, CBO, homestay program) and other stakeholders.

UNIT 4: ECONOMICS OF ECOTOURISM (10)

- 4.1 Demand and supply aspect of ecotourism: concept, determinants and elasticity.
- 4.2 Economic contribution of ecotourism: locally, nationally and internationally
- 4.3 Direct, indirect and induced economic effects of ecotourism
- 4.4 TQM (Total quality management) of ecotourism destination, products and services
- 4.5 Economic tools to assess ecotourism
 - 4.5.1 Demand analysis: WTP and WTA, travel cost and contingency valuation method.
 - 4.5.2 Measures of ecotourism impact: Contribution to GDP, income and employment generation, multiplier effect and leakage

- 4.5.3. Economic valuation of tourism resources (protected areas and wildlife centers):
travel cost method, contingent valuation method)

UNIT 5: ECOTOURISM AND THE ENVIRONMENT (6)

- 5.1 Roots of conservation and community development.
- 5.2 Biodiversity conservation and ecotourism (ecosystem management protected areas)
- 5.3 Linkage of ecotourism with biodiversity conservation and sustainable development
- 5.4 Limitations within the ecotourism destination with dos and don'ts.

UNIT 6: ECOTOURISM PLANNING AND MANAGEMENT (10)

- 6.1 Concept of sustainable ecotourism planning: UNWTO model; philosophy of IBPES – ‘Nature’s contribution to people’ emphasizing on nature based tourism directly related to wildlife management and conservation
- 6.2 Ecotourism potentials (resources): natural, social cultural and physical resources, local capacity and capitals
- 6.3 Ecotourism destination: issues, limitations, alternatives and role of local stakeholders.
- 6.4 Tourism development model: Lewis, Turner, Butlers' and McDonald model
- 6.5 Tourism Area Life Cycle (TALC), Limits of Acceptable Change (LAC), Visitor Impact Management (VIM) and Carrying Capacity at destination level.
- 6.6 Participatory tools for ecotourism planning: SWOT, ZOPP, APPA and SOAR

UNIT 7: MARKETING OF ECOTOURISM (6)

- 7.1 Concept of ecotourism products and their marketing
- 7.2 Marketing mix of ecotourism: features and strategies
- 7.3 Eco-branding and eco-labeling of ecotourism product
- 7.4 Promotional activities of eco-destination: means and practice of local, national and international stakeholders.

PRACTICALS (12)

Field visit and exercise (12): A field study will be conducted to cover the following aspects:

- Visitor's survey to understand attitude, satisfaction, WTP and WTA.
- Host community survey to analyze socio-cultural and economic effect and local benefits.
- Sustainable tourism planning using WTO model, ZOPP and APPA methods.
- Develop the strategies and programs for eco-tourism destination management plan.

After the completion of the field visit, students are required to submit the report covering the above aspects in prescribed format for evaluation by the instructor.

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Course Title: **NATURAL RESOURCE ECONOMICS**

Course Code: SFM 753

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course will provide the students with knowledge of resource economics and enable them to utilize the theory and tools of economics for the management of natural resources.

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

- Understand the concept of neo-classical economics and economic incentive instruments.
- Conduct economic valuation of natural resources.
- Gain in-depth understanding of sustainability and sustainability approaches.
- Identify solutions for biodiversity finance.

UNIT 1: INTRODUCTION (6)

- 1.1 Neo-classical economics
- 1.2 Meaning of natural resource economics
- 1.3 Concept of externalities (market efficiency and market failure)
- 1.4 Management of the commons (Tragedy of commons, Prisoner's dilemma and Ostrom's revolution)

UNIT 2: ENVIRONMENTAL POLICY ANALYSIS (12)

- 2.1 Criteria for evaluating environmental policies
- 2.2 Institutional approaches to facilitate internalization of externalities (Liability rules, Property rights approach)
- 2.3 Command and control strategies
- 2.4 Economic incentive (market based) instruments (Pivouvian tax, subsidy, Transferrable emissions permit)

UNIT 3: ENVIRONMENTAL ECONOMICS ANALYSIS (12)

- 3.1 Benefits-cost analysis
- 3.2 Concept of Total economic value
- 3.3 Importance of the valuation of ecosystem services
- 3.4 Benefits estimation
 - 3.4.1 Market approach (Market price method, Production function, Replacement/Avoided damage cost)
 - 3.4.2 Revealed preference approach (Hedonic price method, Travel cost method)
 - 3.4.3 Stated Preference Approach (Contingent valuation, Choice experiment)
 - 3.4.4 Valuation of timberland

UNIT 4: ENVIRONMENT AND SUSTAINABLE DEVELOPMENT (10)

- 4.1 Concept of sustainability: Weak and strong sustainability.
- 4.2 Sustainability rules: Hartwick approach, London School approach, safe minimum standard approach, Harman Daly's operational principles
- 4.3 Sustainable accounting (Green accounting): Integrated Environmental and Economic Accounting (IEEA)
- 4.4 Concept of green economy
- 4.5 Maximum sustained yield

UNIT 5: SUSTAINABLE FINANCING OF BIODIVERSITY CONSERVATION (8)

- 5.1 Introduction of conservation finance
- 5.2 Biodiversity finance (BIOFIN) initiatives
- 5.3 Solutions for biodiversity finance: Payment for ecosystem services, Wetland banking, Nutrient trading, Biosafety fee, Voluntary climate financing, Debt-for-nature swaps, Disaster risk insurance, Ecological fiscal transfers'

UNIT 6: INSTITUTIONAL ECONOMICS FOR NRM (8)

- 6.1 Evolution process of institutional economics: concepts, features, development and effectiveness
- 6.2 Concept and analysis of transaction and transformation cost
- 6.3 Conflict and cooperation in Natural resource management (NRM)

PRACTICALS (4)

Term paper (4): Each student will be assigned a term paper based on secondary literature. The term paper will be presented among the students and faculties.

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Course Title: **FOREST MANAGEMENT**

Course Code: SFM 754

Credit Hours: 3

Lecture Hours: 60

Total Marks: 75(Theory: 60, Internal Assignment: 15)

General objective: The course aims to impart technical know-how in the planning, approaches and regulation of forest resources for sustainable and wise use.

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

- Understand concept and approaches of forest management.
- Compare forest management practices in Nepal and other countries.
- Understand tools and techniques of forest regulation to optimize production.
- Prepare forest management plans at micro- and macro- level.
- Analyze forest policies in changing context.

UNIT 1: INTRODUCTION (3)

- 1.1 Objective and scope of forest management
- 1.2 Global forest management history
- 1.3 National forest management history

UNIT 2: FOREST MANAGEMENT PRACTICES (5)

- 2.1 Comparison of forest management approaches (developed countries / Nepal)
- 2.2 Concept, strategies and practices of forest management in:
 - 2.2.1 Community forestry
 - 2.2.2 Collaborative forestry
 - 2.2.3 Leasehold forestry
 - 2.2.4 Private forestry
 - 2.2.5 Government managed production forestry
- 2.3 Problem and prospects of forest management (global, regional and national)

UNIT 3: SUSTAINABLE FOREST MANAGEMENT (4)

- 3.1 Sustainable forest management
 - 3.1.1 Concept and approach
 - 3.1.2 National and international practices
 - 3.1.3 Criteria and indicator for SFM
- 3.2 Forest certification
 - 3.2.1 Importance of forest certification
 - 3.2.2 Methods of certification
 - 3.2.3 Appropriateness and practice of forest certification in Nepal

UNIT 4: NORMAL FOREST (4)

- 4.1 Concept of forest normality
- 4.2 Basic requirements for normality
- 4.3 Abnormality situation in forest
- 4.4 Implication of normality concept in Nepal

UNIT 5: GROWING STOCK (4)

- 5.1 Introduction and definition of growing stock
- 5.2 Determination of growing stock

- 5.2.1 Determination based on types of enumeration
- 5.2.2 Determination based on silvicultural system
- 5.3 Relationship between growing stock and yield

UNIT 6: ROTATION (4)

- 6.1 Concept and types of rotation
 - 6.1.1 Concept of rotation (regular and irregular forest)
 - 6.1.2 Types of rotation and their significance
 - 6.1.3 Pre-requisites in fixing rotation length
 - 6.1.4 Determinants in choosing rotation
 - 6.1.5 Rotation Vs conversion period
- 6.2 Rotation determination method
 - 6.2.1 Biological criteria
 - 6.2.2 Financial / economic criteria
 - 6.2.3 Social / environmental criteria
 - 6.2.4 Rotation determination practice in Nepal

UNIT 7: SUSTAINED YIELD AND SITE QUALITY (6)

- 7.1 Principles of sustained yield
 - 7.1.1 Yield types
 - 7.1.2 Prerequisites for sustained yield
 - 7.1.3 Limitations in Nepal's conditions
 - 7.1.4 Steps for achieving sustained yield
- 7.2 Importance and determination of site quality
 - 7.2.1 Site assessment for potential production of a site
 - 7.2.2 Reasons for assessment (land allocation and development planning, choice of species, growth of species, forecasting of growth and yield)
 - 7.2.3 Site assessment method
 - 7.2.6 Maximum mean annual increment class

UNIT 8: YIELD REGULATION (8)

- 8.1 Introduction and concept of yield regulation
- 8.2 Scope of yield regulation
- 8.3 Regulating plantation forest /natural forests
 - 8.3.1 Concepts
 - 8.3.2 Applications
- 8.4 Allowable cut methods
 - 8.4.1 Area control
 - 8.4.2 Volume control
 - 8.4.3 Combined area and volume control
- 8.5 Yield regulation practices in Nepal

UNIT 9: FOREST MANAGEMENT PLAN (6)

- 9.1 Management plan
 - 9.1.1 Definition, objectives and limitations
 - 9.1.2 Types of forest management plan
- 9.2 Preparation of management plans
 - 9.2.1 Data collection
 - Bio-physical
 - Socio-economical
 - 9.2.2 Maps and sketches

- 9.2.3 Contents and write up
- 9.2.4 Plan update (method and scope)
- 9.3 Operational plans
 - 9.3.1 Scope of operational plan
 - 9.3.2 Procedure of operational plan preparation

UNIT 10: FOREST POLICY (4)

- 10.1 History of forest policy in Nepal
- 10.2 Basis for policy formulation
- 10.3 Policy evaluation (existing policy and current issues in forestry- National/International scenario)
- 10.4 Policy amendment procedure and future prediction

PRACTICALS (12)

Field study (12): A field visit will be organized for the students to study different approaches and practices of forest management in nearby sites. Students will study different thematic areas of forest management in groups, prepare and submit reports according to the prescribed format provided by the instructor.

REFERENCES

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Course Title: **STATISTICAL ANALYSIS AND DATA MANAGEMENT**

Course Code: SFM 755

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 45, Internal Assessment: 15, Practical: 15)

General objective: Upon completion of the course students will be able to apply statistical tools and techniques with their computation and interpret the data, data mining and modeling of socio-economic and bio-physical sciences.

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

- Acquire the knowledge and apply descriptive statistics, probability distributions and inferential statistics.
- Understand and apply major formal experimental designs in bio-physical and socio-economic data.
- Understand linear, non-linear modeling for quantitative and qualitative data.
- Acquire knowledge on multivariate analysis with its applications.
- Use different statistical software and gain an understanding of when and why to use these various techniques as well as how to apply them and interpret their output.

UNIT 1: DESCRIPTIVE STATISTICS (4)

- 1.1 Tabular, diagrammatic and graphical presentation: Simple, component, multiple, pie charts, stem and leaf plot, box and whisker plot, outliers, P-P plot, Q-Q plot, error bars, histogram, frequency curve
- 1.2 Measures of central tendency, dispersion, skewness, kurtosis and moments
- 1.3 Correlation (Scatter plot, Karl Pearson, Spearman rank and Kendal tau rank correlations), correlation matrix

UNIT 2: RANDOM VARIABLE AND PROBABILITY DISTRIBUTION (6)

- 2.1 Random variable probability mass function and probability density function, distribution function, expectation
- 2.2 Probability distributions: Binomial, Poisson, Hypergeometric, Uniform and Normal distribution

UNIT 3: INFERENCE STATISTICS AND APPLICATIONS (8)

- 3.1 Estimation: Point estimation, Interval estimation; Confidence intervals
- 3.2 Hypothesis testing
 - 3.2.1 Parametric tests: F- test (For homogeneity and heterogeneity test), Z- test for single proportion, double proportion, single mean, double means and t-test for single mean, double means, pair- test, correlation and regression coefficients test, Analysis of variance (ANOVA): One- way and two- way ANOVA
 - 3.2.2 Non-parametric tests: Chi-square tests, one sample Kolmogorov Smirnov test (for Normal, Poisson, Uniform and exponential test), Median test, Mann Whitney U-test, Kruskal Wallis H-test, Wilcoxon sign rank test, Friedman ANOVA

UNIT 4: EXPERIMENTAL DESIGNS ON NATURAL RESOURCES (4)

- 4.1 Simple experimental designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD)
- 4.2 Complex Experimental Designs: Factorial experiments, Split plot design, Lattice design

UNIT 5: DATA MODELLING FOR SOCIO-ECONOMIC AND BIO-PHYSICAL CASES (10)

- 5.1 Simple linear and Non-linear regression models, Multiple regression model, Linear mixed models, Panel data regression model, Autocorrelation, Durbin Watson test, Poisson log linear model for count data
- 5.2 Regression with dummy explanatory variables, regression with dummy dependent variables, Binary, Ordinal, Probit and Tobit models, Multinomial logit models
- 5.3 Time series analysis: Secular trend and seasonal variation analysis, Data smoothing, Forecasting

UNIT 6: MULTIVARIATE ANALYSIS (4)

- 6.1 Principal Component Analysis (PCA) and Factor analysis
- 6.2 Classification: Cluster analysis and Discriminant function analysis

PRACTICALS (24)

Use of statistical software (24)

(Exercises on SPSS or R)

- Preparation of model sample questionnaires, which are suitable to use almost all statistical tools included in the courses on any subject area.
- Data management
- Data presentation and basic statistics
- Statistical associations and multivariate analysis
- Statistical testing as inferential statistics: Parametric and non-parametric tests
- Predictive models (linear and non-linear for social and bio -physical data)
- Experimental designs (Simple to complex)

Each student will prepare and submit the report of all the computer- based practical for evaluation by the instructor and will also appear in the final practical examination after/before the final theory examination.

REFERENCES

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Course Title: **SOIL AND WATER CONSERVATION ENGINEERING**

Course Code: WME 756

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course aims to impart overall knowledge on soil and water induced land degradation problems and its solution through mechanical and ecosystem- based techniques and make students able to design mechanical and bio-engineering structures to rehabilitate degraded watershed.

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

- Understand soil and water induced land degradation problems.
- Understand the mechanics of the problems.
- Plan, design and estimate mechanical conservation structures taking suitable engineering design parameters.
- Apply different ecosystem- based rehabilitation methods for solving the problems.

UNIT 1: SOIL AND WATER INDUCED PROBLEMS (4)

- 1.1 Soil erosion and landslides: causes, types, impacts, erosion agents, factors affecting soil erosion and landslides
- 1.2 Water logging and poor drainage, flooding, siltation, sedimentation
- 1.3 Typical soil and water induced land degradation problems in different physiographic regions of Nepal with case study examples

UNIT 2: MECHANISM/PROCESS AND ANALYSIS (10)

- 2.1 Mechanics of soil erosion, landslides and sediment transport
- 2.2 Slope stability problems and analysis: active and passive earth pressure, Rankine's theory of earth pressure, modes of slope failure
- 2.3 Bearing capacity of soil: ultimate bearing capacity, allowable bearing capacity, factor of safety, value of allowable bearing capacity of different soil types
- 2.4 Compaction of soil: dry density, water content relationship, optimum moisture content (OMC), factors affecting soil compaction
- 2.5 Site exploration and geotechnical investigation, its phases, test pits method

UNIT 3: SOIL AND WATER EROSION CONTROL ENGINEERING TECHNIQUES (ENGINEERING DESIGNS, DRAWING AND COST ESTIMATION) (12)

- 3.1 Design principle
- 3.2 Review of discharge estimation by rational formula and Manning's equation method
- 3.3 Analysis, design, drawing, layout and cost estimation of soil and water conservation engineering structure with numerical
 - Check dam
 - Retaining / Toe wall
 - Spur
 - Rip-rap revetment
 - Embankment/ Dyke
 - Terracing – bench terraces
 - Roadside drain, grassed waterways
 - Farm ponds (water harvesting structure)

UNIT 4: SOIL STABILIZATION (4)

- 4.1 Concept of soil stabilization
- 4.2 Methods (mechanical, cement, lime, chemical and bituminous)

UNIT 5: VEGETATIVE AND OTHER ECOSYSTEM BASED TECHNIQUES (10)

- 5.1 Functions of vegetative techniques, interaction between vegetative and engineering system
- 5.2 Bio-engineering techniques: fascine, palisades, wattling, brush layering, live check dam, hedgerow, bamboo planting, live fence, grass planting, jute netting, agroforestry, fruit tree planting, shelter belt
- 5.3 Principle of designing vegetative techniques (Ideal plant communities for bio-engineering)
- 5.4 Bio-engineering conservation measures (site investigation for designing the conservation measures)
 - 5.4.1 Degraded land rehabilitation
 - 5.4.2 Gully and ravine reclamation
 - 5.4.3 Landslide treatment
 - 5.4.4 Road slope stabilization
 - 5.4.6 Irrigation canal improvement
- 5.5 Agronomical techniques: conservation tillage, contour farming, strip cropping, multiple cropping, green manuring, Sloping Agriculture Land Technique (SALT) and mulching
- 5.6 Cost- benefit analysis of conservation measures

PRACTICALS (20)

Excursion (4): Students will be taken to nearby site to show soil/water conservation measures. Information sheet about the site focusing on types of measures will be prepared and distributed before heading to the field. Students are required to prepare and submit field reports in prescribed format by the instructor.

Exercise (16): Exercises in series on following topics after theory class and excursion will be conducted in designing and preparing cost estimate of mechanical conservation structures.

- Practice of engineering drawings
- Practice for quantity/cost estimate methods
- Design, drawing and cost estimate of engineering conservation measures for given degraded sites: check dam, retaining wall, bunds, terrace and grassed waterways

Students are required to prepare and submit reports in prescribed format by the instructor and present their work among the students.

REFERENCES

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- Suresh, R. (2014). Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
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Course Title: **WETLAND ECOLOGY AND MANAGEMENT**

Course Code: WME 757

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course provides the fundamental knowledge of wetland ecology and its management in changing environmental context and equips the students for wetland characterization, management planning and value addition with sound understanding of conservation and policy initiatives at national and international level.

Specific objectives: After the completion of this course, students will be able to:

- Understand the ecology of the wetlands and their contribution to human well-being.
- Develop hands on ability to monitor wetland products and services.
- Learn how wetlands are being degraded around the globe and best way of utilizing the wetland resources and restoration techniques.

UNIT 1: WETLAND ECOLOGY (8)

- 1.1 Wetland and its classification, wetland ecosystems, habitat and ecology
- 1.2 Wetland soil and biogeochemistry
- 1.3 Wetland hydrology
- 1.4 Wetland biodiversity
- 1.5 Wetland function and productivity
- 1.6 Trophic states and eutrophication
- 1.7 Wetland and human interaction

UNIT 2: WETLAND PRODUCTS AND SERVICES (8)

- 2.1 Wetland products including plant, animal and mineral products (food staples such as fish and rice, timber for building, fuelwood, vegetable oil, salt, medicinal plants, stems and leaves for weaving, and fodder for animals)
- 2.2 Wetland services (flood control, groundwater replenishment, shoreline stabilization and storm protection, sediment and nutrient retention and export, water purification, reservoirs of biodiversity, cultural values, recreation and tourism, climate change mitigation and adaptation)
- 2.3 Diversity of wetland products and services in different eco-regions
- 2.4 Traditional use practices of wetland resources

UNIT 3: WETLANDS OF NEPAL (4)

- 3.1 Major wetlands of Nepal
- 3.2 Wetlands of biological richness
- 3.3 Wetland and tourism potentiality in Nepal
- 3.4 Major issues of wetland conservation
- 3.5 Lakes and their conservation status
- 3.6 Wetland management practices for local development and ecological sustainability

UNIT 4: WETLAND MANAGEMENT AND RESTORATION (10)

- 4.1 Wetland inventory and situation analysis
- 4.2 Major threats of wetlands (Natural, human and climatic)
- 4.3 Wetland management planning (principals, approach, stakeholders)
- 4.4 Wetland monitoring (indicators and their evaluation)
- 4.5 Community participation on wetland management

- 4.6 Control of siltation and pollution
- 4.7 Management of weeds

UNIT 5: NATIONAL AND INTERNATIONAL INITIATIVES ON WETLAND CONSERVATION (4)

- 5.1 Ramsar Convention on wetland management
- 5.2 Ramsar sites and their significance in Nepal
- 5.3 Wetland policy and management institutions in Nepal
- 5.4 Environmental provisions in wetland management in Nepal (IEE, EIA and other provisions)

UNIT 6: VALUE ADDITION OF WETLAND ECOSYSTEMS (6)

- 6.1 Economic valuation of wetland products and services
- 6.2 Wetland as carbon pool
- 6.3 Water supply and hydrological regulation
- 6.4 Wildlife habitats
- 6.5 Recreational opportunities of wetland
- 6.6 Sustainable utilization of wetland resources

PRACTICALS (20)

Excursion (4): Students will be taken to nearby sites for rapid assessment of wetland resources, ecosystem services, problems, management initiative, conservation and development strategy using standard framework scenario/context analysis.

Exercise (12): After theory class and excursion, students will carry out following exercises related to wetland valuation using economic analysis and service mapping:

- Wetland valuation exercise using secondary data (economic analysis)
- Wetland ecosystem and services mapping.

Students will prepare report and present the work among the students.

Term paper (4): Each student will prepare and submit a term paper on topic assigned by the course coordinator related to the recent issues on wetland ecology and management.

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Course Title: **ECONOMICS OF DEVELOPMENT AND FINANCE**

Course Code: SFM 758

Credit Hours : 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment:15)

General objective: The course aims to make students gain knowledge on the concepts, theories, processes and institutional as well as policy issues underlying economic development, microfinance and enterprise creation on relevant areas.

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

- Understand the concept, paradigm and indicators of development.
- Understand stage growth theories and modern approaches to development.
- Gain knowledge on development policy issues.
- Examine the relationship between microfinance program, microenterprise development and their role in poverty reduction and natural resource management.
- Prepare a business plan.
- Understand marketing strategies, financial resources and their mobilization.

PART A: ECONOMICS OF DEVELOPMENT AND PLANNING

UNIT 1: CONCEPT OF DEVELOPMENT (8)

- 1.1 Development concepts and paradigm: economic growth vs economic development, growth plus change, Sen's capability approach, human development and sustainable development, participatory development, core values of development
- 1.2 Indicators of development: single and composite indices (PQLI, HDI, Happiness index)
- 1.3 Factors of development: natural resource, human resource, capital and technology, value and institution
- 1.4 Local Economic Development: Concept, approach & principles

UNIT 2: THEORIES OF DEVELOPMENT (10)

- 2.1 Stage Growth Theories: K. Marx and W. W. Rostow
- 2.2 Theory of Growth with unlimited supply of labor.
- 2.3 Schulz Transformation Theory of Traditional Agriculture
- 2.4 Theory of Development of under development (Gunnar Frank and Samir Amin)
- 2.5 Participatory and Livelihood Approach of Local Development.

UNIT 3: ISSUES OF DEVELOPMENT AND RURAL DEVELOPMENT (10)

- 3.1 Poverty and inequality: concept, measurement (income base and multiple dimension of poverty) and dimensions.
- 3.2 Unemployment: types, issues and dimension.
- 3.3 Policy issue: privatization, liberalization, globalization, public –private partnership (PPP)
- 3.4 Development planning: concept, objectives, characteristics, problems and process of planning.
- 3.5 Techniques of planning: budgeting and financing, project formulation and appraisal, choice of techniques, logical framework analysis; crisis in planning

PART B: MICRO FINANCE AND ENTERPRISE DEVELOPMENT

UNIT 4: PERSPECTIVES ON MICROFINANCE (5)

- 4.1 Concept, features, need and principles of microfinance
- 4.2 Product and services of microfinance: savings, credit, insurance, transfer and empowerment
- 4.3 Microfinance approaches: Two schools of thoughts – Minimalist and Maximalist
- 4.4 Microfinance models: Grameen Bank Model, Cooperative Model, Village Bank Model, and Self-help Groups (SHGs) Models

UNIT 5: ROLE, ISSUES AND POLICIES OF MICROFINANCE (5)

- 5.1 Microfinance rules and regulation policies in Nepal
- 5.2 Microfinance for financial inclusion and poverty reduction
- 5.3 Microfinance institutions in Nepal: wholesale lending and retail lending
- 5.4 Microfinance programs for socio-economic transformation and empowerment of DAG
- 5.5 Problems of microfinance in practice.

UNIT 6: MICRO-ENTERPRISE DEVELOPMENT (5)

- 6.1 Concept of enterprise and entrepreneurships
- 6.2 Enterprise development and management: creativity and business idea generation, training and consultancy, finance and other inputs.
- 6.3 Role of micro-enterprise in rural development

UNIT 7: BUSINESS SUPPORT SERVICE AND MARKETING (5)

- 7.1 Concept of business support services
- 7.2 Concept and strategies of marketing
- 7.3 Entrepreneurial marketing for micro enterprise
- 7.4 Role of government for rural enterprise development.
- 7.4 Role of financial institutions for micro-enterprises

PRACTICALS (12)

Field Visit and Project Work (12): Students will conduct case study and analysis of rural development project site and micro-enterprise development programs in rural areas. Students will also formulate local development plan of a rural community, and business plan of agro-forestry related micro-enterprises. Students will prepare and submit report of the case study, local development plan and business plan for evaluation by the instructor.

REFERENCES

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Course Title: **HUMAN WILDLIFE INTERFACE MANAGEMENT**

Course Code: PWM 759

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The aim of the course is to provide concept and approaches of conflict management in wildlife conservation.

Specific objectives: After the successful completion of this course students will be able to:

- Understand the measures of reducing human-wildlife conflicts.
- Enhance interagency understanding, communication and cooperation.
- Discuss, investigate and test alternative non-toxic, and/or non-lethal methods for resolving human wildlife conflict in urban centers and at the urban-wilderness interface.
- Analyze legislative approaches in human wildlife conflict management.
- Document ethno-zoology of the selected wildlife species in Nepal.

UNIT 1: OVERVIEW AND FUNDAMENTAL CONCEPT (4)

- 1.1 Introduction to human dimension in wildlife management
- 1.2 Objectives of human dimension in wildlife management
- 1.3 Stakeholders and beneficiaries of wildlife management
- 1.4 Political ecology of conservation
- 1.5 Conservation development linkage

UNIT 2: SOCIOECONOMIC CONSIDERATION (4)

- 2.1 Social and psychological considerations in wildlife management
- 2.2 Economic considerations, eco- development: what, why, where and whether
- 2.3 Local use practices and dependency on biological resources
- 2.4 Socio economic issues related to human wildlife interactions

UNIT 3: ETHNOZOOLOGY OF SELECTED WILDLIFE SPECIES OF NEPAL (4)

- 3.1 Case study from a mountain community or mountain wildlife species like snow leopard, musk deer, brown bear
- 3.2 Case study of a Raute community or a Tharu/ Bote/ Mushar community
- 3.3 Documentation of species' values: food, economic, cultural, medicinal from different geographic regions (10 each from high mountain, mid hills and Terai)

UNIT 4: CARE AND REHABILITATION OF ANIMALS (4)

- 4.1 Problem animal handling and care
- 4.2 Animal welfare issues (management and care of problem and orphan individuals, ethical consideration for domesticated wild animals, e.g. elephants)
- 4.3 Harvesting (culling) of overabundant populations (wild boar, blue sheep)

UNIT 5: THE PLANNING AND MANAGEMENT PROCESS (5)

- 5.1 Wildlife management as a process within system
- 5.2 Decision- making in wildlife management.
- 5.3 Planning human dimension inquiry
- 5.4 Methods of human dimension inquiry
- 5.5 Stakeholder engagement in wildlife management

UNIT 6: CONSERVATION COMMUNICATION (4)

- 6.1 Communication for effective wildlife management.
- 6.2 Community outreach
- 6.3 Designing conservation communications
- 6.4 Application of IT (television, mobile, social media)

UNIT 7: HUMAN DIMENSIONS APPLICATIONS (6)

- 7.1 Traditional knowledge and society
- 7.2 Women's participation in conservation
- 7.3 Human dimensions of abundant wildlife, rare and endangered wildlife, wildlife use
- 7.4 Wildlife conservation challenges
- 7.5 Human footprints scoring
- 7.6 Case studies from Nepal and global

UNIT 8: COMMUNITY- BASED CONSERVATION INITIATIVES (8)

- 8.1 Community- based conservation initiatives practiced at local level (community based anti-poaching unit, rapid response team, youth enforcement, patrolling, local level mitigation measures)
- 8.2 Reasons for failure, success and lessons learned
- 8.3 Conservation induced displacement and rehabilitation
- 8.4 Community survey methods including participatory tools and techniques
- 8.5 Human wildlife conflict and mitigation measures
- 8.6 Conflict typology
- 8.7 Relief and compensation guideline
- 8.8 Case study: death (elephant, leopard, tiger, rhino), property and crop damage mitigation measures (trench, bio-fence, barbed fence, solar fence, power shoot off fence)

UNIT 9: ILLEGAL WILDLIFE TRADE (5)

- 9.1 Global, regional and national wildlife crime scenarios and trends
- 9.2 Illegal wildlife trade
- 9.3 Anti-poaching operations (APO/CBAPO) using GPS, GIS, satellite, etc.
- 9.4 Species of significant illegal trade (plant and animal)
- 9.5 Conventions and bi-lateral/ multi-lateral initiatives

UNIT 10: PROFESSIONAL CONSIDERATIONS FOR THE FUTURE (6)

- 10.1 Environmental ethics for wildlife management
- 10.2 Ethics of development: ethical frameworks, multiple stakeholders, community involvement, alternative forms of community investment, ethical code for development projects
- 10.3 Continuing education in human dimensions
- 10.4 Adaptive value for wildlife management
- 10.5 CBD (ABS), CITES bill

PRACTICALS (10)

Field Exercise (10)

- Wildlife damage survey
- Case study of selected forest dwelling community
- Case study of selected wild food species and their value
- Wildlife rescue observation
- Human footprints analysis

All students will prepare, submit and present report on each exercise for evaluation by the instructor.

REFERENCES

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Course Title: **SOCIETY AND FORESTRY**

Course Code: SFM 760

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course aims to build the capacity of students to plan and work effectively in multicultural society.

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

- Understand the importance of society in forestry and natural resource management sector.
- Appreciate the importance and role of institution and governance in relation to forestry sector.
- Explain the socio-cultural issues related to forestry and natural resource management.
- Explore and understand the ways to attain social development through forestry in Nepalese context.

UNIT 1: INTRODUCTION (4)

- 1.1 Concept of society and forestry
- 1.2 Historical development of society and forestry linkage (global, regional and national)
- 1.3 Society and forestry interface (need, importance, application)
- 1.4 Effects of population dynamics in forestry

UNIT 2: THEORY OF SOCIAL DEVELOPMENT (10)

- 2.1 Concept of social change and development
- 2.2 Progress of social change (social transformation, modernity, structural social change)
- 2.3 Social change and development (global, regional and national)
- 2.4 Socio-cultural evolutionism and the idea of progress (Comte, Spencer, Morgan, Durkheim, Tonnies, Lester Ward)
- 2.5 The idea of social differentiation, reintegration and adaptation (Durkheim, Weber, Parsons, Smelser)
- 2.6 The idea of mode of production and the corresponding social change (Marx, Engels)

UNIT 3: SOCIETY AND ITS LINKAGE WITH FORESTRY IN NEPALESE CONTEXT (6)

- 3.1 Formation, development and dynamics of society
 - 3.1.1 Socio-culture
 - 3.1.2 Social structure (ethnicity, class, gender, geography, etc.)
- 3.2 Issues, challenges and opportunities for managing forest resources (migration, remittance, commercialization, enterprise development)
- 3.3 Knowledge systems: Indigenous/local, traditional and scientific knowledge
- 3.4 Change on forest dependency (concept, trend)

UNIT 4: RESOURCE MANAGEMENT INSTITUTION AND GOVERNANCE (12)

- 4.1 Forestry Sector
 - 4.1.1 Government/state management:
 - a) Policy, legislation and institutional framework
 - b) protected areas and conservation areas.
 - 4.1.2 Participatory/communal management
 - a) Local/traditional systems
 - b) Formal users group approaches
- 4.2 Farming sector

- 4.3 Government/state management
 - 4.3.1 Policy, legislation and institutional framework
 - 4.3.2 Land tenure and taxation
 - 4.3.3 Pasture and livestock development and management
 - Agriculture: subsistence vs. market orientation
 - Livestock, farm, forestry linkages
- 4.4 Water Resource
 - 4.4.1 Government/state management: policy, legislation and institutional framework
 - 4.4.2 Irrigation schemes and farmer managed irrigation schemes.
 - 4.4.3 Management for: hydropower, household and other uses by state and communities

UNIT 5: SOCIAL AND INSTITUTIONAL ISSUES (10)

- 5.1 Disparities, inequality and stratification (ethnicity, class, geography, gender)
- 5.2 Poverty alleviation and livelihoods
 - 5.2.1 Role of forestry: policies and practice
 - 5.2.2 Poverty trap, safety net and contribution of forestry on livelihood (forest- based Contribution: subsistence and commercial)
 - 5.2.3 Case studies related to poverty, livelihoods and forestry
- 5.3 Land and tree tenure
 - 5.3.1 Tree tenure: concept and practice
 - 5.3.2 Issues of land and resource tenure in community based management
- 5.4 Decentralization and devolution
 - 5.4.1 Analysis of legal and policy frameworks
 - 5.4.2 Decentralization/devolution: illustrations from forestry sector in Nepal
 - 5.4.3 Participatory management of resources in Nepal: the rhetoric and reality
- 5.5 Conflict management in forestry sector (concept, cause, and management strategy)

UNIT 6: SOCIAL DEMOGRAPHY CHANGE OF NEPAL (6)

- 6.1 Urbanization (global and regional trend, challenges)
- 6.2 Issues of urbanization in developing societies
- 6.3 Trends of urban growth in Nepal and its challenges, problems and issues
- 6.4 Urbanization and urban development
- 6.5 Rural urban sociology and integration

UNIT 7: PRACTICE OF SOCIAL DEVELOPMENT AND FORESTRY (8)

- 7.1 Social development (concept, application)
- 7.2 Drivers of social development in Nepal
 - 7.2.1 Population dynamics and resource use
 - 7.2.2 Shift in global scenario (THD, REDD+, CC, landscape management)
 - 7.2.3 Migration (labour/urban/overseas), remittance and development
 - 7.2.4 Markets, social change and development
- 7.3 Effect of migration, social change and globalization on forestry
- 7.4 Social development through forestry
 - 7.4.1 Application of social change in forest management
 - 7.4.2 Production forestry
 - 7.4.3 Farm forestry and food security
 - 7.4.4 Forest-based enterprises and marketing

PRACTICALS (4)

Term paper (4): Each student will be assigned a term paper based on secondary literature and will present the term paper among the students and faculties.

REFERENCES

- Blaiki, P., Cameron, J. and Seddon, D. (2002). Understanding 20 years of change in west-central Nepal: Continuity and change in lives and ideas. *World Development* 30 (7): 1255-1270.
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Course Title: **MOUNTAIN FARMING AND RURAL DEVELOPMENT**

Course Code: WME 761

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course will make the students understand the mountain farming system, rural livelihoods and their challenges on changing socio-economic environment, and develop capacity required for best farming technology, optimum production and improved livelihoods resilience.

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

- Have better understanding of mountain farm resources, farming systems and rural livelihoods.
- Develop and apply best agricultural practices to minimize current level of environmental degradation and optimize production.
- Identify and plan best livelihoods and development options for food security, climate change adaptation and building livelihoods resilience.
- Develop ideas for linking forest resources for agriculture development in sustainable manner.

UNIT 1: CHARACTERISTICS OF MOUNTAIN LANDSCAPE AND FARM RESOURCES (8)

- 1.1 Physiography
- 1.2 Soil, water and climate
- 1.3 Forest and vegetation
- 1.4 Rangeland
- 1.5 Agroecology
- 1.6 Forest -agriculture -livestock linkage
- 1.7 Overview of Nepalese mountain landscape

UNIT 2: MOUNTAIN LIVELIHOODS AND VULNERABILITY (6)

- 2.1 Mountain community and their livelihoods
- 2.2 Livelihood diversification in the mountain
- 2.3 Social vulnerability in the changing context
- 2.4 Mountain poverty and determinants
- 2.5 Food security
- 2.6 Intensive agriculture practices

UNIT 3: PRODUCTION AND FARMING SYSTEM (8)

- 3.1 Irrigated rice land, rainfed cultivated land and home garden
- 3.2 Livestock production and pasture land management
- 3.3 Cereal crops, cash crops and high value crops
- 3.4 Horticulture base, silkworm, mushroom and fishery
- 3.5 Medicinal and aromatic plant production
- 3.6 Agroforestry system
- 3.7 Agrobiodiversity
- 3.8 Family farming, community farming and farm tourism

UNIT 4: SOIL FERTILITY MANAGEMENT PRACTICES (6)

- 4.1 Traditional practices; terracing, fallow, sediment laden runoff waters, in-situ manuring, green manuring and use of nitrogen fixing plants, composting, etc.
- 4.2 Improved technology (integrated nutrient management, chemical fertilizers, tillage operation, sloping land agriculture technology (SALT))
- 4.3 Role of forest on agricultural nutrient supply
- 4.4 Rehabilitation of marginal land

UNIT 5: FARMING CHALLENGES, MANAGEMENT PLANNING AND POLICY

PROVISION (6)

- 5.1 Land ownership, labor shortage, productivity decline, migration, climate change, land use conversion, insecurity issues
- 5.2 Mountain agriculture policy and provision
- 5.3 Nepal government institutions and policy for farm production, commercialization and marketing
- 5.4 Cooperatives and micro- finance for agriculture and rural development
- 5.5 Farm inventory, planning and budgeting
- 5.6 Marketing of the farm products
- 5.7 Risk and uncertainty analysis
- 5.8 Agriculture business planning
- 5.9 Pocket area of farming

UNIT 6: RURAL DEVELOPMENT (6)

- 6.1 Concept and theories of rural development
- 6.2 Resource and constraints of rural development
- 6.3 Shifting development approaches with globalization, changing environmental context and societal demand
- 6.4 Agricultural facility, infrastructure and institutional development for community development
- 6.5 Mainstreaming environmental concerns on development planning
- 6.6 Governance on rural development

UNIT 7: BEST PRACTICES FOR SUSTAINABLE MOUNTAIN FARMING AND RURAL LIVELIHOODS IMPROVEMENT (8)

- 7.1 Mountain farming opportunities and entrepreneurship
- 7.2 Suitable technology and mechanization to address labor shortage for mountain farming
- 7.3 Food and nutrient security in mountain region
- 7.4 Gender perspectives of mountain farming
- 7.5 Transforming subsistence to sustainable commercial farming
- 7.6 Improved irrigation and water management
- 7.7 Agricultural extension strategy in mountain region
- 7.8 Mountain livestock genetic improvement

PRACTICALS (12)

Field Excursion and Presentation (8): One-day excursion will be arranged to conduct rapid field assessment in order to conduct farm project planning. Students will make presentation based on field observation, learning and interactions as instructed by Tour- in- charge/Course coordinator.

Review Paper Preparation (4): Each student will prepare a review paper based on published papers in provided issues of mountain farming and rural livelihoods and will present their work in group among the students.

REFERENCES

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Course Title: **FOREST PROTECTION**

Course Code: SFB 801

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course provides advance knowledge on understanding of the ecology and management of the insects, pests and pathological problems in the forests of Nepal.

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

- Gain knowledge about major forest insects and pests, their ecology, and their impacts on forest management values.
- Understand the principles of forest insects and pest management.
- Assess different factors harmful to a forest and seedlings in the nurseries.
- Recommend various methods (protective and preventive) to control damaging agents.
- Identify types of diseases, pathogen, and different pathological problems in a forest.

UNIT 1: ENTOMOLOGICAL ASPECTS OF FORESTRY (4)

- 1.1 Introduction to entomology
- 1.2 Insect structure and function
- 1.3 Insect classification: Phloem boring insects, wood boring insects, shoot boring insects, root, tip, terminal, defoliating and seed insects

UNIT 2: LIFE CYCLE AND CONTROL MEASURES OF FOREST INSECTS (4)

- 2.1 *Apriona cinerea* (Poplar stem borer)
- 2.2 *Plecoptera reflexa* (The sissoo defoliator)
- 2.3 *Clostera fulgurita* (Poplar defoliators)
- 2.4 *Ectropis deodarae* (Deodar defoliator)
- 2.5 *Eutectona machacralis* (Teak leaf skeletonizer)
- 2.6 *Hypsipyla robusta* (Toon shoot borer)
- 2.7 *Hoplocerambyx spinicornis* (Sal heartwood borer)
- 2.8 *Hymenochaete rubiginosa* (Heart rots in Sal)

UNIT 3: PATHOLOGICAL ASPECT OF FORESTRY (7)

- 3.1 Forest diseases, disease symptoms, sign, and mode of infection
- 3.2 Forest disease classification (root diseases, stem diseases, and foliar diseases)
- 3.3 Factors affecting forest health: fire (types of fire) insect pests; vertebrate pests; invertebrate pests; weeds and pathogens
- 3.4 Introduction to plant quarantine and phytosanitary certification

UNIT 4: PATHOLOGICAL ASPECT OF FORESTRY (7)

- 4.1 Pathological problems in nursery, natural, plantation forest, urban forest, and agro farm forest
- 4.2 Principles of forest disease management
- 4.3 Defense mechanism in plant
- 4.4 Pathogenesis, Koch postulates.

UNIT 5: MANAGEMENT OF INSECTS, PEST AND DISEASES (5)

- 5.1 Management of insect pests and mycoflora of seeds of forest trees
- 5.2 Integrated pest management (IPM) in forestry
- 5.3 Use of IPM to control different types of forest diseases in Nepal

UNIT 6: BIOLOGICAL AND CHEMICAL CONTROL (6)

- 6.1 Different control measures and their application to manage diseases (Chemical, biological, silvicultural, mechanical, cultural control and genetical control methods)
- 6.2 Natural components, introduced species, enhancement of natural enemies and biotic Insecticides.
- 6.3 Chemical control: insecticides, fungicides, pheromones, growth regulators and antifeedant

UNIT 7: CONCEPT ON SUCCESSION OF TIMBER BORERS (3)

- 7.1 Borers of freshly felled timber
- 7.2 Borers of timber in depots
- 7.3 Dry wood borers
- 7.4 Borers of converted timber and timber in use

UNIT 8: MANAGEMENT FOR TREE IMPROVEMENT (6)

- 8.1 Tools used for developing and identifying disease resistant tree (tree improvement, breeding, plus tree, selection, elite tree)
- 8.2 Weed problems in nursery and plantation and their management
- 8.3 Invasive plants in forests, wetland, and their management
- 8.4 Protection of forest crops against wildlife damage
- 8.5 Mycorrhizae and their importance

UNIT 9: DECAY IN TIMBER (6)

- 9.1 Types of decays, chemistry of decay, decay and its control
- 9.2 Gross characters of decay
- 9.3 Methods of treatment spread of decay
- 9.4 Mould resistant to treated wood

PRACTICALS (12)

Tour (8): Students will be taken to nearby appropriate forest, nursery and sawmill for understanding common tree diseases, pathological problems and their management and identifying different types of decays in timber. Students are required to prepare and submit report to the instructor

Discussion and Presentation (4): After the tour, students in groups will present their tour observation, learnings on assigned topics among the students.

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Course Title: **BIOMETRICS**

Course Code: SFM 802

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 45, Internal Assessment: 15, Practical: 15)

General objective: This course aims to impart in depth knowledge to students in forest biometrics and develop their skills in forest sampling and estimating individual and stand-level growth and yield.

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

- Implement inventory plans in forest management.
- Analyze growth and yield of various forest stands
- Understand various forest growth and yield models.

UNIT 1: VOLUME AND BIOMASS OF TREES AND FOREST PRODUCTS (8)

- 1.1 Measuring tree and stand-level attributes
- 1.2 Developing stem volume equations and tables
 - 1.2.1 Data requirement and measurement
 - 1.2.2 Local volume equation and table
 - 1.2.3 General volume equation and table
 - 1.2.4 Evaluation of volume equations
- 1.3 Developing merchantable volume equation and table
 - 1.3.1 Data requirement and measurement
 - 1.3.2 Evaluation of merchantable volume equation
- 1.4 Tree and stand-level biomass equations and tables
 - 1.4.1 Data requirement and measurement
 - 1.4.2 Evaluation of regression equation

UNIT 2: GROWTH PREDICTION (6)

- 2.1 Diameter, basal area and volume growth
- 2.2 Stand growth
- 2.3 Increments (CAI, MAI)
- 2.4 Stand structure
- 2.5 Stem analysis and stump analysis

UNIT 3: SITE QUALITY, GROWTH AND YIELD (8)

- 3.1 Stand characteristics (even-aged, uneven-aged, pure and mixed-species stand)
- 3.2 Evaluation of site quality
- 3.3 Growth and yield of even-aged forest and uneven-aged forest
- 3.4 Growth and yield modeling approaches
 - 3.4.1 Data sources for growth and yield models (permanent sample plot, long-term research plot, stem and stump analysis, LiDAR and satellite imageries)
 - 3.4.2 Stand table projection
 - 3.4.3 Stand-level model
 - 3.4.4 Tree-level model
- 3.5 Evaluation of growth and yield models
- 3.6 Application of growth and yield models
- 3.7 Yield (types of yield and yield tables)

UNIT 4: FOREST SAMPLING (6)

- 4.1 Principles of sampling
- 4.2 Selection of sampling units (random selection, purposive selection and systematic selection)
- 4.3 Types of sampling
 - 4.3.1 Simple random sampling
 - 4.3.1.1 Application, method, advantages and disadvantages
 - 4.3.2 Stratified random sampling
 - 4.3.2.1 Criteria of stratification
 - 4.3.2.2 Allocation of field plots (proportional, optimum and cost optimal disproportionate method)
 - 4.3.2.3 Application, method, advantages and disadvantages
 - 4.3.3 Cluster sampling
 - 4.3.4 Double or two phase sampling
 - 4.3.5 Systematic Sampling
- 4.4 Application and limitation of sampling

UNIT 5: INVENTORY (8)

- 5.1 Introduction and scope
- 5.2 Strip system of cruising and Line plot system of cruising
- 5.3 Point sampling and relascope survey
- 5.4 Use of aerial photographs and satellite data in forest inventory
 - 5.4.1 Interpretation of aerial photographs and satellite imageries
 - 5.4.2 Forest type classification
 - 5.4.3 Area and volume estimation
- 5.5 Forest inventory, planning and execution
 - 5.5.1 Objectives, sources of information, field measurement techniques, statistical consideration, staff management, method of calculation, analysis and data capture, the execution of field work and control for accuracy, security of data, record of events, results
 - 5.5.2 Types of plots (permanent plots, temporary plots, both permanent and temporary plots, in plantation and natural forest)

UNIT 6: DENDRO-CHRONOLOGY (4)

- 6.1 Introduction and origin of dendro-chronology
- 6.2 Principles of dendro-chronology
- 6.3 Data requirement, measurement and analysis
- 6.4 Application of dendro-chronology

PRACTICALS (20)

Field Exercise (10)

- Measurement of height of trees by using Vertex, Abney's level and Clinometers
- Stem and stump analysis to develop relationship of diameter with basal area, volume, height and age
- Inventory with point sampling
- Increment boring and annual ring measurement

Laboratory Exercise (10)

- Preparation of local volume tables (general, local and merchantable volume tables) by regression method
- Modeling diameter and height relationship

- Modeling tree volume with respect to diameter and height
- Modeling tree biomass with respect to diameter and height

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Course Title: **RESEARCH METHODOLOGY AND SCIENTIFIC WRITING**

Course Code: SFM 803

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course aims to impart scientific perspective, knowledge and skills to students for systematic enquiry by developing understanding of philosophical foundations of research, elements of research design, methods and tools for data collection and analysis, and scientific writing.

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

- Understand research types and their characteristics.
- Describe the research process, activities, skills and ethical value in research.
- Develop research proposal, identify research problems, formulate research questions, and hypotheses.
- Develop skill of reviewing literature and analyzing secondary data sources.
- Develop research design to solve the research problem.
- Understand tools and techniques for data collection and statistical analysis.
- Write research reports/thesis and scientific article.

UNIT 1: A REVIEW OF THE FUNDAMENTAL CONCEPTS (5)

- 1.1 Meaning, objectives, significance types, approaches and process of research, characteristics and criteria of good research
- 1.2 Philosophical aspect of research
- 1.3 Conceptual and theoretical framework
- 1.4 Critical thinking and research paradigm
- 1.5 Research proposal (purpose, type, components and format)

UNIT 2: LANGUAGE OF RESEARCH, VARIABLES AND ITS MEASUREMENT (4)

- 2.1 Concept, construct, hypothesis and theory
- 2.2 Variables and its types, measurement of variables (scaling) – nominal, ordinal, interval, ratio
- 2.3 Reliability and validity
- 2.4 Accuracy, precision and biases

UNIT 3: RESEARCH PROBLEM, OBJECTIVES AND HYPOTHESIS (5)

- 3.1 Concept need and source of problem
- 3.2 Identification and formulating of research problem
- 3.3 Defining, delimiting and evaluation of a problem
- 3.4 Research objectives
- 3.5 Research hypothesis (meaning, definitions, nature, functions, importance, kinds, characteristics, formulation and testing)

UNIT 4: LITERATURE REVIEW (5)

- 4.1 Meaning, need and objectives of literature review
- 4.2 Sources and functions of literature
- 4.3 Process and tools of literature review
- 4.4 Writing literature review: citation and referencing, quotation, paraphrasing and organizing review

UNIT 5: RESEARCH DESIGN (12)

- 5.1 Meaning, concept, functions and importance of research design
- 5.2 Components and parts of research design
- 5.3 Features of a good research design
- 5.4 Types of research designs
 - Descriptive vs diagnostic
 - Historical research design
 - Developmental research design
 - Longitudinal research design
 - Cross-sectional research design
 - Case study research design
 - Survey research design
 - Exploratory Vs formulative
 - Experimental and quasi-experimental
 - Casual comparative
 - Action research design
 - Qualitative research design
 - Evaluation research design
- 5.5 Sampling Design
 - Meaning and definition of sampling
 - Functions of population and sampling
 - Probability and non-probability sampling methods
 - Characteristics of a good sample
 - Sample size determination

UNIT 6: METHODS OF DATA COLLECTION (6)

- 6.1 Communication methods: questionnaire, schedule, interview
- 6.2 Observation: self-observation and participatory or participant observation
- 6.3 Discussion: focus group, key informant
- 6.4 Experimentation
- 6.5 Case study
- 6.6 Participatory methods: Action Research Methods, RRA and PRA (tools and techniques)

UNIT 7: DATA PROCESSING, ANALYSIS AND INTERPRETATION (4)

- 7.1 Data preparation (editing, coding, entry and processing)
- 7.2 Descriptive and inferential analysis
- 7.3 Qualitative analysis
- 7.4 Interpretation and discussion of findings

UNIT 8: RESEARCH REPORT, SCIENTIFIC ARTICLE AND THESIS WRITING (10)

- 8.1 Introduction, step by step procedure, writing style and language, types, components and structure of reports, articles and thesis, documentation and formatting, best practices
- 8.2 Guidelines for writing research report, scientific article and thesis
- 8.3 Peer review of research articles and their critiques

PRACTICALS (9)

Research proposal (5): Each student will write, submit and present research proposal in the thematic area of study.

Critiques on proposal (4): Each student will provide written critiques for at least two proposals of his/her colleague.

REFERENCES

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Course Title: **REMOTE SENSING AND GIS APPLICATION IN NRM**

Course Code : WME 804

Credit Hours : 3

Lecture Hours: 60

Full Marks: 75 (Theory: 30, Internal Assessment: 15 and Practical: 30)

General objective: This course provides broader understanding on the practical application of remote sensing imageries and geospatial data for resource assessment, management, monitoring and modelling using geospatial technique.

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

- Understand the fundamental concepts of GIS and remote sensing.
- Increase knowledge and skill on geospatial database creation and handling.
- Develop skill on geospatial analysis and support decision-makers by using cross-cutting Decision Support System (DSS) for resource assessment, management and monitoring.

UNIT 1: FUNDAMENTALS OF GIS AND REMOTE SENSING (8)

- 1.1 Concept, components and scope of GIS and remote sensing
- 1.2 Development of GIS and remote sensing in global and in the context of Nepal
- 1.3 Radiation principles and energy interactions with matter and atmosphere
- 1.4 Spectral reflectance of EMR in vegetation, soil, and water
- 1.5 Satellites, sensors and imageries (types and characteristics)
 - 1.5.1 Different sensors developed in the global arena: optical, geostationary, sun synchronous, active, passive, hyper spectral, thermal.
 - 1.5.2 Ground receiving stations (data acquisition, processing and archiving)
 - 1.5.3 Image interpretation (interpretation keys, visual and computer assisted)

UNIT 2: GEOSPATIAL DATABASE CREATION AND MANAGEMENT (6)

- 2.1 Creation of thematic layers from various sources (scanning, sub-setting digitization, open source data, digital data,)
- 2.2 Projection and coordinate systems
- 2.3 GPS, its components, features (settings, errors) and uses (positioning, delineation navigation and ground truthing)
- 2.4 Geo-referenced data structure: (raster, vector), layers, theme, topology
- 2.5 Attribute referenced data (socio-economic, feature attribute) and time referenced data
- 2.6 Database management: geodatabase, RDBMS, object oriented database, metadata

UNIT 3: IMAGE PROCESSING, CLASSIFICATION AND GEOSPATIAL DATA ANALYSIS (6)

- 3.1 Digital image, image resolutions, errors and their correction
- 3.2 Image enhancement, fusion, transformation and classification,
- 3.3 Post classification operations (ground truthing, confusion matrix and accuracy assessment)
- 3.4 Surface analysis (DEM, slope, aspect, viewshed, hillshade)
- 3.5 Spatial analysis (overlay, distance, buffering)
- 3.6 Watershed analysis (watershed delineation, drainage direction and accumulation)

UNIT 4: ERRORS, RECTIFICATION AND MAP COMPOSITION (4)

- 4.1 Sources of errors
- 4.2 Concept of RMS errors
- 4.3 Editing and rectification of errors
- 4.4 Error tolerance

4.5 Map elements and its composition

PRACTICALS (36)

Case study and presentation (4): Case studies on various topics as listed below will be presented among students:

- LULC preparation and change detection
- Deforestation and forest degradation
- Resource assessment or inventory
- Application of geo-spatial technique in scientific forest management.
- Habitat suitability analysis
- Soil erosion modelling
- Biomass and carbon assessment
- Forest fire detection and management

Fieldwork and Lab- based exercises (28): Field data collection and field verification will be carried out and lab- based practical exercises will be carried out by the students in groups of 20-25 facilitated by two teachers in each group. Students are required to submit their practical works as instructed by the course coordinator/teacher. Fieldwork and lab- based exercises are listed below:

- Interface with software, visualization of satellite image data, creating subset data from Arc-GIS, ERDAS and e-Cognition
- Downloading RS raw data from web, extraction and layer stacking
- Interpretation of satellite imagery and prepare spectral response curve of water body, vegetation, river bank and built-up area
- Georeferencing (topo map or image to image registration)
- Image enhancement and filtering (convolution, re-sampling, statistical filtering) histogram equalization, PCA, image fusion and image indices
- Unsupervised, supervised, knowledge engineer and segmentation based image classification
- Accuracy assessment and post classification
- Change detection and analysis
- Digitization of contour line, spot height and feature boundary from topographic map
- Boundary and feature survey from GPS data
- Land cover map preparation, overlay on google earth and transformation of projection
- Surface analysis and proximity analysis
- Map composition and export
- Project work assignment

Group assignments and presentations (4): Students in groups will carry out project work in different thematic applications and each group will present the assignment among students and faculty.

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Course Title: **WATERSHED MANAGEMENT**

Course Code: WME 805

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 45, Internal Assessment: 15, Practical: 15)

General objective: The course provides concept, skill and exposure of integrated watershed management in changing environmental context with detail idea on watershed degradation and different approach of management with practical skills of analyzing watershed condition, planning and research monitoring

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

- Apply knowledge base of management principles in watershed resources.
- Gain insight into different forms of watershed degradation, management planning for suitable productivity and ecosystem services and best intervention measures to protect, control and rehabilitate land and water resources.
- Design and conduct watershed monitoring research.
- Analyze watershed conditions, status, processes, and apply appropriate management practices.

UNIT 1: CONCEPT OF WATERSHED MANAGEMENT (4)

- 1.1. Watershed: products and services
- 1.2. Characteristics of watershed including geomorphic characters
- 1.3. Principles of watershed management
- 1.4. Integrated watershed management
- 1.5. Basin approach watershed management
- 1.6. Springshed management
- 1.7. Water -food -energy nexus approach

Unit 2: ANALYSIS OF WATERSHED RESOURCES AND CONDITION (6)

- 2.1 Watershed resource base
- 2.2 Multicriteria decision- making (MCDM) tool
- 2.3 Frame work for analysis (DPSIR)
- 2.4 Land use land cover analysis and land productivity evaluation
- 2.5 Water availability and quality analysis
- 2.6 Economical analysis of watershed management and services (economics tools for watershed resources valuation)
- 2.7 Watershed modelling

UNIT 3: ISSUES OF WATERSHED MANAGEMENT (4)

- 3.1 Different forms of watershed degradation and water induced disasters
- 3.2 Urbanization change in climate and land use practices
- 3.3 Resource use and socio-economic problem
- 3.4 Land fragmentation, fallowing and food security
- 3.5 Road erosion, landslide and sedimentation
- 3.6 Upstream and downstream linkage and issues
- 3.7 Collaboration among line agencies and multiple stakeholders
- 3.8 Transboundary issues of watershed management

UNIT 4: LEGAL ASPECTS (4)

- 4.1 Land tenure systems, land use policy and practices in Nepal
- 4.2 Water laws in Nepal
- 4.3 Soil and watershed conservation act, regulation, and guidelines
- 4.4 Legislation related to watershed management (agriculture, protected areas, environment and forest)
- 4.5 Watershed management role and responsibility at local, state and central government
- 4.6 PES policy and practices

UNIT 5: WATERSHED MONITORING AND RESEARCH (8)

- 5.1 Spatial and temporal scale of watershed monitoring and research (plot, sub-watershed, catchment; event: daily, monthly, annual, etc.)
- 5.2 Land degradation assessment tools
- 5.3 Soil fertility and productivity monitoring
- 5.4 Erosion, landslides and sedimentation monitoring
- 5.5 Land capability and land suitability classification
- 5.6 Land evaluation and land use decision
- 5.7 Spring recharge area identification
 - 5.7.1 Geomorphological approach/ lithological
 - 5.7.2 Isotope analysis
- 5.8 Recent research issues of watershed management

UNIT 6: WATERSHED PROJECT AND MANAGEMENT PLANNING (8)

- 6.1 Bio-physical, Socio-economic, and institutional aspects of watershed projects (analysis tools and methods; case studies)
- 6.2 Watershed project cycle
- 6.3 LFA approach of project planning
- 6.4 Sub-watershed prioritization using land use, land system and demographic data
- 6.5 Component of watershed management plan
- 6.6 Evaluation and monitoring of the watershed management program
- 6.7 Urban aspect of watershed management
- 6.8 Watershed management for sustainability of mega project (hydropower)
- 6.9 PES approach of watershed management

UNIT 7: WATERSHED CONSERVATION ACTIVITIES (6)

- 7.1 Prevention, control and rehabilitations measures
 - Land use planning and low impact designing
 - Sustainable land management/productivity conservation
 - Disaster risk reduction and natural hazard prevention
 - Water and sediment management and river training
- 7.2 Development infra-structure protection
- 7.3 Climate change adaptation and resilience development
- 7.4 Recharge improvement and spring revival measures
- 7.5 Community mobilization, capacity development and livelihood improvement
- 7.6 Churia Conservation program and activity

PRACTICALS (20)

Exercise (16): Students will do following lab- based and/ or classroom- based practical and analysis, specifically:

- Watershed delineation using topographic map and DEM
- Morphometric analysis of watershed
- Framework analysis for watershed condition assessment
- Logical Framework Approach (LFA) for watershed planning
- Sub-watershed prioritization exercise (Manual/GIS based)

Students are required to submit their practical work report as instructed by the course coordinator/teacher. Students also will prepare and make presentation in group.

Field Excursion (4): Students will be taken to nearby watershed site to demonstrate different watershed management interventions adopted in order to address different forms of watershed degradations.

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Course Title: **URBAN FORESTRY AND LANDSCAPING**

Course Code: SFM 806

Credit Hours: 3

Lecture Hours: 60

Full Mark: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course aims to enhance skills and knowledge of students in planning and managing urban forestry, and analyzing the benefits and cost of urban forestry.

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

- Understand urban forest ecology and its implication.
- Understand urban forestry practices at global and national level.
- Utilize skills and knowledge of computer software in urban forestry planning and landscaping.
- Understand the knowledge of tree inventory in urban sites.
- Analyze benefits/costs of urban forestry.

UNIT 1: URBAN FORESTRY (4)

- 1.1 Urban forestry: planning and management
- 1.2 Historical perspectives of urban forestry (global and national)
- 1.3 Urban forestry ordinances
- 1.4 Provincial and federal urban forestry programs in Nepal
- 1.5 Urban forests and the SDGs: economic benefits and green economy
- 1.6 World urban forestry's contribution, and SAARC level greening initiatives

UNIT 2: URBAN FORESTRY PLANNING AND MANAGEMENT (5)

- 2.1 Urban forestry planning process
- 2.2 Trends of urban development and urban forestry
- 2.3 National and municipal level of planning
- 2.4 The role of urban and peri-urban forests in reducing risks and managing disasters
- 2.5 The green and recreational area plan

UNIT 3: URBAN FORESTRY ECOSYSTEM (8)

- 3.1 The role of urban trees in human thermal comfort
- 3.2 Urban forest ecosystem and sustainability
- 3.3 Urban forestry ecosystem management plan
- 3.4 The urban forest and air pollution
- 3.5 Urban catchment hydrology and storm water runoff
- 3.6 Chemical and particulate pollution of urban air, soil and water
- 3.7 Urban resilience to climate change and disaster
- 3.8 Urban heat island and summer heat wave

UNIT 4: BENEFITS AND COSTS OF URBAN FOREST ECOSYSTEM (5)

- 4.1 Physical-biological benefits and costs of urban vegetation
- 4.2 Social-economic benefits of urban forestry
 - 4.2.1 Benefits to individuals
 - 4.2.2 Benefits to communities
 - 4.2.3 Real estate values
 - 4.2.4 Tree value formulas

- 4.2.5 Other benefits of urban trees and forests
- 4.3 Benefit-cost analysis
- 4.4 Implications for planning, designing and management

UNIT 5: URBAN FOREST INVENTORY (10)

- 5.1 Suitable tree species (indigenous and exotic) for urban forestry plantation
- 5.2 Tree planting, establishment and management (street, park, river or canal)
- 5.3 Tree care and pest diagnostic basics
- 5.4 4D tree management in urban forestry
- 5.5 Silvicultural operations in urban forestry
- 5.6 Tools for assessing and managing urban and community forests Arboriculture
- 5.7 Urban tree inventory (urban canopy cover, river or canal site, street tree, park and avenue areas)
- 5.8 Urban wildland interface
- 5.9 Green space management in cities

UNIT 6: URBAN TREE GROWTH (8)

- 6.1 Common urban forest variables for measurement
- 6.2 Tree performance evaluation
- 6.3 Urban tree growth modeling
 - 6.3.1 Empirical models
 - 6.3.2 I-Tree eco model
 - 6.3.3 Lindenmayer-Systems
 - 6.3.4 L-PEACH
 - 6.3.5 Hybrid models
- 6.4 Adjusting tree growth prediction

UNIT 7: LANDSCAPE PLANNING AND MANAGEMENT (10)

- 7.1 Landscaping needs and design principles
- 7.2 Landscape design and implementation
- 7.3 Material and enclosure selection, application, and configuration
- 7.4 Cost estimating and budgeting of desired landscape
- 7.5 Landscaping tools, materials, and equipment use and application
- 7.6 Outdoor rooms, porches and hideaways
- 7.7 Planting, design and seasonal and climate application (Softscapes)
- 7.8 Patios, decking, fencing, block and walls (Hardscapes)
- 7.9 Street scape and walkway planning process
- 7.10 Water features, fountains, ponds, statues and container gardens

PRACTICALS (10)

Field Exercise (6): Field exercise will be organized to identify the urban tree species, conduct urban tree inventory and analyze benefit-cost of urban forestry. Each student will submit the report of the field exercise for evaluation.

Laboratory exercise (4): A lab- based exercise will be conducted to enhance the knowledge of computer software such as i-tree for urban forestry and landscaping planning. Each student will submit the report of exercises for evaluation.

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Course Title: **FOREST BASED ENTERPRISES DEVELOPMENT**

Course Code: FPE 807

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course builds knowledge and skills of students to identify, prioritize and plan for comprehensive enterprise development of both timber and non-timber forest products.

Specific objectives: After completion of this course, the students will be able to:

- Identify major forest products of respective areas, i.e. timbers and NTFPs.
- Prepare value chain map of potential timbers and NTFPs and appropriate strategies for sustainable marketing channel.
- Prepare a comprehensive enterprise development business plan.
- Review the forest- based enterprise development in Nepal.

UNIT1: INTRODUCTION (5)

- 1.1 Introduction: definition, importance of timber and NTFPs
- 1.2 Definition, types and scope of different forest- based enterprises
- 1.3 Ethno-botanical knowledge and their importance
- 1.4 Forest products and livelihood
- 1.5 Review of successful forest enterprises in Nepal

UNIT 2: ENTERPRISES IDENTIFICATION AND ESTABLISHMENT (7)

- 2.1 Feasibility study of enterprises
- 2.2 Forest- based enterprise identification
- 2.3 Criteria for enterprise prioritization
- 2.4 Enterprise modalities: issues and constraints of forest- based enterprise development and product marketing
- 2.5 Policy and legal issues of timber and NTFPs- based enterprises.
- 2.6 Sensitivity analysis, market analysis and technical analysis of proposed enterprises
- 2.7 Methods for preparing a business plan of forest- based enterprises

UNIT 3: VALUE CHAIN OF FOREST ENTERPRISES (10)

- 3.1 Introduction and scope of the value chain in forest- based enterprises
- 3.2 Mapping the value chain of (*Asparagus racemosus*, *Rauwolfia serpentina*, *Cinnamomum tamala*, and *Cordyceps sinensis*)
- 3.3 Income and employment generated by value chain in timber and NTFPs enterprises
- 3.4 Impacts of value chain in forest- based enterprises
- 3.5 Case study of value chain analysis

UNIT 4: REVIEW OF FOREST- BASED ENTERPRISES (7)

- 4.1 Composite products (plywood, fiber board, particle board, oriented strand board, laminated products)
- 4.2 Pulp and paper
- 4.3 Cutch and Katha
- 4.4 LAC and manufacture of SHELLAC
- 4.5 Resin, turpentine and rosin
- 4.6 Charcoal
- 4.7 Essential oil
- 4.8 Herbal products (herbal tea and herbal soap)

- 4.9 Other enterprises (edible food, silkworm, tans and dyes, cane)

UNIT 5: QUANTITATIVE STUDIES ON TIMBER AND NTFPs (7)

- 5.1 Resource assessment techniques
- 5.2 Finding out the yield of a resource
- 5.3 Measuring yield
- 5.4 Measuring the product
- 5.5 Choice of sampling scheme
- 5.6 Working out overall yield estimates
- 5.7 Measuring growth and production rates

UNIT 6: HARVESTING OF TIMBER AND NTFPs (4)

- 6.1 Importance
- 6.2 Tools and techniques
- 6.3 Sustainable harvesting
- 6.4 Season of harvesting

UNIT 7: TRADE AND MARKETING OF NTFPs (4)

- 7.1 Importance of trade and marketing of NTFPs
- 7.2 Fundamentals of marketing (themes and principles)
- 7.3 Trade and marketing of NTFPs (local, national and international)
- 7.4 Benefit sharing and community support from NTFP trade and marketing

UNIT 8: POLICY AND PRACTICES FOR CONSERVATION OF NTFP SPECIES (4)

- 8.1 Policy and regulation for timber and NTFP (local, national and international)
- 8.2 Importance of trade and marketing of NTFPs
- 8.3 Certification of forest products

PRACTICALS (12)

Excursions (8): Students will be taken to nearby forest- based enterprise site to observe, understand and take first-hand information about value chain, value addition and enterprise development and operation. Students are required to prepare and submit field reports in prescribed format by the instructor

Practical (4): Students will prepare business plan for a forest- based enterprise and present in-group among students.

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Course Title: **PROJECT MANAGEMENT**

Course Code: SFM 808

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory 60, Internal Assessment: 15)

General objective: The general objective of the course is to provide knowledge on project organization, planning, monitoring and evaluation.

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

- Understand project management, project monitoring and project organizations.
- Understand project planning and implementation.
- Design and develop project

UNIT 1: DEVELOPMENT PROJECT CONCEPT (4)

- 1.1 Definition
- 1.2 Need of the project
- 1.3 Project vs programme
- 1.4 Difference between development project and research project and project cycle
- 1.5 Government of Nepal development strategies/planning
 - Five year plan of National Planning Commission
 - Current donor agencies interest/strategies/involvement in rural development of Nepal

UNIT 2: DEVELOPMENT PROJECT FRAMEWORK (4)

- 2.1 Concept
- 2.2 Theory of Change
- 2.3 Type of project development framework (log frame, result based framework, monitoring and learning framework)
- 2.4 Project development matrix
- 2.5 Project framework development processes
- 2.6 Risk and assumption

UNIT 3: PROJECT ENVIRONMENT (4)

- 3.1 Social
- 3.2 Political
- 3.3 Financial
- 3.4 Institutional
- 3.5 Technical
- 3.6 Others
- 3.7 Effect of environment on project management

UNIT 4: PROJECT MANAGEMENT AND PROJECT MANAGER (4)

- 4.1 Introduction of project management
- 4.2 Role of project manager
- 4.3 Management skills
- 4.4 Major project management challenge
- 4.5 Causes of development project failure

UNIT 5: PROJECT PLANNING AND BUDGETING (4)

- 5.1 Budgeting concept
- 5.2 Importance of budgeting

- 5.3 Types of budgeting
- 5.4 Budgeting processes
- 5.5 Problems in budgeting

UNIT 6: PROJECT ORGANIZATIONS AND HUMAN RESOURCE DEVELOPMENT (4)

- 6.1 Introduction about variations organization setup
- 6.2 Brief introduction about various project organization setup
- 6.3 People management and team building in project organization
- 6.4 Project organization and staffs/stakeholder's capability building
- 6.5 Human resource management challenges

UNIT 7: PLANNING AND IMPLEMENTATION OF DEVELOPMENT PROJECT (4)

- 7.1 Logical break-down of activities
- 7.2 Annual planning and Work Break
- 7.3 Scheduling of activities
- 7.4 Project implementation challenges and future planning

UNIT 8: PROCUREMENTS, CONTRACTS AND USE OF PROFESSIONAL SERVICES (4)

- 8.1 Procurement
- 8.2 Procurement principle
- 8.3 Types of procurement (direct purchase, competitive bidding)
- 8.4 Procurement processes for goods, services

UNIT 9: PROJECT FINANCE AND FINANCIAL MANAGEMENT (4)

- 9.1 Introduction
- 9.2 Budgeting
- 9.3 Financial management and accounting
- 9.4 Investment appraisal
- 9.5 Financial analysis

UNIT 10: MANAGING STAKEHOLDERS (4)

- 10.1 Introduction to participatory approach
- 10.2 Stakeholder mapping or Venn diagram
- 10.3 Beneficiaries/target groups (communities, gender and social equity, social inclusion of DAG others)
- 10.4 Partners (Donors, NGOs, CBOs)
- 10.5 Transparencies/accountability

UNIT 11: MONITORING AND EVALUATION OF DEVELOPMENT PROJECT (4)

- 11.1 Monitoring and evaluation concepts and types
- 11.2 Monitoring and evaluation principle
- 11.3 Criteria for evaluation (relevancy, efficiency, effectiveness, impact and sustainability)
- 11.4 Project annual review and planning
 - 11.4.1 Periodic review of the project
 - 11.4.2 Initial, annual, midterm review
 - 11.4.3 Project activities modification based up on review result
- 11.5 Project Audit
 - 11.5.1 Resource audit
 - 11.5.2 Public audit
 - 11.5.3 Social audit
- 11.6 Project evaluation methods

UNIT 12: PROJECT DOCUMENTATION, DISSEMINATION, PROPOSAL, REPORT WRITING AND BEYOND PROJECT (4)

- 12.1 Documentation and dissemination of project outcomes and lesson learned
- 12.2 Project proposal development and report writing
- 12.3 Beyond project
- 12.4 Current issues of development project and project management.
- 12.5 Strategic of safe landing for sustainable future management.
- 12.6 Suitability of the project activities after termination of the project.

PRACTICALS (12)

Field Study (8): A field study will be conducted to provide firsthand knowledge to students in forestry related development projects of different natures so as to review and understand project documents and implementation process. Students will prepare and submit the study report for evaluation.

Develop log frame and project proposal (4): Based on the project concept, students will develop log frame and project proposal. Students will prepare and submit the developed document for evaluation.

REFERENCES

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Course Title: **DISASTER RISK MANAGEMENT**
Course Code: WME 809
Credit Hours: 3
Lecture Hours: 60
Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course develops understanding of the students for assessment and management of multi hazards and disasters integrating with contemporary development practices.

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

- Understand the fundamentals, principles, policies and practices of DRM.
- Manage disaster informatics and assess the risk through appropriate tools and techniques.
- Assess the post disaster needs and response planning.
- Mitigate the disaster risks applying community- based management technologies.

UNIT 1: FUNDAMENTALS OF NATURAL HAZARDS AND DRM (4)

- 1.1 Basic concepts and definition of hazard, disaster, risk and vulnerability, mitigation, preparedness, response and recovery
- 1.2 Types of disasters in Nepal and around, and their classification
- 1.3 Impact of natural hazard (earthquake, flood, landslide, GLOF)
- 1.4 Disaster management cycle: prevention, preparedness, mitigation, relief, rescue and recovery

UNIT 2: DRM PRINCIPLES, POLICIES, INSTITUTIONS AND PRACTICES (8)

- 2.1 Integrated and comprehensive disaster risk reduction approaches, strategies and policies
- 2.2 Institutions and organizational framework for disaster risk management
- 2.3 Legal provisions and policies related to DRM
 - 2.3.1 Global: Sendai, Paris agreement, UNHCR Principles and international law and guidelines on humanitarian assistance (SPHERE)
 - 2.3.2 Regional: SARRC disaster management center
 - 2.3.3 National: DRM act and institutional mechanism, mainstreaming DRM in various sectors
 - 2.3.4 Province and local level policies and institutional mechanisms

UNIT 3: DISASTER INFORMATICS AND RISK ASSESSMENT TOOLS AND TECHNIQUES (10)

- 3.1 Disaster informatics
 - 3.1.1 Data management for DRR
 - 3.1.2 Disaster information management in disaster response and Emergency Operation Center (EOC)
 - 3.1.3 Web application internet in DRR
 - 3.1.4 Early warning systems
 - 3.1.5 Multi-criteria decision support system for emergency management
 - 3.1.6 Role of social media in information sharing
- 3.2 Risk assessment tools and techniques
 - 3.2.1 Risk analysis techniques
 - 3.2.2 Risk identification, reduction and transfer
 - 3.2.3 Approaches to mapping social vulnerability
 - 3.2.4 Participatory disaster risk assessment
 - 3.2.5 Action plans, strategy for survival

3.2.6 Tools (SIERA, RADIUS, HAZUS, CRISIS)

UNIT 4: POST DISASTER NEEDS ASSESSMENT AND RESPONSE PLANNING (12)

- 4.1 Humanitarian Relief System
 - 4.1.1 United Nations disaster assessment and coordination system
 - 4.1.2 Declarations of emergency and calls for assistance
 - 4.1.3 Agencies and coordination mechanism
- 4.2 Emergency response, early recovery and reconstruction phase
- 4.3 Assessment and planning
 - 4.3.1 Basic principle, process guidelines and tools on assessment and response immediate and long term
 - 4.3.2 Principle of planning in emergencies and reconstruction and development of framework
- 4.4 Emergency and long term management
 - 4.4.1 Assessment and operational planning
 - 4.4.2 Coordination and local level organization
 - 4.4.3 Logistic planning
- 4.5 Implementation and operation of humanitarian assistance
 - 4.5.1 Timely response and unhindered access
 - 4.5.2 Donor and funding mechanism
 - 4.5.3 Assessment, planning, logistics and distribution mechanism
 - 4.5.4 Search and rescue
 - 4.5.5 Coordination and cooperation– the cluster approach
 - 4.5.6 Stakeholders and their role and responsibilities– donor and UN agencies, national and local governments, INGOS, NGOs and PVOs

UNIT 5: DISASTER RISK MITIGATION TECHNOLOGY (6)

- 5.1 Disaster mitigation
 - 5.1.1 Concept, importance, guiding principles
 - 5.1.2 Tools, approaches, strategies,
 - 5.1.3 Sustainable development, sustainable land use planning
- 5.2 Emerging technologies in disaster mitigation
 - 5.2.1 Remote sensing, GIS, disaster mapping, land use zoning
 - 5.2.2 Emergency communication, wireless and radio, HAM radio
 - 5.2.3 Worst scenario analysis, emergency operations center.
- 5.3 Hazard specific technologies
 - 5.3.1 Flood, landslide, earthquake, fire, GLOF (climate induced disasters)

UNIT 6: COMMUNITY- BASED DRM (4)

- 6.1 Traditional best practices and their processes at community level
- 6.2 Importance of community-based disaster risk management
- 6.3 Role of community- based CBOs, institutions (microfinance, cooperatives) in DRM
- 6.4 Participatory disaster risk assessment and management planning
- 6.5 Disaster risk communication at community level
- 6.6 Participatory monitoring and evaluation
- 6.7 Government policies and guidance on CBDRM

PRACTICALS (16)

Field exercise tour (12): Students will spend at least three days in nearby appropriate site for fieldwork to investigate a disaster situation, evaluate different scenarios, assess alternative models of disaster risk reduction and evaluate effective approach.

Report writing and presentation (4): After fieldwork, students will prepare report and present their work among students.

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Course Title: **BIO-ENERGY**

Course Code: FPE 810

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The course provides knowledge and skill for identification of appropriate bio-energy technology for development and management of biomass resources.

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

- Plan for biomass energy resource development.
- Work on proper management of biomass resources.
- Work for conservation and improved utilization of bio-energy.
- Assess the demand and supply of important bio-energy resources.
- Identify appropriate bio-energy technologies.

UNIT 1: INTRODUCTION (6)

- 1.1 Definition and types of energy (renewable and nonrenewable energy sources)
- 1.2 National and international scenario of energy generation and consumption pattern
- 1.3 Importance, scope and limitation of non-biomass based alternative energy (solar, hydro, wind, geo-thermal, hydrogen, tidal, backup battery cell, nuclear etc.)
- 1.4 Concept and importance of bio-energy in renewable energy (RE)
- 1.5 Traditional bio-energy sources
- 1.6 Potential modern bio-energy
- 1.7 Role of bio-energy in AE (bio-briquettes, charcoal, wood-fuel, liquid bio-fuel, bio-ethanol, bio-hydro carbon oil, bio-diesel, bio-gas, wood-gas, dendro-thermal power and bio-mass power plant)
- 1.8 Social, economic and environmental impacts of bio-energy

UNIT 2: BIO-ENERGY RESOURCES (4)

- 2.1 Prospects and potential of forestry and non-forestry based bio-energy
- 2.2 Identification of potential bio-energy resources for development
- 2.3 Sustainable management of bio-energy resources (management and development: existing resource assessment, new resource development, management practices etc.)
- 2.4 Sustainability challenges of bio-energy resources

UNIT 3: CLASSIFICATION OF BIOMASS ENERGY ACCORDING TO PRODUCTION SYSTEMS (5)

- 3.1 Solid biomass fuels (woody and non-woody production sources, i.e. forestry, agriculture, livestock, industry, household, urban habitat development and other sectors)
- 3.2 Components of solid biomass (fuel wood, charcoal, briquettes, dried residues of crops and animals' dung and production methods)
- 3.3 Other biomass energy sources
 - 3.3.1 Liquid bio-fuels derived from woody and non-woody biomass, modern bio-energy components
 - 3.3.2 Gaseous bio-fuels derived from woody and non-woody biomass, modern bio-energy components

UNIT 4: BIO-ENERGY TECHNOLOGY (7)

- 4.1 Direct combustion system (cooking-stoves, boilers, kilns, furnaces, etc.)
- 4.2 Thermo-chemical conversion system (charcoal kilns, retorts, gasifiers, etc.)
- 4.3 Bio-chemical conversion system (bio-methanation process, fermentation process,
- 4.4 Distillation system (bio hydrocarbon oil)
- 4.5 Dendro-thermal plants and cogeneration plants
- 4.6 Biomass power plants
- 4.7 Hybrid technology system

UNIT 5: ENVIRONMENTAL CONCERNS OF BIO-ENERGY (3)

- 5.1 Greenhouse gases (GHGs) emission and carbon sequestration
- 5.2 Clean development mechanism (CDM), Reducing emission from deforestation and forest degradation (REDD+) in developing countries, forest certification etc.
- 5.3 Green energy as a sustainable energy option (substitution of fossil fuels)

UNIT 6: ON FARM OIL- BASED BIO-DIESEL PRODUCTION (4)

- 6.1 Species and variety selection, planting considerations
- 6.2 Oil extraction and byproducts
- 6.3 Challenges and opportunities with farm-based fuel production
- 6.4 Case study of on-farm fuel systems

UNIT 7: CELLULOSIC ETHANOL BIO-FUEL BEYOND CORN (2)

- 7.1 Introduction
- 7.2 Cellulose as ethanol feedstock
- 7.3 Challenges in cellulosic ethanol

UNIT 8: BIO-ENERGY AND ANAEROBIC DIGESTION (8)

- 8.1 Introduction
- 8.2 Benefits of anaerobic digestion
- 8.3 The anaerobic digestion processes
- 8.4 The process of starting a digester
- 8.5 Loading rate
- 8.6 Operation and control of a digester
- 8.7 Role of mixing in biogas production
- 8.8 Types of anaerobic digesters

UNIT 9: ENTREPRENEURIAL OPPORTUNITIES IN BIO-ENERGY (5)

- 9.1 Bio-energy entrepreneurship
- 9.2 The energy situation now and in the future
- 9.3 Bio-energy entrepreneurship motivations
- 9.4 Market drivers
- 9.5 Opportunities in bio-energy: bio-fuel value chain
- 9.6 Opportunities in small and large scale bio-energy

UNIT 10: NATIONAL POLICY, STRATEGY, ACT AND PROGRAMME (4)

- 10.1 Current sector specific policies, strategies, acts and programmes
- 10.2 Bio-energy and AE related institution and coordination
- 10.3 Sector specific constraints and issues
- 10.4 Possible measures for improvement

PRACTICALS (12)

Excursions (8): Students will be taken to nearby biogas related success and failure enterprise sites to observe, understand and take first-hand information about solid waste bio-energy/liquid energy/gas energy enterprise. Students will prepare and submit reports in the format instructed by the tour- in- charge or course coordinator.

Case study (4): Students will do review of success and failure of the enterprise and make presentation in groups among students.

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Course Title: **FOREST AND WILDLIFE PRODUCT ENTERPRISE DEVELOPMENT**

Course Code: FPE 811

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General Objective: This course provides knowledge and skills for identifying, developing and managing entrepreneurship of potential forest and wildlife based products.

Specific Objectives: After completion of this course, the student will be able to:

- Understand the role of forest and wildlife products in livelihood.
- Develop entrepreneurship skill on forest and wildlife products based enterprise.
- Examine policy, practices, trade and marketing of forest and wildlife products.

UNIT 1: ENTERPRISES AND ENTREPRENEURSHIP (4)

- 1.6 Definition, types and scope of different forest based enterprises
- 1.7 Ethno-botanical knowledge and their importance
- 1.8 Forest products and livelihood
- 1.9 Successful forest enterprises in Nepal

UNIT 2: ENTERPRISE IDENTIFICATION AND ESTABLISHMENT (10)

- 2.8 Feasibility study of enterprise
- 2.9 Forest based enterprise identification and prioritization
- 2.10 Criteria for enterprise prioritization
- 2.11 Enterprise modalities
- 2.12 Issues and constraints of forest based enterprise development, and product marketing
- 2.13 Policy and legal issues of forest based enterprises.
- 2.14 Sensitivity analysis, market analysis and technical analysis of proposed enterprises
- 2.15 Methods for preparing a business plan of forest based enterprises

UNIT 3: ENTREPRENEURS ROLE FOR ENTERPRISE DEVELOPMENT (6)

- 3.1 Role of entrepreneurs (initiator, risk taking, reduces risk, allocator, adhering to legal norms, forecasting)
- 3.2 Process of entrepreneurship development
 - 3.2.1 Clear view of the objective of the project
 - 3.2.2 Selecting the potential targets
 - 3.2.3 Identifying local talents and markets
 - 3.2.4 Choosing the right location
 - 3.2.5 Tying up with institutions
 - 3.2.6 Develop the entrepreneurship program as needed
 - 3.2.7 Analyze the result for future development
- 3.3 Relation between entrepreneurship and management

UNIT 4: VALUE CHAIN OF PLANT BASED ENTERPRISES (7)

- 4.1 Introduction and scope of the value chain in forest based enterprises
- 4.2 Mapping the value chain of (*Asparagus racemosu*, *Cinnamomum tamala*, and *Cordyceps sinensis*)
- 4.3 Income and employment generated by value chain of plant product as a enterprises
- 4.4 Impacts of value chain in forest based enterprises

- 4.5 Case study on value chain analysis

UNIT 5: MEDICINAL AND AROMATIC PLANTS AND THEIR PRODUCTS (4)

- 5.1 Definition and importance
- 5.2 Collection and extraction methods
- 5.3 Parts use for medicine of commercially valuable plants
- 5.4 Processing method of major medicinal plant in Nepal (at least two species)

UNIT 6: FIBRE YIELDING PLANT PRODUCTS (4)

- 6.1 Definition and Importance
- 6.2 Collection and extraction methods
- 6.3 Parts use for fiber of commercial valuable plants.
- 6.4 Processing method of major fiber yielding plants in Nepal (at least two species)

UNIT 7: BOTANICAL AND ZOO/ZOOLOGICAL GARDEN (4)

- 7.1 Concept, importance
 - 7.1.1 Botanical garden
 - 7.1.2 Zoo/zoological garden
- 7.2 Scenario (global, regional and national)
- 7.3 Research design and development

UNIT 8: WILDLIFE BREEDING AND FARMING (6)

- 8.1 Wildlife products and its utilization
- 8.2 Introduction of breeding and wildlife farming
 - 8.2.1 Ostrich farming
 - 8.2.2 Pheasant farming
 - 8.2.3 Vulture breeding
 - 8.2.4 Turtle breeding
- 8.3 Game ranching
- 8.4 Economics of wildlife farming
 - 8.4.1 Valuation techniques
- 8.5 Wildlife museum

UNITA 9: TRADE AND MARKETING POLICY FOR PLANT AND WILDLIFE PRODUCTS (3)

- 9.1 Importance of trade and marketing of plant and wildlife products.
- 9.2 Policy for trading plant and wildlife products (patent /animal right) (national/international)
- 9.3 Policy and law related to wildlife farming

PRACTICALS (12)

Excursions (8): Students will be taken to nearby forest or wildlife product enterprise sites to observe, understand and take first-hand information about enterprise development and operation. Students are required to prepare and submit field report in prescribed format by the instructor.

Case study (4): Students will do review of forest or wildlife based products enterprise development, management, operation, and present in-group among students.

REFERENCES

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- नेपाल सरकार २०७३, वन पैदावार सकलन तथा विक्री वितरण निर्देशिका २०७३, वन तथा भू-संरक्षण मन्त्रालय, सिंहदरवार, काठमाडौं, नेपाल ।
- नेपाल सरकार २०७४, सङ्कटापन्न वन्यजन्तु तथा वनस्पतिको अन्तर्राष्ट्रिय व्यापारलाई नियमन तथा नियन्त्रण गर्न बनेको ऐन, वन तथा भू-संरक्षण मन्त्रालय, सिंहदरवार, काठमाडौं, नेपाल ।

Course Title: **WILDLIFE CONSERVATION AND MANAGEMENT**

Course Code: PWM 812

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The aim of the course is to familiarize students with the methods of wildlife conservation and make them able to apply appropriate methods, tools and techniques for wildlife management and research.

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

- Apply different techniques of wildlife management and research.
- Understand behavioral ecology, wildlife genetics, bio-safety and bio-prospecting.
- Demonstrate skills in habitat analysis and evaluation.
- Discuss the techniques for wild animal's nutritional, digestibility and diet analysis.
- Understand the techniques for mitigation of wildlife damages and evaluate the human dimensions of wildlife conservation and management.

UNIT 1: INTRODUCTION (3)

- 1.1 Wildlife conservation practices in global and Nepalese context
- 1.2 Current issues, challenges or problems in wildlife conservation and management in Nepal
- 1.3 Potentialities and opportunities for wildlife conservation through applied research in Nepal

UNIT 2: POPULATION MONITORING, TOOLS, TECHNIQUES AND FIELD SURVEY (12)

- 2.1 Frequency and purpose of population monitoring: regular, periodical and long term
- 2.2 Capturing, marking and handling wild animals (mammals, birds and reptiles)
- 2.3 Identification and tracking of wild animals for research and monitoring (e.g. problem individual)
- 2.4 Chemical immobilization techniques, its purpose and application
- 2.5 Tools and equipment (camera trap, radio collar, binocular, range finder, GPS, compass, traps, snares)
- 2.6 Monitoring of major wildlife groups
 - 2.6.1 Carnivores: camera trap, occupancy, genetics
 - 2.6.2 Herbivores: distance sampling, pellet group counts
 - 2.6.3 Aves: point sampling
 - 2.6.4 Herpetofauna: Conservation Drone (crocodile), opportunistic survey
- 2.7 General consideration for field and lab works
 - 2.7.1 Field layout and inventory/survey
 - 2.7.2 Sample collection and storage (for diet analysis, nutritional analysis, carrying capacity)
 - 2.7.3 Sample analysis and data generation for analysis in the lab

UNIT 3: HABITAT ECOLOGY, ASSESSMENT AND MANAGEMENT (12)

- 3.1 Historical, ecological and evolutionary perspective of habitat ecology
- 3.2 Role of habitat in determining population distribution
- 3.3 Principles of assessing habitat quality and change
- 3.4 Ecology of major terrestrial habitats (forest- high mountain forest, hill forest, terai forest, alpine meadow, riverine forest, shrub lands, grasslands and wetlands)
- 3.5 Habitat evaluation methods (habitat suitability index, carrying capacity, Simpson's Diversity Index, Shannon-Weiner Index)

- 3.6 Vegetation sampling and measurement (biomass, density, frequency)
- 3.7 Effect and control of invasive and alien species on habitat e.g. *Lantana camera*, *Mikania micrantha*, water hyacinth (*Eichhornia crassipes*), Karautijhar (*Leersia hexandra*) and so on.
- 3.8 Ecological restoration and planning techniques and process in habitat management
- 3.9 Institutions involved and their roles in wildlife conservation and habitat management in Nepal

UNIT 4: TECHNIQUES FOR WILDLIFE NUTRITIONAL AND DIET ANALYSIS (7)

- 4.1 Nutritional analysis for captive wild animals in zoo, domesticated shade and in wild
- 4.2 Food digestibility measurement- fecal analysis for above categories
- 4.3 Nutritional and energy requirements for wildlife populations for above categories
- 4.4 Food habit (diet) analysis of herbivore and carnivore-microhistological analysis

UNIT 5: WILDLIFE UTILIZATION AND ETHICAL CONSIDERATIONS (6)

- 5.1 Theory of Sustainable Exploitation
 - 5.1.1 Subsistence Vs. commercial harvesting
 - 5.1.2 Wildlife farming
 - 5.1.3 Surplus hunting
 - 5.1.4 Wildlife trade (ostrich, Kalij, monkey)
- 5.2 Animal ethics and research permits
 - 5.2.1 Ethical consideration for captive and domesticated animals
 - 5.2.1 Ethical consideration during wildlife research
 - 5.2.2 Ethical consideration during animal translocation

UNIT 6: CURRENT ISSUES IN WILDLIFE CONSERVATION WITH CASE STUDIES (5)

- 6.1 Community- based conservation vs. rare species conservation
- 6.2 Impact of climate change in different wildlife species
- 6.3 Payment for ecological production of environmental services
- 6.4 Shifting from extraction to preservation
- 6.5 Forest landscape restoration and importance of microorganisms
- 6.6 Natural disaster, wild animal's rescue and management

PRACTICALS (15)

Field and Lab Exercises (15)

- Vegetation sampling and measurement in nearby campus premises
- Analysis of population data using distance sampling, mark-recapture, presence and occupancy modeling
- Demo on camera trapping and radio telemetry
- Population and habitat suitability modeling of some endangered mammal species
- Diet analysis of herbivore and carnivore- micro histological analysis
- Estimation of carrying capacity of wild animal's habitat
- Demo on nutritional and food digestibility analysis: examination of some animal species of Nepal
- Demo on chromosome mapping of wildlife and population assessment (study) through DNA analysis

Students will prepare and submit report of each practical for evaluation.

REFERENCES

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Course Title: **HERPETOLOGY, ORNITHOLOGY AND MAMMALOLOGY**

Course Code: PWM 813

Credit Hour: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: The objective of this course is to provide knowledge on classification, general ecology, sensory organs, and behavior of amphibians, reptiles, birds and mammals.

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

- Understand the behavior and ecology of common birds of Nepal.
- Develop the techniques of research on amphibians, reptiles, birds and mammals.
- Imply the knowledge for the conservation and management of herpetofauna, birds and mammals.

GROUP A - HERPETOLOGY

UNIT 1: INTRODUCTION (5)

- 1.1 Brief history of herpetology in Nepal
- 1.2 Classification and diversity of Nepalese amphibians and reptiles
- 1.3 Origin and evolution of amphibians and reptiles
- 1.4 Conservation status of Nepalese herpetofauna (NPWC Act 1973; 2029 BS) and further amendments, IUCN and CITES)

UNIT 2: GENERAL MORPHOLOGY, HABITATS AND DISTRIBUTION (5)

- 2.1 General morphology, habitats, vertical and geographical distribution of Caecilian, salamander, frogs, crocodiles, turtles, lizards and snakes in Nepal
- 2.2 Factors affecting distribution patterns of Nepalese herpetofauna
- 2.3 Major causes of amphibians and reptiles habitat degradation/fragmentation in Nepal
- 2.4 Potential impact of climate change on the herpetofauna

UNIT 3: ECOLOGY OF HERPETOFAUNA (3)

- 3.1 Food preferences (herbivores, carnivores and omnivores)
- 3.2 Mechanism of prey capture and ingestion
- 3.3 Modes of reproduction, development and parental care
- 3.4 Hibernation and estivation
- 3.4 Defense mechanism and escape behavior

UNIT 4: SNAKES OF NEPAL (2)

- 4.1 Nature and composition of snake venom
- 4.2 Identification of venomous and non-venomous snakes of Nepal
- 4.3 Incidents of snakebite in Nepal and how to avoid them
- 4.4 First aid and modern treatment of snakebites
- 4.5 Importance of snake conservation

GROUP B - ORNITHOLOGY

UNIT 1: INTRODUCTION (2)

- 1.1 Origin and evolution of birds
- 1.2 Classification and diversity of Nepalese birds
- 1.3 Main habitats (forest, wetland, grassland, human settlement and agricultural land) of birds in Nepal
- 1.4 Review of conservation status of Nepal's birds (NPWC Act 1973; 2029 BS) and further amendments, IUCN, CITES and Nepal Red List)

UNIT 2: BRIEF ACCOUNTS OF SOME BIRDS OF NEPAL (4)

- 2.1 Terrestrial birds (forest birds, grassland birds)
- 2.2 Swimming and diving birds (ducks and geese; grebes)
- 2.3 Birds of prey (owls, osprey, eagles, vultures, falcons)
- 2.4 Shore and waders (cranes, storks, ibises, spoonbills, herons and bitterns)
- 2.5 Arboreal birds (parrots, pigeons and doves, woodpecker, bee- eaters)
- 2.6 Aerial birds (swifts and swallows)
- 2.7 Endemic bird of Nepal
- 2.8 Pheasants of Nepal
- 2.9 Migratory birds of Nepal

UNIT 3: BODY PARTS AND SENSORY ORGANS (2)

- 3.1 Sense of smell and hearing
- 3.2 Homing and navigation
- 3.3 Vocalization
- 3.4 Types of bills
- 3.5 Types of feet

UNIT 4: BEHAVIOUR (5)

- 4.1 Territory
 - 4.1.1 Classification (breeding territory, non-breeding territory)
 - 4.1.2 Size and function of territory
- 4.2 Mating
 - 4.2.1 Kinds of mating (monogamy, polygamy, promiscuity)
 - 4.2.2 Mating displays (pre-fertilization display, fertilization display, post- fertilization display)
- 4.3 Nesting
 - 4.3.1 Classification of nests (ground nest, cavity nest, platform nest, cupped nest)
 - 4.3.2 Nest building (site selection, participation of the sexes, false nest)
 - 4.3.3 Reuse and protection of nests
- 4.4 Egg laying and Incubation
 - 4.4.1 Size, shape and coloration of eggs
 - 4.4.2 Numbers of eggs in a clutch
 - 4.4.3 Incubation (participation of sexes and behavior, length and time involved with examples of some species)
 - 4.4.4 Brood parasitism
- 4.5 Parental Care
 - 4.5.1 Brooding
 - 4.5.2 Feeding
 - 4.5.3 Nest sanitation
 - 4.5.4 Defense

UNIT 5: BIRD RELATED ACHIEVEMENTS AND CONSERVATION ISSUES (2)

- 5.1 Bird related achievements in Nepal (vulture restaurants, vulture breeding center and important birds and biodiversity conservation areas)
- 5.2 Bird conservation major issues in Nepal and their mitigations
- 5.3 Poaching and illegal trade of birds in Nepal
- 5.4 Potential impact of climate change on the Nepalese birds

GROUP C - MAMMALOLOGY

UNIT 1: INTRODUCTION (2)

- 1.1 Classification of mammals with special reference to Nepal
- 1.2 Species diversity and habitat utilization of mammals in Nepal
- 1.3 Review of conservation status of Nepalese mammals (NPWC Act 1973; 2029 BS) and further amendments, IUCN, CITES and Nepal Red List)

UNIT 2: IDENTIFICATION OF THE MAMMALS (3)

- 2.1 General morphology of typical mammal
- 2.2 Interpreting mammalian signs (scats, tracks, scratching, rooting etc) in the wild
- 2.3 Sexing and ageing mammals by observation
- 2.4 Brief ecology of large cats of Nepal

UNIT 3: MAMMALIAN PHYSIOLOGY (4)

- 3.1 Digestive, circulatory, respiratory, nervous, excretory and reproductive systems of mammal

UNIT 4: ENDOCRINOLOGY (4)

- 4.1 Structure and role of the thyroid, pituitary, gonads, pancreas and adrenal glands of mammal

UNIT 5: DISTRIBUTION AND THREATS TO MAMMALS IN NEPAL (2)

- 5.1 General distribution of protected/major mammal species of Nepal
- 5.2 Factors affecting distribution patterns of Nepalese mammals
- 5.3 Major causes of mammalian habitat degradation/fragmentation in Nepal
- 5.4 Potential impact of climate change on the Nepali mammals

PRACTICALS (15)

Laboratory and Field Exercises (15)

- Dissection: general anatomy of common garden lizard or wall lizard and pigeon
- Slide preparation: pecten of pigeon
- Field identification of common amphibians, reptiles, birds and mammals around the campus area and during field tour
- Dissection of rat: general anatomy and skin preparation
- Identification of tracks and scats of different animals in the campus area and during excursion and tours

All students will prepare, submit and present report for each exercise for evaluation by the instructor.

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Course Title: **RANGELAND MANAGEMENT**

Course Code: WME 814

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment: 15)

General objective: This course provides understanding on human-rangeland interface and concept of carrying capacity for effective and sustainable rangeland management and improvement of habitat and livestock production.

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

- Understand concept of range science and apply such concepts in management of rangeland.
- Apply the principles of vegetation management to improve wildlife habitat and livestock production.
- Understand human- rangeland interface and concept of carrying capacity in decision-making of rangeland management.
- Understand policy and practice related to rangeland in Nepal.

UNIT 1: BASIC CONCEPT ON RANGELND MANAGEMENT (6)

- 1.1 Magnitude and importance of rangeland, world classification of rangeland biome and types of rangeland, physical characteristics of rangeland
- 1.2 Rangeland ecosystem versus desert ecosystem, rangeland versus grassland.
- 1.3 Rangeland systems: foundation for a conceptual framework
- 1.4 Pastoral practices in transition: animal husbandry in high Asian contexts
- 1.5 Rangeland in different physio-geographical areas of Nepal
 - 1.5.1 Terai grassland
 - 1.5.2 Mid-hills grassland/kharkas, high Himalayan grasslands/kharkas
 - 1.5.3 Influence of rangeland on other industries
- 1.6 Future of range industries in Nepal

UNIT 2: RANGE IMPROVEMENTS (6)

- 2.1 Principles and practices of range land management
- 2.2 Improvement of range productivity by vegetation manipulation through control of undesirable vegetation, burning, fertilization, soil and water conservation and protection
- 2.3 Range improvement and livestock management
- 2.4 Rangeland degradation, poverty and conflict
- 2.5 Effect of grazing upon productivity of the site
- 2.6 Influence of improper grazing on forage value
 - 2.6.1 Importance of range management in soil and water conservation
 - 2.6.2 Concept of herbicides and pesticides application for rangeland improvement.

UNIT 3: RANGELAND ECOLOGY (6)

- 3.1 Understanding the concept of range ecology
- 3.2 Production potential of different silvo-pasture system
- 3.3 Fodder bank establishment and management
- 3.4 Differences between sedges and grasses
- 3.5 Limitations to fodder and pasture development and choice of species
- 3.6 Effects of climatic factors upon livestock, influence of physical conditions upon vegetation

- 3.6.1 Natural factors influencing rangeland: soils, elevation and topography, livestock, water, economic significance of natural factors
- 3.6.2 Ecological consequences of climate change on rangelands

UNIT 4: RANGE INVENTORY (5)

- 4.1 Purpose of range inventory
- 4.2 Vegetation analysis by different methods
- 4.3 Carrying capacity and grazing carrying
- 4.4 Limitations of the carrying capacity
- 4.5 Range condition classification for Nepal
 - 4.5.1 Concept and definitions
 - 4.5.2 Classification systems
 - 4.5.3 Condition trend analysis

UNIT 5: FORAGE MANAGEMENT (6)

- 5.1 Fodder from trees/shrubs and their nutritive values
- 5.2 Forage propagation techniques
- 5.3 Root behavior, crown architecture including methods for minimizing unfavorable interactions
- 5.4 Planting fodder tree species, causes of failure in early range seeding
- 5.5 Pasture development, performance of fodder and pasture species in Nepal, grazing systems, paddock, closer cycle, and cut and carry cycle
- 5.6 Sources of gap between optimal requirement and present availability of the forage resources in Nepal
- 5.7 Techniques for dealing with problematic weeds in pastures

UNIT 6: FEEDING BEHAVIORS OF LIVESTOCKS AND WILD ANIMALS (6)

- 6.1 Feeding habits and grazing behavior of range livestock
- 6.2 Improving livestock distribution, wildlife habitat evaluation
- 6.3 Introduction of nutritious grasses and legumes species.
- 6.4 Range animal nutrition, predation, forage preference of domestic and wildlife
- 6.5 Optimal livestock and range utilization
- 6.6 Seasonality of plant growth

UNIT 7: RANGELANDS AS SOCIAL–ECOLOGICAL SYSTEMS (5)

- 7.1 Traditional practices of rangeland management
- 7.2 Livestock production systems
- 7.3 Adaptive management of rangeland systems
- 7.4 Managing the livestock–wildlife interface on rangelands
- 7.5 Maintaining the human–natural systems of pastoralism in the Himalayan region
- 7.6 Sociocultural and ecological systems of pastoralism in the Himalayan region
- 7.7 Pastoral communities’ perspectives on climate change and their adaptation strategies in the Hindukush-Karakoram-Himalaya

UNIT 8: RANGELAND POLICY AND PRACTICE IN NEPAL (5)

- 8.1 Rangeland policy and tenure system, state policy and local performance: pasture use and pastoral practices
- 8.2 Indigenous herding system in Nepal
- 8.3 Local herding system
- 8.4 Trans-humane sheep herding
- 8.5 Constraints and opportunities about rangeland/grassland in Nepal

- 8.6 Types of enclosures, effects of closure
- 8.7 Management history of fodder and pasture development in Nepal

UNIT 9: POISONOUS PLANT PROBLEMS IN THE RANGELAND (3)

- 9.1 Preventing poisonous plant losses
- 9.2 Curing animal suffering from poisoning
- 9.3 Poisonous plants of major importance
- 9.4 Economic impact of poisonous plants on the rangeland
- 9.5 Assessing rangeland health
- 9.6 Understanding of animal diseases and their control

PRACTICALS (12)

Field Excursion (4): Students will visit nearby area to observe grazing behavior of herbivorous animals, identify grass, and fodder species. Students will collect data required for determining carrying capacity for grazing.

Exercise (4): After fieldwork, students will carry out calculation of nutritive value of different forage species in the lab and prepare reports on carrying capacity.

Term paper (4): Each student will prepare and present a term paper based on literature review on the topic assigned by the course coordinator related to case studies on different gaps, policies and other researches in rangeland management being carried out in Nepal and other parts of the world.

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Course Title: **FOREST RESOURCE ASSESSMENT AND PLANNING**

Course Code: SFM 815

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory: 60, Internal Assessment:15)

General objective: After the completion of the course, students will gain knowledge on methodological approach in forest resource assessment and develop skills in forest resource measurement, analysis and planning.

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

- Analyze forest policies.
- Assess forest conditions and its dynamism.
- Design sampling, conduct field inventory and analyze forest conditions.
- Understand and apply forest planning techniques.

UNIT 1: POLICY CONTEXT OF FORESTRY (5)

- 1.1 Forest policy strategies (global, regional, national)
- 1.2 Current situation of forest policy
- 1.3 Major issues in forestry sector

UNIT 2: FOREST CONDITION (5)

- 2.1 Global forest resource assessment
- 2.2 Present national forest condition
- 2.3 Drivers of deforestation and forest degradation
- 2.4 Forest dynamics
- 2.5 Effect of tree species diversity on forest dynamics

UNIT 3: METHODOLOGICAL APPROACHES IN FOREST RESOURCE ASSESSMENT (10)

- 3.1 History of national forest inventory
- 3.2 Forest cover mapping
- 3.3 Forest resource inventory
- 3.4 Sample plot design
- 3.5 Forest soils assessment
- 3.6 Forest biodiversity assessment
- 3.7 Forest disturbance analysis

UNIT 4: FOREST EXTENT AND CHANGE ANALYSIS (10)

- 4.1 Global, regional and national trends in forest area
- 4.2 Characteristics of different forest types
- 4.3 Forest cover change detection
- 4.4 Growing stock and biomass analysis
- 4.5 Forest Carbon measurement and analysis

UNIT 5: FOREST MANAGEMENT PLANNING (10)

- 5.1 Concept
- 5.2 Process (scoping, survey, analysis, synthesis, implementation, monitoring and revision)
- 5.3 Issues and challenges of forest management planning
- 5.4 Forest management planning techniques

PRACTICALS (20)

Field and Laboratory Exercise (20)

- Conduct forest dynamic analysis (4)
- Analyze forest disturbance (4)
- Prepare forest cover map and change analysis (4)
- Forest carbon analysis (4)
- Forest management planning techniques (4)

Each student will prepare, submit and present report on each exercise for evaluation by the instructor.

REFERENCES

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- Pretzsch, H. (2009). Forest Dynamics, Growth and Yield. Springer, Heidelberg.

Course Title: **LIVELIHOODS, FORESTS AND COMMON PROPERTY RESOURCE MANAGEMENT**

Course Code: SFM 816

Credit Hours: 3

Lecture Hours: 60

Full Marks: 75 (Theory 60, Internal Assessment :15)

General objective: The course aims to enhance understanding of livelihood, forest-poverty dynamics and theory of common property resource management and analyze the problems and possible solutions.

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

- Understand the livelihoods and livelihood analysis.
- Understand poverty and forest-poverty dynamics.
- Understand and apply theory of CPR management into practice.
- Analyze demand and supply side problems of CPR.
- Examine the problems and possible solutions for CPR management institutions in Nepal.
- Analyze the CPR management policies in Nepal.

UNIT 1: LIVELIHOODS AND LIVELIHOOD DIVERSIFICATIONS (8)

- 1.1 Concepts of livelihoods and livelihood diversifications
- 1.2 A framework for analysis of rural livelihoods
- 1.3 Use of the framework for livelihood analysis
- 1.4 Determinants of livelihoods diversification
- 1.5 Gender and rural livelihoods

UNIT 2: POVERTY AND INCOME DISTRIBUTION (8)

- 2.1 General introduction
- 2.2 Common terms and concepts
- 2.3 State and implications of poverty in Nepal
- 2.4 Measures of poverty: head count ratio, poverty gap index, square poverty gap index
- 2.5 Multidimensional poverty measures
- 2.6 Poverty and income distribution
- 2.7 Determinants of poverty
- 2.8 Poverty dynamics growth and inequality
- 2.9 Poverty and income distribution case in Nepal (case)

UNIT 3: FOREST POVERTY LINKAGES (8)

- 3.1 The forest-related environmental income and poverty link
- 3.2 Types of benefits and stakeholders
- 3.3 Roles of forest income in rural livelihoods
- 3.4 The poverty–forest dependence connection
- 3.5 Other conditioning factors of forest dependence
- 3.6 Environmental (income) Kuznets curve
- 3.7 Kuznets ratios
- 3.8 Forest poverty linkages and their dynamics (case)

UNIT 4: COMMON PROPERTY RESOURCE (CPR) THEORY (10)

- 4.1 Concepts of common property resources
- 4.2 Types of common property resources

- 4.3 Theories of common property resources
- 4.4 Classifying goods
- 4.5 Hardin's tragedy of commons and Olsen's collective action theory
- 4.6 Oakerson's framework analysis for commons
- 4.7 CPR design principles
- 4.8 Managing CPRs in Nepal (case)

UNIT 5: DEMAND AND SUPPLY SIDE PROBLEMS OF CPR (8)

- 5.1 Demand side problems in CPR management
- 5.2 Supply side problems in CPR management
- 5.3 Case study

UNIT 6: CPR INSTITUTIONS AND FOREST MANAGEMENT (8)

- 6.1 Institutional arrangements for common property resources
- 6.2 Institutional and management problems and opportunities in:
 - 6.2.1 Biodiversity and buffer zone management
 - 6.2.2 Watershed management
 - 6.2.3 Community forestry
 - 6.2.4 Leasehold forestry
 - 6.2.5 Collaborative forestry
 - 6.2.6 Case study

UNIT 7: POLICIES IN CPR MANAGEMENT (4)

- 7.1 Review of CPR policies
- 7.2 Poverty alleviation strategies and programs in CPR management
- 7.3 Strength and weaknesses of state and non-state actors in CPR management

PRACTICALS (6)

Term paper (6): Each student will be assigned a term paper based on secondary literature. Each student will make presentation on the term paper prepared among the students and faculties.

REFERENCES

- Agrawal, A. (2001). Common property institutions and sustainable governance and resources. *World Development* 29(10): 1649-1672.
- Angelsen, A. and Wunder, S. (2003). Exploring the Forest-Poverty Link: Key Concepts, Issues and Research Implications. CIFOR Occasional paper no. 40. Center for International Forest Research, Bogor, Indonesia.
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Course Title: **THESIS PROPOSAL SEMINAR**

Course Code: R&T 851

Credit Hour: 1

Full Marks: 25

General objective: The Thesis Proposal Seminar aims to qualify students for thesis work and production of proposal for research.

Specific objectives: After the completion of Thesis Proposal Seminar, the students will be able to:

- Produce research proposal in area of interest.
- Develop skills for research design and planning.
- Disseminate research ideas with larger community.

Requirements

After registration of the thesis proposal at concerned department of the respective campus, each student will make presentation and defend the thesis proposal in a seminar organized by the campus. A team of experts formed by the respective campus will evaluate the proposal defense during the seminar following standard guidelines. The team of experts reserves the right to reject or ask for re-submission of the proposal on the following condition(s):

- If the topic of research is not related with the core subject area of respective master's degree program.
- If the work is wholly or largely duplicate work previously undertaken.
- If the proposed research does not meet the minimum standard of master's degree program.

Course Title: **THESIS**
Course Code: R&T 852
Credit Hours: 13
Full Marks: 325

General objective: The aim of the thesis is to build the capacity of students to design, plan and implement significant and original research that address the existing problems and gaps in respective area of interest of the students.

Specific objectives: After the successful completion of thesis work, the students will be able to:

- Acquire the literary skills necessary to conduct and communicate the research.
- Acquire in-depth knowledge in the field of study, providing deeper knowledge in current research and development work.
- Develop capability to use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues.

Requirements

A consistent and comprehensive research proposal is an integral part of the M.Sc. thesis. A candidate who has successfully presented the thesis proposal and whose proposal has been approved by the expert team of Thesis Proposal Seminar is eligible to carry out the thesis work. The student should carry out the thesis individually under the supervision of a committee of potential supervisors. The committee of supervisors will consist of two to three members with one principal supervisor and the rest co-supervisors. The principal supervisor must be the faculty member of Institute of Forestry with a PhD degree in related discipline or at least a master's degree in related discipline who has published at least one article in peer-reviewed journal as the first author. The co-supervisors with at least master's degree in related discipline and work experience from within or outside TU/IOF can be nominated to guide the thesis work. The concerned department of respective campus holds the right to nominate the supervisors in consultation with the individual student. It is obligatory that students conduct thesis work in core discipline of respective M.Sc. program of enrollment. A thesis completed by analysis of only secondary data will not be accepted. The thesis should be strictly in line with the proposal accepted in the thesis proposal seminar.

Evaluation

The students will prepare and submit the thesis in the prescribed format of IOF for final evaluation. For the evaluation of the thesis, a three member Research Assessment Committee (RAC) will be formed. The principal supervisor by default and one external examiner nominated by respective campus and another by Exam division of Institute of Forestry will be the members of RAC. Upon approval of the student's thesis, the supervisors will inform through written statement to the concerned campus for evaluation of the thesis. The student then submits the draft of the thesis. Along with the draft of the thesis, the student should prepare and submit manuscript of the research article for publication in peer reviewed journal based on thesis work. RAC members will critically go through the thesis, evaluate the manuscript of the article submitted and arrange for viva- voce of the student. The externals of RAC hold the right to disapprove the draft of the thesis, if it does not meet the minimum standard of M. Sc. thesis. If the student successfully passes the viva-voce, the RAC recommends for public defense.

RAC will evaluate the thesis based on the evaluation sheet provided by the examination division. 40% of the weightage of the evaluation is assigned to the thesis supervisors and the remaining 60% is assigned to the external examiners of RAC. The respective supervisor/s will duly sign the final thesis.

Thesis will be graded on the following criteria in percentile:

<u>Description</u>	<u>Grade</u>
Excellent (90% and above)	A
Very good (80% to less than 90%)	B
Good (70% to less than 80%)	C
Satisfactory (60% to less than 70%)	D
Insufficient (50% to less than 60%)	E
Detained (Less than 50%)	F

Note: Grades with A and F should be compulsorily justified with written statements by the evaluator.

Course Title: **THESIS DEFENSE SEMINAR**

Course Code: R&T 853

Credit Hour: 1

Full Marks: 25

General objective: The Thesis Defense Seminar aims to provide opportunity to students to develop skills in presentation and discussion of research findings in public forum.

Specific objectives: After the completion of Thesis Defense Seminar, the students will be able to:

- Enrich academic experience through research work.
- Develop skills in publicly presenting research results.
- Make effective and professional interactions and offer feedbacks on other students' research.

Requirements

The students will only be eligible to present the research findings for public defense in thesis defense seminar if the Research Assessment Committee approves the thesis. Then respective department or the campus itself will form the evaluation committee for the thesis defense seminar. The committee will evaluate the student's presentation based on the standard evaluation sheet developed by the department or the campus. The student should incorporate the comments and suggestions provided by other fellow students, faculty members and invited experts during the thesis defense seminar in preparing the final thesis.