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FACULTY OF FORESTRY

Course Bulletin of B. Sc. Forestry

AGRICULTURE AND FORESTRY UNIVERSITY (AFU)
Rampur, Chitwan, Nepal
2072

AFU BULLETIN

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Course Bulletin of B.Sc. Forestry

AGRICULTURE AND FORESTRY UNIVERSITY
(AFU)
Rampur, Chitwan,
Nepal 2072

1st Semester Courses

Course Code : BSH 101

Course Title : Principles of Cytology, Genetics and Plant Breeding

Credit Hours : 3 (2+1) Full Marks: 75

Theory: 50 Practical: 25 OBJECTIVES

Upon the completion of this course, the students will be able to understand the structure and functions of cell organelles, cell divisions, laws of inheritance, and principles and method of plant breeding.

SYLLABUS:

Introduction: Brief history of Cytology and Genetics Cell structure, Organelles and their functions, Cell Divisions. Mendel's law of Inheritance: Mendel's experiments, Principles of segregation,Principles of Independent assortment,Deviations from Mendel's findings, Likages and Crossing overs. Cytoplasmic inheritance, Mutation.Quantitative inheritance, Lethality and Interactions of genes.Physical basis of heredity:Nucleic acids and their structure, functions and synthesis, fine structure of genes Genetic code, Recombinant DNA,Cloning and amplification of DNA .Gene transfer methods and transgenic plants, their uses and issues.
Plant Breeding: Historical perspectives, Concepts and scope.Principles and tools in plant breeding.Methods of plant breeding with emphasis on tree species.Emerging issues, and application of new techniques in plant breeding.

Course Breakdown

Theory:

S.N.	Topic	No. of Lectures
1.	Introduction: Brief history of Cytology and Genetics	1
2.	Cell structure, Organelles and their functions, Cell Divisions	3
3.	Mendel's law of Inheritance: Mendel's experiments, Principles of segregation,Principles of Independent	2
4.	Deviations from Mendel's findings, Likages and Crossing overs. Cytoplasmic inheritance	2
5.	Mutation	1
6.	Quantitative inheritance, Lethality and Interactions of genes	2
7.	Physical basis of heredity: Nucleic acids and their structure, functions and synthesis, fine structure of genes	3
8.	Genetic code, Recombinant DNA,Cloning and amplification of DNA	3
9.	Gene transfer methods and transgenic plants, their uses and issues	2

Practical

S.N.	Topic	No of Practicals
1.	Detail study of cell structure	2
2.	Cell Division: study different slides of different stages of mitosis and meiosis.	2
3.	Preparation of fixatives and stains	1
4.	Squash and smear techniques	2
5.	Preparation of permanent slides of cell divisions	2
6.	Determination of pollen fertility and viability	2
7.	Floral biology- its measurement, emasculation, crossing and selfing techniques in selected species.	2
8.	Demonstration of hybrid variation and production techiques	2
Total		**15**

REFERENCES:

1. Chaudhary, R C. 1993. Introduction to Plant Breeding. Oxford & IBH Publishing Co.New Delhi,India.

2. Gupta, P K 1998. Genetics. Rastogi Publications,Meerut,India.

3. Jensen,N F. 1988.Plant Breeding Methodology.

4. Levin,B. 1998. Genes VI. Oxford University Press,London.

5. Snustad,P ad Simmons,J M. 2000. Principles of Genetics.Jonn Willey & Sons Inc, New York.

Course Code : BSH 102

Course Title : Communicational and Technical English
Credit Hours : 3(2+1) Full Marks: 75 Theory

50 Practical 25 OBJECTIVE:

Upon the completion of this course, the students will be able to communicate technical information effectively and competently in writing and speech with confidence, using audiovisual materials, to a variety of audiences.

SYLLABUS:

A. Reading comprehension:

Strategies for reading comprehension; note taking; summary/précis writing.

B. Fundamentals of technical communication

Introduction to communication, communication process, barriers of communication, different communication models, effective communication (verbal / non verbal); substance of technical writing, technical writing defined, technical and non-technical writing, attributes of good technical writers, qualities of good technical writing.

C. Audience adaptation

Analyzing audience's needs and point of view, providing needed background (defining terms, explaining concepts, helping the readers through your report),

D. Achieving a readable style

Care in word choice, active verbs, active versus passive voice, first person point of view, concrete words and specific language, pomposity, empty words, elegant variation, sexist words, clear sentence structure, sentence length, sentence complexity and density

E. Writing technical documents:

Writing technical reports: Variable nature of reports, liability and report writing, determining report structure, general structure of a research report;

Writing proposals: Solicited and Unsolicited Proposals, Internal and External Proposals,

*P*roposal formats—informal and formal formats
Other forms of written communication: Business letters, job application, résumé, memo, notice, circular, agenda / minutes, instructions

F. Designing visual aids: purpose of visuals, choosing graphics, designing tables, designing graphs, bar graphs, line graphs, circle graphs, organization charts, flow charts, tree charts, pictorial charts, integrating text and visuals

G. Documentation: When do you document? What do you document? Systems of Documentation, General Rules, Footnotes and Endnotes, Parenthetical Notes, Author-Date Documentation, Works Cited, MLA and APA, Plagiarism

H. Oral Presentation of Technical Information: Oral reports, difference between oral and written reports, planning the oral report, technical talk, public speaking conducting and participating in meeting, group discussions, brain storming sessions and presentations.

Course Breakdown

Theory

S. N.	Topic	No. of lectures
1.	Introduction to the course, Strategies for reading comprehension, note taking, summary/precis writing.	3
2.	Introduction to communication, communication process, barriers of communication, different communication models, effective communication (verbal / non verbal)	3
3.	Substance of technical writing, technical writing defined, technical and non-technical writing	1
4.	Attributes of good technical writers, qualities of good technical writing	1
5.	Analyzing audience's needs and point of view, providing needed background	1
6.	Achieving a readable style: care in word choice, active verbs, active versus passive voice, first person point of view, concrete words and specific language, pomposity, empty words, elegant variation, sexist words.	4
7.	Clear sentence structure, sentence length, sentence complexity and density	2
8.	*Writing technical reports*: Variable nature of reports, liability and report writing determining report structure, general structure of a research report	3
9.	*Writing proposals*: Solicited and unsolicited proposals, internal and external proposals, proposal formats—informal and formal formats	2
10.	*Other forms of written communication:* Business letters, job application, résumé, memorandum, notice, circular, agenda / minutes, Instructions	4
11.	Visual aids, integrating text and visuals	1
12.	Documentation, works cited, MLA and APA, Plagiarism	2
13.	Oral communication: Oral reports, difference between oral and written reports, planning the oral report	1
14.	Technical talk, conducting and participating in meeting, interviewing	2
Total		**30**

Practical

S. N.	Topic	No. of Practicals
1.	Developing Reading Skills through Non Technical (Literary) and Technical Texts (from recommended Books)	2
2.	Developing Writing Competence:	
	a. Writing technical Reports	2
	b. *Writing proposals*	2
	c. Business letters, job application, résumé, memo, notice, circular, minutes, and/or instructions	2
3.	Designing visual aids	2
4.	Documentation	2
5.	Oral reports, technical talk, conducting and participating in meeting, Presentations, interviews	3
Total		15

BOOKS - RECOMMENDED:

1. Board of Editors. 2010. *Contemporary Communicative English for Technical Communication.* Pearson Longman

2. D. Sudharani. 2010 . *Advanced Communication Skills Laboratory Manual*, Pearson Education, India,

3. Meenakshi Raman, and Sangeeta Sharma. 2004. *Technical Communication Principles and Practice.* Oxford University Press,

4. Barun K.Mitra. 2006. *Effective Technical Communication: a guide for scientists and engineers*. Oxford University Press.

5. V. Sashikumar (ed.) . 2006 . *Fantasy- A Collection of Short Stories* Orient Black

6. SwanSingh, Abadhesh, 2012. Essentials of Technical Communication. MemCoe, Institute of Forestry, Pokhara

REFERENCES:

1. John M. Lanon.2008. *Technical Communication.* Pearson/Longman.

2. Dumont, Raymond and John M. Lannon.1990. *Business Communications*. Scott, Freshman and Company, Glenview, Illinois.

3. Houp, Kenneth W., Thomas E. Pearsall, & Elizabeth Tebeaux.1995. *Reporting Technical Information*. Allyn & Bacon, Needham Heights, Massachusetts.

4. Donna Gorrel.1994. *A Writer's Handbook from A to Z.* Allyn &Bacon, A Division of Simon and Schuster, Inc., Needham Heights, MA 02194.

5. Lannon, John M.1998. *Technical Writing*. Scott, Freshman andCompany, Glenview, Illinois.

6. Stratton Charles.1984. *Technical Writing Process and Product*. Holt, Rinehart and Winston, New York.

7. Elizabeth Tebeaux, and Sam Draggahe.2009. *Essentials of Technical Communication,* Oxford University Press.

8. A Guide to paper writing in Forestry- Dr. Swoymbhu Man Amatya

Course Code : BSH 103

Course Title : Elementary Economics

Credit Hours : 2 (2 +0) Full Marks: 50

Theory: 50 Practical: 0 OBJECTIVES

Upon completion of this course, the students will be able to understand and apply the theories and principles of micro and macro economics to enhance, decision making analytical skill and efficient resource utilization for promoting; business activities.

SYLLABUS

Concept of Economics Science as wealth of nation, material welfare and science of choice; Subject matters of Economics, Concept of micro & macro economics. Demand analysis & determinants of demand, elasticity of demand and measurement. Utility analysis, Law of diminishing marginal utility and equi marginal utility; concept of consumer surplus. Concept of cardinal & ordinal analysis; IC analysis, indifference schedule, curve, marginal rate of substitution & properties of IC; budget line & its shifting, consumer equilibrium under IC; price, substitution and income effect; derivation of demand curve in IC approach. Concept of production; Concept of Production and factors of production & production function; Total, Average & Marginal product curves, Law of variable proportion, Iso-quant, Iso-cost line and producer equilibrium; Laws of returns to scale. Concept of costs, money & real cost, fixed & variable cost, Total cost, Average cost and marginal costs and their derivation. Concept of Total, Average & Marginal revenue and revenue curve under perfect & imperfect market. Concept of Supply, supply schedule & curve, elasticity of supply. Equilibrium of a firm and industry, Perfect

competition market & its characteristics; price determination under perfect competition. Monopoly market and its characteristics; price & output determination under monopoly. Definitions of national income, Concepts of national income GDP, GNP, NNP, NI, PI, DI; Measurement of national income by product & income method; difficulties in measuringt the national income.

Course Breakdown

S. N.	Topic	No. of Lectures
1.	Definition of Economics: Wealth of nation, material welfare & Scarcity & choice	2
2.	Subject matter of Economics: Micro & Macro	1
3.	Concept of demand, Law of demand, demand schedule & curve.	1
4.	Demand function, determinants meaning and types of elasticity of demand	1
5.	Measurement of price elasticity of demand by point & arc method.	1
6.	Concept of cardinal utility, law of diminishing marginal & equi marginal utility	2

7.	Derivation of demand curve & consumer surplus	1
8.	Concept of ordinal approach, Indifference schedule & curve	1
9.	Principle of Marginal Rate of Substitution & properties of IC	1
10.	Budget line and causes to shift budget line	1
11.	Consumer Equilibrium under IC analysis & Income effect	1
12.	Price effect into the income & substitution effect and derivation demand curve	1
13.	Meaning & concept of production & factors of production	1
14.	Concept of Short run & long rung production function, TP, AP & MP	1
15.	Law of variable proportion	1
16.	Concept of iso-quant and iso cost line	1
17.	Producer Equilibrium & least cost combination	1
18.	Laws of Returns to scale (Increasing, Constant & Decreasing)	1
19.	Concept of money & real cost, fixed & variable cost	1
20.	Derivation of TC, AC & MC in short run	1
21.	Concept & derivation of TR, AR & MR curves in Perfect & imperfect markets	1
22.	Concept of Supply, law of supply & elasticity of supply	1
23.	Concept & characteristics of Perfect competition & price determination	1
24.	Equilibrium of a firm & output determination under perfect competition	1
25.	Concept of Monopoly market, price & output determination on it	1
26.	Concepts & meaning of National income	1
27.	Measurement of National Income by product & income method	1
28.	Difficulties to measurement of the National income	1
Total		**30**

TEXT BOOKS

1. Modern Economic Theory, K.K. Dewette
2. Micro Economics, Rajendra Gopal Shrestha
3. Macro Economics, Rajendra Gopal Shrestha

REFERENCE BOOKS:

1. Business Economics, Prof. Dr. Shyam Joshi
2. Advanced Economic Theory, H.L. Ahuja
3. Modern Microeconomics, A. Koutsoyiannis
4. Price Theory and its Uses, Donald Stevenson Watson and Malcolm Getz
5. Principles of Economics, P.N. Chopra
6. Macroeconomic Theory, M.L. Jhingan
7. Microeconomics: Theory and Policy, D. N. Dwivedi

Course Code : BSH 104

Course Title : Social Science for Forestry

Credit Hours : 2 (2+0) Full Marks: 50

Theory 50 Practical: 0 OBJECTIVES

To enable students develop basic understanding of Sociology, understand the value of group dynamics in natural resource management and analyze the role of Social system/ Structure on natural resource management.

SYLLABUS

Definition, Nature, Scope and major Sub-Divisions of Sociology, Meaning, definitions and characteristics of some of the major basic concepts in Sociology, Ethnocentrism, Cultural Relativism, Social Group Vs. community, Users group, Interest group, Insider/outsider (emic/ etic) Perspective, Meaning, definitions and forms of Social Institutions and Social Organization, Meaning, definitions, characteristics and factors of Social Change and Cultural Change, Meaning, definitions and characteristics of various social processes, Social Control, Social Inequality, Theoretical approaches to social change and development, Cultural Diversity and Pluralism in Nepal, Economic structure of Nepalese Society, Nepalese ethnic/caste & class structure and gender in Nepalese context ad their changes, Processes of acculturation, westernization, modernization Nepalization & Sanskritization in Nepal, National Integration in Nepal, Natural resources and Natural resources management in sociological perspectives, Indigenous Vs. scientific natural resources management, Role of caste, class, gender and age in decision making, politics and power, distribution and equity in natural resource management in Nepal, Good governance and Conflict resolution in farming

and forestry sector of Nepal.

Course Breakdown

S.No.	Topic	No. of Lectures
1.	Definition, nature, scope and major sub-divisions of Sociology	1
2.	Meaning, Definitions and Basic Characteristics of major basic concepts in Sociology: Society, Community, Culture, Class, Caste, Gender, Ethnicity, Social Norms and Values, Social Status and Social Roles	5
3.	Ethnocentrism, Cultural Relativism, Social Group Vs. community	1
4.	Users group, Interest group, Insider/outsider(emic/etic) perspective	1
5.	Meaning, definitions and forms of Social institutions and Social organization	1
6.	Meaning, definitions, characteristics and factors of social change and cultural change	1
7.	Meaning, definitions and characteristics of acculturation, assimilation, accommodation, cooperation, competition, conflict, integration and socialization	4
8.	Social control and Social inequality; Meaning, definitions and dimensions	2

9.	Theoretical approaches to social change and development: Modernization theory, Dependency theory and World system theory	3
10.	Cultural diversity and Pluralism in Nepal	1
11.	Economic structure of Nepalese society	1
12.	Nepalese ethnic/caste & class structure and gender in Nepalese context ad their changes	2
13.	Processes of acculturation, westernization, modernization Nepalization & Sanskritization in Nepal	2
14.	Meaning, definitions, factors and status of National integration in Nepal	1
15.	Concept of Natural Resources and Natural Resources Management in sociological perspectives	1
16.	Indigenous Vs. Scientific Natural Resources Management1	
17.	Role of caste, class, gender and age in decision making, politics and power, distribution and equity in natural resource management in Nepal	2
18.	Good governance and Conflict resolution: Concept and application in farming and forestry Sector of Nepal	1
Total		**30**

REFERENCESS

1. Bhattachan, KB and KN Pyakuryal. 1996: The Issues of National Integration in Nepal: An Ethnoregional Approach. In: *Occasional Papers in Sociology andAnthropology Vol.* 5, Kirtipur: Central Department of Sociology andAnthropology, pp. 17-38
2. Ember, Carol R., M. Ember, and Peter N. Peregrine. 2011. *Anthropology*, 13th edition. Pearson Education.
3. Gurung, GM and B Bhandari. 1993: National Integration in Nepal. In: *Occasional Papers in Sociology and Anthropology Vol. 3,* Kirtipur: Central Department of Sociology and Anthropology, pp. 69-94
4. Rao, C. N. S. 2002. *Sociology: Primary Principles*. Delhi: S. Chand and Company Ltd.
5. Shiva, Vandana. 1997. "Resources" in *The Development Dictionary: A Guide to Knowledge as Power.* New Delhi: Orient Longman, pp.276-292.
6. Vidya Bhusan & Sachdeva, D. R. 2000. *An Introduction to Sociology*. Allahabad: KitabMahal

Course Code : BSH 105
Course Title : Forest law and policy
Credit Hours : 2(2+0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the concept and principles of forest policy and law, and legal procedures of forest protection and conservation.

SYLLABUS

Importance and scope of forest policy and law is played crucial role to develop basic knowledge and its implementation practices in the government system of Nepal. The course contains salient features of forest law, acts and regulation of forest, environment, wildlife soil and water conservation, plant protection and buffer zone. Similarly, the course also enhanced the practical knowledge and skill of student about the legal procedures and charge sheet during the course period.

THEORY

S.N.	Topics	No. of Lectures
1.	**Salient Features of Forest Policy and Law:**	
1.1	Introduction, concept and history of forest law and policy	1
1.2	Private forest nationalization Act 2013	1
1.3	Forest Act 2049	3
1.4	National park and wildlife conservation Act 2029 & 2050	3
1.5	Plant protection Act 2029 and 2050	2
1.6	Soil and water conservation Act 2050	2
1.7	Environment Act 2053	3
2.	**Salient Features of Forest policy and Rules and Regulations:**	
2.1	Sales and distribution rules of forest products	3
22	Wildlife Rules and Regulation	3

	2.3	Buffer zone Regulation 2052	2
	2.4	Environment Regulation 2054	3
	2.5	Legal procedures and charge sheets, theory and practices	4
Total			**30**

Recommended texts and reference books:

1. Nepal Ain Sangrah, Volume 7, revised.
2. Forest Act 2049
3. Mulukin Ain 2049
4. Nepal NiyamSangrah, Volume 7, revised.
5. Soil conservation act 2050
6. National park and wildlife conservation Act 2029 & 2050
7. Natural resources related Acts and Regulation,(Gopal Shivakoti, "Chintan")
8 Outline of procedural law (Gyandra Bahadur Shreastha)

Course Code: BSH 106
Course Title : Principle and Practice of Office Management
Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50
Practical: 0

OBJECTIVE:

After completion of the Course students will have basic knowledge of Human Resources Management and Financial Management as well as able to understand Basic Principle and Practices of Office Management.

SYLLABUS:

Management: Introduction about Management, Basic Management Functions, Roles and Skills, History & development of Office Management particularly in Nepal, Objectives of Office Management, Office Environment, Office layout, Main Office components, Brief discussion about Government's rules/regulations and directives of Office Management, Evaluation and Monitoring Systems of Offices.
Organization: Organization structures, systems, mechanism, and culture, Present Government Organization. Individual behavior, (ability, capability, People perception and attitude). Leadership quality and decision making processes. Time management, Basic Concept of Managing People
Financial Management: Introduction, Financial Management and Accounting, Government accounting system and its objective, Role of district treasury, and Controller Office, Budget estimation and formulation, Financial analysis
Inventory Accounting: Introduction, Procurement strategy and planning, Objective, classification, Procurement rules/regulations/directives,
Office Procedure: Correspondence, Office protocol,

Record keeping, Filing & Indexing Systems, Authority letters, Benefits (leaves, retirement, pension, gratuity, others), Introduction about current National Plan, Briefing about Natural Resources Laws/Acts/ Directives (Mainly related to management of resources eg; Forest Laws/Acts, Wildlife Acts, Environment Acts etc), Briefing about Constitution of the Country

Course Breakdown:

Theory

S.N.		Topics	No. of Lectures
1.	**Management:**		
	1.1	Introduction about management, Basic management Functions, Importance of management	2
	1.2	History & development of Office Management in Nepal Office Management, Office Environment, Office layout.	2
	1.3	Brief discussion about Government's rules and regulations and directives of Office Management, Evaluation and Monitoring Systems of Offices.	2
2.	**Organization:**		
	2.1	Introduction, Organization structures, Present Government Organization.	2
	2.2	Leadership, Types of leadership, Decision. Decision Making Process	2
3.	**Financial Management:**		
	3.1	Introduction, Financial Management and Accounting, Government accounting system and its objective,	2
	3.2	Role of district treasury, and Controller Office,	2
	3.3	Budget, Objectives of G. Budget, Budget estimation, formulation, evaluation	2
4.	**Inventory management:**		
	4.1	Introduction, classification, objectives, Contracts, Classification	2
	4.2	Government's Procurement rules/regulations/directives	2
5.	**Office Procedure:**		
	5.1	Introduction, Correspondence, Authority letters	2
	5.2	Record keeping, Types of Filling	2
	5.3	Indexing and types of indexing,	2
	5.4	Retirement, pension, gratuity, others.	2
6.	**Introduction about current National Plan, Program, Project:**		2
Total			**30**

Text Books:

1. Principle and Practice of Office Management By Amuda Shrestha
2. Fundamentals of Human Resource in Nepal By Agrawal, Govind Ram
3. Basics of Financial Management By Pradhan, Surendra

REFERENCES:

1. Organizational Behavior By Stephen P Robbins, Prentice Hall of India, New Delhi
2. Dynamics of Human Resource Management in Nepal By Agrawal, Govind Ram
3. Financial Management and Practices in Nepal By Pradhan, Radhes
4. Organization and Management in Nepal By Agrawal, Govind Ram
5. Management Accounting By Wagle, Keshab Nath, Dahal, Rewan Kumar

Course code : SFB 101
Course Title : Principles and practices of Silviculture
Credit hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical:0

OBJECTIVES:

Upon completion of the course, the students will be able to understand silvics and its importance, locality factors, methods of forest regeneration, silvicultural treatments, plantation in different areas.

SYLLABUS:

Introduction, locality factors, natural and artificial regeneration, silvicultural treatments, afforestation and reforestation of different types of areas.

Course breakdown

Theory

S.N.	Topic	No. of Lectures
1.	**Introduction**	3
	1.1 Definition and objective of silviculture	
	1.2 Silvics and its importance	
	1.3 Relation of silviculture with other branches of forestry	
2.	Locality factors	5
	2.1 Definition, importance and classification	
	2.2 Climatic factors	
	2.3 Topographic factors	
	2.4 Edaphic factors	
	2.5 Biotic factors	
3.	Methods of regeneration	3
	3.1 Natural regeneration from seed (seed production, seed year, seed dispersal, germination and establishment)	
	3.2 Natural regeneration from vegetative parts (sprouting, root Suckers, coppicing) and factors affecting natural regeneration	

	4.5	Spacing, pitting, and handling seedlings	
	4.6	Plantation versus direct sowing	
	4.7	Cconcept of Forest fertilization	
	4.8	Concept of irrigation in plantation	
5.	Silvicultural treatments		5
	5.1	Thinning (methods, effects, regulation)	
	5.2	Pruning (types and effects), lopping	
	5.3	Release operations (weeding, cleaning, liberation cutting, use of herbicides)	
	5.4	Improvement cuttings (T.S.I.), salvage and sanitation cuttings	
	5.5	Effects of prescribed burning and fire on regeneration	
6.	Afforestation/reforestation of different types of areas		6
	6.1	Objectives and importance of afforestation and reforestation	
	6.2	Choice of species and methods of plantation in following areas	
	6.2.1	Denuded hill slopes6.2.2 Abandoned cultivated lands	
	6.2.3	Grasslands	
	6.2.4	Ravine lands	
	6.2.5	Dry area with or without irrigation	
	6.2.6	Canal banks	
	6.2.7	Road side plantation	
	6.2.8	farm forestry/on farm trees	
	6.2.9	Urban forestry	
Total			30

Text and Reference Books

1. Principles and practice of silviculture-L.S. Khanna
2. Handbook of silviculture-Champion and Trevor
3. Elements of general silviculture-Dr. S.S. Negi
4. The practice of silviculture-D.M. smith
5. Principles of silviculture-J.W. daniels, J.Helms, and F.S. Baker
6. Manual of reforestation techniques-R.C. Ghosh
7. Plantation forestry-R.K. Loona
8. Plantation forestry in the tropics-J.Evans

Course Code : WPR 101
Course Title : Wildlife Biology
Credit Hours : 2 (2+0) Full Marks: 50

Theory 50 Practical: 0 OBJECTIVE:

Upon the completion of this course, the students will be able to understand the basic concepts of wildlife biology, Components and concepts related to wildlife habitat, principles of wildlife population and concepts of animal behavior.

SYLLABUS:

Introduction, Animal behavior, Aggressive, terrestrial, reproductive behavior, migration, population estimation and analysis, distribution, geographic region, Wildlife habitat, ecology and management of mammals and birds, International conservation conventions, Wildlife values and status.

Course Breakdown

Theory:

S. No.	Topics	No. of Lectures
1. Introduction and Definitions		2
1.1	Brief introduction of wildlife of Nepal	
1.2	Definitions: Wildlife, wilderness, Wildlife conservation,	
1.3	wildlife Management, Keystone species, Hot spots, Indicator species,	
1.4	endemic, exotic, Buffer species, Corridor, Niche	
1.5	Differences: Interspersion and juxtaposition, edge and eco-tone, home range and territory, dispersion and normadism, Snag & den	
2. Animal Behavior		4
2.1	Aggressive behavior- types and causes	

Territorial behavior-size, function and Dominance, Reproductive behavior- Brood care and courtship, Aggressive and Courtship, Courtship and mating. Parental Behavior- Care, Factors affecting care, types of Parental Care, Care and attachments

2.2 Social organization-Monogamy and polygamy, Mating group Mating strategies, societies of Lion, deer and antelope

2.3 Migration –:
Fish and Birds-Definition, types, causes and advantages Mammals, Reptiles and insects

3. Population Estimation and Analysis 4

3.1 Estimation of animal abundance
3.1.1 Mark and Recapture, Transect survey
3.1.2 Pellet Group Counts, Roadside Counts, Water hole counts
3.1.3 Road kills, Change in-ratio method, Scent Station Survey
3.2 Population Analysis
3.2.1 Estimating rate or increase and Estimating mortality and survival, Life table

4. Zoo Geographic Region 4

1.1 Pattern of geographic distribution-Continuous, Discontinuous , Bipol
1.2 Barrier Affecting distribution- Physical, Climatic, Biological
1.3 Zoo Geographical Region of the World- Prominent Classification (Palaerctic, Neoartic, Neotropical, Ethopian, Oriental, Australian)
1.4 Zoo Geographical Region of Nepal

5. Wildlife Habitat and Population 8

5.1 Habitat components: food, cover, space and water
- Nutritional Requirements
- Variation in food availability
- Quality and Quantity of food
- Food Chain and food web
- Cover types, Improvements and Habitat selection
- Water requirement

5.2 Concepts related to wildlife habitat tropic levels
- Energy transfer, Carrying capacity, Succession , edge effect

5.3 Succession and habitat change types of succession
5.4 Wildlife Population
5.4.1 Population dynamics (Natality and Mortality)
5.4.2 Population Dispersal, population fluctuations, Categories & patterns
5.4.3 Population Genetics
5.4.3. 1 Severe reduction in gene pool
5.4.3.2 Genetic swamping
5.5 Captive breeding & Wildlife farming

6. Ecology and Management of Some Mammals/Birds of Nepal 1

6.1 Red Panda, Snow leopard, Blue sheep, Musk deer, Wild yak, Brown bear
6.2 Himalayan Golden Eagle, Himalayan Breaded Vulture, Black-Necked Crane

7. International Conservation and Convention and Wildlife Trade		2
	7.1 Reason for International conservation and cooperation's IUCN, CITES,WWF, Ramsar, WCS, TRAFFIC	
	7.2 Wildlife trade (Ivory, Decoration ,Medical, Perfume industry, Dress material, Pet and Amusement)	
8. Wildlife Values and Legal Status of Wildlife		5
	8.1 Positive Value	
	8.1.1 Consumptive & Non-consumptive Value	
	8.1.1.1 Commercial	
	8.1.1.2 Ethical	
	8.1.1.3 Scientific & Educational	
	8.1.1.4 Recreational	
	8.1.1.5 Ecological	
	8.1.1.6 Aesthetic	
	8.2 Negative value, Measuring Wildlife Value, Economic Survey	
	8.4 National Park & Conservation Act 1973	
Total		30

REFERENCES:

(1) Sharma B.D.1994. High Altitude Wildlife of India

(2) Lakhey S.P. 2003.Wildlife and Protected Area Management

(3) Saha G.K. & S.Mazundar 2008. Threatened Mammals of India

2nd Semester Courses

Course code FPU 101 Course title: Wood Anatomy

Credit Hours : 3 (2+1) **Full Marks: 75**

Theory 50 **Practical 25**

OBJECTIVES:

Upon the completion of this course, the students will be able to identify wood through physical feature and explain the structure, physical characteristics and strength properties of wood.

SYLLABUS:

Wood anatomy, scope, structure, physical features and strength properties of wood, evaluation of defects and abnormalities for various uses. The course deals with the use of physical and anatomical features of wood for timber identification. The course will also expose the students to the effect of accelerated rate of growth on wood quality and also to the genetics of wood properties. Practical course are designed to equip the students with determination of various wood properties.

Course Breakdown:

Theory

S.N.	Topic	No. of Lectures
1.	The Importance of anatomical studies in areas of wood utilization- an overview.	1
2.	Gross structure of wood includes: Dead bark, living bark , sap wood , heart wood , early /late wood	2
3.	Wood property variation as related to tree form and reaction wood. Effect of growth rate on wood properties - growth rate and specific gravity in conifers and	2

hard woods.

4.	General features visible on logs, sleepers and converted material: sap wood, heartwood, growth rings, growth marks, colour, odor, taste, grain, texture, luster, figure and weight. Other components influencing wood quality such as knots, shakes, discoloration, deposition, gum, resins, reaction wood and spiral grains.	3
5.	Extractives in some prominent timber species and their importance. Oleo resins, gum oleo resins in some characteristic woods.	2
6.	Physical properties of wood; density and specific gravity. Variation in density of early and late wood constituents. Effect of growth rings on density	2
7.	Physical properties of wood as influenced by moisture content of wood, specific gravity of wood substance	2
8.	Thermal properties of wood-thermal expansion, specific heat, thermal conductivity and diffusivity. Change of temperature in wood under heating. Effect of moisture on thermal properties. Thermal properties of wood composites	2

9.	Dimensional changes on heating green wood. Effect of dry and wet heat and heating in presence or absence of air on strength and dimensional stability	2
10.	Electrical properties of wood. DC electrical conductivity-effect of moisture content, temperature and extractives.	2
11.	Response of defects to stress waves in timber. Sound transmission and acoustics in buildings.	1
12.	Shear forces and bending moments, stresses in beams, beam deflections. Standard test on timber specimen: bending, compression parallel and perpendicular to the grain, hardness, shear, tension parallel and perpendicular to the grain, cleavage, nail and screw pulling, brittleness	3
13.	Role of moisture on elastic and shrinkage: directional shrinkage and calculation of fiber saturation point.. Testing of specialized wood products, performance tests and method of evaluation for door shutters, joinery, furniture, packing cases, tool handles, agricultural implements and sports goods.	3
14.	Safe working stresses and end use of timber species based on strength data. Classification of timber for various end uses.	3
Total		**30**

Practical:

S.N.	Topic	No. of Practicals
1.	Identification of wood using a hand lens and highly magnify microscope- characteristics features.	1
2.	Timber identification and its importance. Procedures for field identification of timbers. Study of physical features of wood	1
3.	Study of gross features of wood. Study of anatomical features of wood. Pores or vessels, different types. Study of wood rays, and their different types. Study of the non porous woods, their physical and anatomical description. Study of infiltration and inclusions in wood.	2
4.	Anatomical studies of reaction wood.	1
5.	Microscopic features of soft wood and hard wood.	3
6.	Hand lens features and identification of wood.	1
7.	Wood strength, density, moisture content determination.	1
8.	Microscopicslide inspection of twenty five characteristics species.	1
9.	Maceration, staining, slide preparation and measurement of dimensions of woodytissues.	1
10.	Determination of wood properties such as cell length, wall thickness etc. of wood samples.	1
11.	Determination of wood density, study of thermal, electrical and acoustic properties of wood.	1
12.	Visitmuseum for wood sample study	1
Total		**15**

REFERENCES :

1. Mehta T. 1981. *A Handbook of Forest Utilization*. Periodical Expert Book Agency.

2. Indian Forest Utilization, FRI publication.vol.1&2

3. Trotter H. 1982. *Manual of Indian Forest Utilization*. FRI & College, Dehra Dun.

4. Wadoo MS. 1992. *Utilization of Forest Resources*. IDRIS Publ.

5. Panshin, A.J and de Zeeiw, C. 1980. Text book of wood technology , New York: McGraw Hill Book Company.

6. Dr. SS Negi, Woos science and technology

7. Rao.K.Ramesh,1971 Field Identification of fifty Important Timber of India

8. Brown, H.P. 1985. *Manual of Indian Wood Technology*. International Books and periodicals supply service, New Delhi.

9. Luxmi Chauhan and Vijendra Rao. 2003. *Wood Anatomy of Legumes of India*. Bishein Singh Mahendrapal Singh. Dehra Dun. p. 220

10. Pearson, R.G. and Wheeler, E. A. 1981. *Computer Aided Identification of Hardwood Species*. IAWA Bull. n.s., Vol. 2 (1). Pp 37-40.

11. Rao KR and Juneja KBS. 1992. *Field Identification of 50 Important Timbers of India*. ICFRE, Dehra Dun. 52 p

12. Wood Handbook: Wood as an Engineering Material 2010

Course Code : FSE 101
Course Title : Forest Surveying
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 5 Practical: 25

OBJECTIVES:

Upon the completion this course, the students will be able to understand forest surveying and apply surveying techniques to forestry related problems. They should be able to hands-on use of equipment, proper field measurement techniques and proper field note keeping.

SYLLABUS:

Importance and scope of forest surveying. Modern trends and principles of forest surveying. Chain and its types, optical square, cross staff. Reconnaissance and site location, locating ground features by offsets–field book. Chaining for obtaining the length and area of forests, methods for overcoming obstacles, conventional symbols, plotting chain survey and computation of areas, errors in chain surveying and their elimination. Types of compasses, use and adjustments, bearings, local attraction and its adjustments. Chain and compass surveying of an area, booking and plotting. Plane table surveying and its equipment. Contourmap, characteristics of contour, contour interval.

Course Breakdown

Theory

SN	Topic	No. of Lectures
1.	**Introduction**	3
1.1	Definition and object of surveying	
1.2	Primary divisions and Classification of surveying	
1.3	Principles of surveying, Measurements, units of measurements	
1.4	Work of the surveyor, Scales	

4.	Compass Surveying	7
	4.1 Compass traverse, Methods of traversing	
	4.2 Bearing of lines, designation of bearings-relation of included angles and bearing latitude and departure	
	4.3 Local attraction-causes, effects & elimination	
	4.4 Dip of the needle, magnetic declination-causes	
	4.5 Traversing with chain and compass	
	4.6 Plotting of the traverse	
	4.7 Numerical problems	
5.	Plane table surveying	6
	5.1 Definition, objects and suitability	
	5.2 Equipment necessary in plane table surveying	
	5.3 Advantage and disadvantage of plane table surveying	
	5.4 Setting up of the plane table	
	5.5 Methods of plane table surveying	
	5.6 Errors in plane table surveying	
6.	Contouring	3
	6.1. Definition of different terms	
	6.2. Characteristics of contour line	
	6.3. Uses of contour map	
7.	GPS Survey	4
	7.1 Concept and use of GPS	
	7.2 GPS position setting& Handling of GPS	
	7.3. Accuracy and type of GPS	
	7.4 Acquisition of field point and tracking with GPS	
Total		30

Practical

S. N.	Topic	No. of Practicals
1.	Direct Ranging	1
2.	Indirect Ranging	1
3.	Linear measurement	1
4.	Right angle setting in field, use of optical square and with chain and tape	1
5.	Chain survey of an area	2
6.	Preparation of map	2
7.	Sylva Compass survey	1
8.	Surveyor Compass survey	1
9.	Prismatic Compass survey	1
10.	Plotting of compass survey	1
11.	Plane table surveying Radiation method	1

12.	Plane table surveying (Intersection & Traverse method)	1
13.	GPS Survey	1
Total		**15**

REFERENCES:

1. Ram Parkash. 2006. Forest surveying. International Book Distributors, Rajpur Road, Dehradun, India. 372 P

2. B.C. Punmia, Ashok K. Jain and Arun K. Jain 2005 Surveying – Volume I . Laxmi Publication Pvt. Ltd. Daryaganj, New Delhi, India. 536 P

3. T.P. Kanetkar & S. V. Kulkarni 1988. Surveying levelling – Part 1, Pune Vidyarthi Griha Prakasan, India. 608 P

4. S. S. Bhavikatti 2008. Surveying and Levelling- Volume I, International Publishing house Pvt. Ltd, New Delhi, India. 404 P

5. S.K. Roy 2006. Fundamentals of surveying. Prentice Hall India, New Delhi, India. 620 P

6. P. Som & B. N. Ghosh 1982 Advanced surveying. Tata Mc Graw- Hill. 278P

Course Code : BSH 107
Course Title : Tree Physiology

Credits Hours : 3 (2+1) **Full Marks: 75**

Theory: 50 **Practical: 25**

OBJECTIVE:

Upon completion of this Course, the students will understand the basic concepts of Tree Physiology, the mechanism of various Physiological processes governing growth and development of plants and apply the knowledge of Tree Physiology in Silviculture and Forest management.

SYLLABUS:

Introduction, Principles and Practical application of Plant Physiology, Absorption of water and Mineral salts, Phenomenon of water loss, Translocation of water and mineral salts, Mineral Nutrition in plants, Photosynthesis, Respiration, Nitrogen Metabolism, Plant growth and development, and Seed Physiology

Course Breakdown

S.N.	Topic	No. of Lectures
1.	Introduction, Principles and practical application of plant physiology	1
2.	Absorption of water and mineral salts	
i.	Root hairs and Mycorrhizae, Absorption of water and mineral salts	1
ii.	Mechanism of active and passive absorption	1
iii.	Environmental factors affecting absorption of water and mineral salts	1
3.	Phenomenon of Water Loss	

i. Transpiration and Guttation, kinds of transpiration, and mechanism of transpiration 1

ii. Mechanism of stomatal opening and closing 1

iii Role of Transpiration 1

iv. Environmental factors affecting the rate of transpiration 1

4. Translocation

i. Ascent of sap, theories of ascent of sap 1

ii. Translocation of mineral salts and translocation of organic food 1

iii. Phloem transport theories 1

5.	**Mineral nutrition in plants**		
	i.	Methods of studying plant nutrition	1
	ii.	Essential mineral elements in plants their functions and deficiency symptoms	1
6.	**Photosynthesis**		
	i.	Introduction and mechanism of Photosynthesis	1
	ii.	Light reaction (Hill Reaction)	1
	iii.	Dark reaction(Calvin's Cycle,)	1
	iv.	Introduction to C-3 & C-4 Cycle, CAM plants and CAM pathway	1
	v.	Environmental Factors affecting Photosynthesis	1
7.	**Respiration**		
	i.	Introduction, kinds and Mechanism of respiration, Glycolysis and Fermentation	1
	ii.	Kreb's Cycle, Electron transport chain, and balance sheet of ATP in respiration	1
	iii.	Environmental factors affecting the rate of respiration	1
	iv.	Hexose Mono-phosphate Shunt. Photorespiration	1
8.	**Nitrogen Metabolism**		
	i.	Physical and Biological Nitrogen Fixation	1
	ii.	Metabolism of Nitrite and nitrate ions, and Nitrogen Cycle	1
9.	**Growth and developments**		
	i.	Concept of growth and development	1
	ii.	Concept and role of phytohormones and growth regulators	1
	iii.	Photoperiodism and Vernalization	1
	iv	Phytochromes, properties and role in growth and development	1
10.	**Seed Physiology**		
	i.	Physiology of seed germination and factors affecting seed germination	1
	ii.	Seed Dormancy Causes of Seed dormancy Methods of breaking dormancy of seeds	1
Total			**30**

Practical:

S.No.	Topics	No. of Practical
1.	Eosin test to demonstrate Ascent of Sap	1
2.	Ringing experiment to show the path of ascent of sap	1
3.	Experiment to demonstrate transpiration pull	1
4	Experiment to show that water absorption is roughly equal to transpiration	1
5.	Measurement of rate of transpiration	
	i. Potometer method	1
	ii. Whole plant weighing method	1
6.	Separation of Chloroplast Pigments by solvent extraction	1
7.	Experiments on Photosynthesis	
	i. To demonstrate the role of light and chlorophyll in photosynthesis	1
ii.	To demonstrate the role of CO_2 in photosynthesis	1
	iii To demonstrate that O2 is liberated during Photosynthesis	1
8.	Experiment on application of Auxin and Gibberelin	1
9.	Experiments on respiration	
	i. To demonstrate aerobic respiration	1
	ii. To demonstrate anaerobic respiration	1
10.	Experiments on seed germination	1
11.	Experiments on seed treatments for breaking dormancy	1
Total		**15**

REFERENCES:

1. Pandey,S. N and Sinha, B. K. 1981, Plant Physiology, 3rd edition,Vikash Publishing house New Delhi, India

2. Devlin R. M. and Witham F. H. 1975., Plant Physiology, 3rd edition Affiliated East West Press, New Delhi, India

3. Salisbury, F.B. & Ross, C.W., 1986, Plant Physiology, CBS Publishers and distributers, Shahdara, New Delhi, India

4. Noggle G. R.& Fritz G.J. 1986, Introductory plant physiology,2nd ed., Prentice Hall, New Delhi, India

5. Wilkins, M.B 1967, Physiology of Plant Growth & Development, Tata McGraw Hill, New Delhi, India

6. Wilkins, M.B., 1987, Advanced plant physiology, 1st ed., ELBS Longman group , U.K.

7. Leopold, A. C., & Krideman, P. B. 1975, Plant Growth and Development, 2nd ed. McGraw Hill, New Delhi, India

8. Kramer, P. J. & Kozlowski, T.T., 1979, Physiology of woody plants, Academic press, New York, USA

Course Code : WPR 102

Course Title : Wildlife and Ecotourism Management

Credit Hours : 3 (2+1) Full Marks: 75 Theory

50 Practical 25 OBJECTIVES:

Upon the completion of this course, the students will be able to apply theoretical knowledge and practical skills in the conservation, management and sustainable utilization of wildlife resources and thereby promote ecotourism in the protected area systems of Nepal.

SYLLABUS:

Basic concept of wildlife management, definitions of important technical terms, principle of wildlife management and techniques, ecological distribution of wildlife in Nepal, wildlife management practice in Nepal, economic benefit of wildlife and eco-tourism ,concept of eco-tourism management, tourism, environment and managing eco-tourism and participatory approach of eco-tourism management and planning.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	**Basic concept of wildlife management** - What is wildlife management (factors influence wildlife populations, interaction of wildlife species, impacts of humans, wildlife and surrounding landscapes)? - Definition of important technical terms (conservation/management, endangered species, habitat, niche, home range and territory, migration, dispersion, edge and ecotone) - Values of wildlife (Positive and negative)	4
2.	Principles of wildlife management and techniques - Habitat requirements (Food, Water, Space and Cover) - Habitat management	5

- Population properties (Fluctuation, densities, dispersal, tolerances, sex and social structures)
- Carrying capacity
- Species richness
- Corridors
- Managing human-wildlife conflict
- In-situ and Ex-situ conservation

3. Ecological distribution of wildlife in Nepal 3

(Faunal diversity: past history, impact, ecological factor)

- Tropical and sub tropical zone
- Temperate, Sub Alpine and Alpine zone

4.	Wildlife management practice in Nepal - Preservation and conservation - Red Listing of Mammals of Nepal - Trends of protected area management system - Major problems in Protected Areas - National Parks - Wildlife Reserves - Conservation Areas - Hunting Reserve - Buffer Zones	4
5.	List and explain the economic benefit of wildlife and eco-tourism - Revenue generation - Employment generation - Creation of eco-tourism potentials - Meet supplies/production	3
6.	Concept of eco-tourism - Definition (tourism, eco-tourism) - Impacts of tourism (Economic, social, cultural, environmental) - General requirements for eco-tourism	2
7.	Tourism and environment - Nature based tourism, sustainable tourism and eco-tourism - History and development of eco-tourism in Nepal -Sustainable eco-tourism (social, economic and environmental goals) - Principal of sustainable eco-tourism	2
8.	Managing eco-tourism - The concept of carrying capacity - Limits of acceptable change - Visitor impact management - Measuring tourism demand	2
9.	Participatory approach of eco-tourism planning and management - ZOPP Model (Objective oriented planning) - APPA Model (Appreciative Participatory Planning Approach) -ICDP Model (Integrated Conservation and Development Planning) - Community awareness and mobilization for eco-tourism management - Institutional strengthening - Capacity building	5
Total		30

Practical

S N	Topic	No. of Practicals
1.	Case study of human-wildlife conflict	5
2.	Field observation of in-situ and ex-situ conservation	5
3.	Eco-tourism, its impact and management in relevant Protected areas with ecotourism	5
Total		**15**

REFERENCES:

1. Berwick and Sahana 2000. Wildlife Management—Asian and American approach. Natraj Publishing House, India.

2. Bhatta, D. P. Ecotourism in Nepal with theoretical concepts and principles.

3. DNPWC and TRPAP 2005. A training of trainers' manual on eco-tourism and biodiversity conservation.

4. Gopal, R. 2012 (second edition). Fundamentals of wildlife management, Inida.

5. Janawali, S.R., Baral, H. S., Lee, S., Acharya, K. P., Upadhyaya, G. P., Pandey, M., Shrestha, R., Joshi, D., Lamichhane, B. R., Griffiths, J., Khatiwada, A. P., Subedi, N., and Amin, R. 2011. The Status of Nepal's Mammals: The National Red List Series.

6. Majupuria, T. C and Majupuria, R. K. 2006. Wildlife and protected areas of Nepal (Resources and management).

7. Sale, J. B. and Berkmuller, K. 1988. Manual of wildlife techniques for India. Field document.

Course Code : SFB 102
Course Title : Dendrology

Credit Hours : 3(2+1) Full Marks: 75

Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand life history, ecological characteristics, and major uses of common trees, shrubs and vines of Nepal; identify important trees, shrubs and vine species of Nepal; and explain the key vegetative indicators of habitat types in various life/ecological zones of Nepal.

SYLLABUS:

Introduction of dendrology: History, importance and scope; Trees and forests. Morphological characteristics: Tree stems, twigs, general form of woody trunk; Barks of common trees, color, gums, latex, etc; Leaf characters and types of leaves; Reproductive morphology with reference to description and identification of reproductive parts; Flowers and Seeds; Tree architecture. Anatomy of wood: Anatomy and development of trees; Primary and secondary growth in roots and stems; Formation of wood cambium and its derivatives: peripheral and epical growth components, heart wood initiation; Dendrochronology- technique and scope. Principles and systems of classification of plants: Fundamentals of taxonomy, concept, short history of plant classification, some important systems of classification and their comparisons, principles and International Code of Botanical Nomenclature; General study of herbarium. Basic Concepts and Principles of Dendrochronology:(The Uniformitarianism

Principle, Principle of Limiting Factor, Concept of Ecological Amplitude, Concept of Autocorrelation, Aggregate Tree Growth Model, Site Selection, Sensitivity, Cross Dating Replication, Concept of Standardization, Modeling growth-environmental relationships).Botanical basis: Wood anatomy, Wood types, Growth rings (Tree rings).Methods of dendrochronology: Basic Field and Lab techniques (Study Site and Species selection, Sampling techniques, Collection of tree-core/cut-stump samples, Processing of the samples, Counting and dating of the tree-rings, Measurement of the samples, Detection of error in dating, Chronology development).

Course Breakdown

Theory:

S.N.	Topic	No. of Lectures
1.	Introduction of dendrology: History, importance and scope; Trees and forests	5
2.	Morphological characteristics: Tree stems, twigs, general form of woody trunk; Barks of common trees, color, gums, latex, etc; Leaf characters and types of leaves; Reproductive morphology with reference to description and identification of reproductive parts; Flowers and Seeds; Tree architecture.	5
3.	Anatomy of wood: Anatomy and development of trees; Primary and secondary growth in roots and stems; Formation of wood cambium and its derivatives: peripheral and epical growth components, heart wood initiation	5
4.	Dendrochronology- technique and scope: Basic Field and Lab techniques (Study Site and Species selection, Sampling techniques).	3
5.	Collection of tree-core/cut-stump samples, Processing of the samples, Counting and dating of the tree-rings, Measurement of the samples, Detection of error in dating, Chronology development)	5
6.	Principles and systems of classification of plants: Fundamentals of taxonomy, concept, short history of plant classification, some important systems of classification and their comparisons, principles and International Code of Botanical Nomenclature; General study of herbarium.	5
7.	Botanical basis: Wood anatomy, Wood types, Growth rings (Tree rings)	2
Total		**30**

Practical

S. N.	Topic	No. of Practicals
1.	Dendrological diagnostics of important tree species (bark, blaze, bole, crown, branching, flowers, fruits)	2
2.	Stand-age structure, Ring-width analysis	2
3.	Tree Scars, Basal area increment.	2
4.	Taxonomic study of tree species (available in local area)	3
5.	Use of increment borer, tree core collection and tree-ring study (one conifer and one broad-leaved), interpretation with relation to climatic condition	2
6.	Morphological observations on important timber species of common	2

	occurrence for architectural patterns of habit, bole, buttress, blaze leaf, flower, fruit and seeds.	
7.	Laboratory visit to Herbarium section	2
Total		**15**

REFERENCES:

1. Fritz, H. C. 1976, Tree Rings and climate, Academic Press

2. Hardin JW, Leopold DJ and White, F M. 2000 Harlow and Harrar's Textbook of Dendrology. 9th ed, McGraw Hill, New York

3. NARMSAP. 2002. Forest and vegetation Types of Nepal. Natural Resource Management Sector Assistance Programme, TISC Document Series No. 105. Kathmandu

4. Stace CA. 1980. Plant Taxonomy and Biosystematics. Edward Arnold, London

5. Thomas, P. 2000. Trees: Their Natural History. Cambridge University Press. New York

6. Torrs, and J Storrs, J. Trees and Shrubs of Nepal and the Himalayas. Book Faith India, Delhi

Course Code : NRM 101
Course Title : Forest Extension
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand forest extension and generate the skill to develop various extension materials and conduct extension activities confidently among the various communities (rural and urban).

SYLLABUS:

Introduction to forest extension, communication, motivation, extension teaching methods, teaching learning process, diffusion of innovation, extension materials production, extension program planning and implementation, Monitoring and evaluation of the Extension program. In practical the students will be taught to prepare forest extension scripting for Audio, Audiovisual and printing medium.

Course Breakdown

Theory

S.N.		Topic	No. of Lectures
1.	**Introduction of Forest Extension**		
	(i)	Concept of Extension, Evolution of Forest Extension, Philosophy of Forest Extension Education	1
	(ii)	Principle and objectives of Extension education, formal and informal education	1
2.	**Communication**		
	(i)	Concept of Communication and its role in Development, importance of Communication in forest extension	1
	(ii)	Elements of communication, Barriers of communication, Overcoming of communication barriers	1
	(iii)	Communication types, Media, Principles and rules for effective communication	1
	(iv)	Interpersonal communication and barriers to it	1

	(v)	Strategies for effective interpersonal communication	1
3.	**Motivation**		
	(i)	Introduction on human perception, attitude and behavior, their role on program implementation	1
	(ii)	Concept and importance of motivation, Extrinsic /intrinsic needs	1
	(iii)	Maslow's hierarchy of human needs, Theories of Motivation	1
	(iv)	Strategies to enhance motivation, Concept of participation, Approach to people's participation	1

4.	**Extension teaching methods**		
	(i)	Principle and objectives of extension teaching methods, Classification of extension teaching methods	1
	(ii)	Selection of appropriate extension teaching methods	1
	(iii)	Basic concept on media (Individual, group, mass), Basic concept on Extension tools (Audio / Visual / Audio visual / Printed)	1
	(iv)	Integrated approach in Extension	1
5.	**Teaching learning process**		
	(i)	Principle of teaching and learning, Andragogical concept	1
	(ii)	Principles and application of Adult learning in extension, Organizing learning process (Adult)	1
	(iii)	School children learning process in extension, Organizing learning process (School children)	1
6.	**Diffusion of innovation**		
	(i)	Concept of diffusion of innovation, Adoption and diffusion	1
	(ii)	Characteristics of innovation, Adoption process	1
	(iii)	Types of Adoption decisions, Categories of Adopters	1
7.	**Extension program production**		
	(i)	Assessment of target groups, Assessment of problems (Rapid rural appraisal/ Participatory rural appraisal/ Participatory process for rapid result (RRA/PRA/PPRR), Assessment of solutions	2
	(ii)	Production of Extension materials (Audio/ Visual/ Audio visual/ Printed), Pre-testing of the materials, Production of materials	4
8.	**Extension program planning and implementation**		
	(i)	Basic concept on rural and urban communities	1
	(ii)	Logical frame approach on extension program planning, Stake holder mapping	1
9.	**Monitoring and Evaluation of the extension program**		
	(i)	Concept and objectives of monitoring and evaluation	1
Total			**30**

Practical

S.N.	Topic	No. of Practicals
1.	Scripting of Audio materials (Radio drama/ Radio script/ Radio report, Poems/ Essay/ Radio humor/ Radio spot) (Students will make and submit 5 scripts among from above topics for which 10 marks will be allocated.)	5
2.	Scripting of Audio visual materials (Short film/ Documentary/ Docu-Drama/ Tele spot) (Students will make and submit 3 scripts among from above topics for which 6 marks will be allocated.)	5
3.	Scripting of printed materials (Leaflets/Booklets/Broacher/Pamphlets) (Students will make and submit 3 scripts among from above topics for which 9 marks will be allocated)	5
Total		**15**

REFERENCES:

1. Farmer–Led Extension, Concepts and practices 1997, Ed. Scarborough, V. S. Killough, D.A. Johnson and J .Farrington, Intermediate Technology Publication Ltd, 103-105 Southampton Row, London WCIB 4HH, UK

2. Querre Francois1992, A thousand and one worlds, A rural radio hand book, Development Support Communication Branch, Information Division, Food and Agriculture Organization of the United Nations, Rome

3. Shrestha R. 1998, A Hand book of Extension Education, Sarojani Shrestha, Swoyambhu, Kathmandu, Nepal

4. Interpersonal Communication Skills, Training Manual 1995, UNFPA, United Nations Population Fund, Office for South and West Asia, Kathmandu, Nepal

5. Intodia, S.L., L.L. Somani and J.P. Lakhera 1993, Dictionary of Extension Education, Agrotech Publishing Academy: Udaipur, India

6. Shrestha R. 2007, Prashar Kay, Kina ra Kasary? (Nepali), Extension and Publicity Wing, Department of Forests, Babar Mahal, Kathmandu, Nepal

7. Rogers, E.M. 1983, Diffusion of Innovations, Third Edition, The free Press, A Division of Macmillan Publishing Co., Inc. New York.

Course Code : SWM 101
Course Title : Introductory Soil Science
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand soil formation, composition, properties and interpretation in relation to soil fertility for plant growth and development.

SYLLABUS:

Concept and definition of soil; the origin of soils; Factors and process of soil formation under parent materials, climate, topography, biota and time and development of soil profile. Properties of soil: Physical properties; Soil texture, structure, color, particle density, bulk density, moisture, temperature porosity and their impact on plant growth; Chemical properties; Soil pH and its effect on nutrients availability and their control; buffer capacity; cation and anion exchange phenomenon and their effect on plant growth; Biological properties and its role on plant growth; Soil organic matter and its impact on soil fertility. Soil macro and microbial system; soil classification; soil interpretation and plant nutrients, manure and fertilizer.

Course break down

S.N	Topics	Sub-topics	No. of Lectures
1	Definition, concept and origin of soil	Definition and concept (Pedological and Edaphological) The origin of soils (from minerals, rocks and organism)	2

2.	Factors of soils for	Soil forming factors under parent materials, plant growth climate, topography, biota and time. Soil development processes Soil profile development	3
3.	Properties of soils and their relation	Physical properties: Soil texture, structure, color, density, moisture, temperature, porosity to plant growth and their role on plant growth Chemical properties: Soil pH and its effect on nutrients availability and their control by liming materials; buffer capacity; cation and anion exchange phenomenon and its impact on plant growth Biological properties and its role on plant growth	7

4.	Soil organic	Humus formation (source, composition and steps matter and soil fertilityof organic matter decomposition) and characteristics Amount and distribution of organic matter in soil Soil organic matter and its impact on soil fertility	3
5.	Soil macro and microbial system	General introduction to Bacteria, Actinomycetes, Fungi, Algae and protozoa and their role on soil for plant growth, and its soil micorhyzae role on plant growth General introduction to Earthworm, termites, Ants and Nematodes and their role on soil for plant growth.	3
6.	Soil Classification	General introduction, purpose and principles of soil classification Soil classification systems (FAO/UNESCO legend) General introduction to soil taxonomy Soil orders Soils of Nepal (including soil orders)	6
7.	Soil interpretation	The soil survey report and its utilization Land capability classification system Purpose and value of soil maps	3
8.	Plant nutrients, manure and fertilizer	Essential plant nutrients (macro and micro elements) and their functions for plant growth, their sources General introduction to manure and fertilizer and requirement for plantgrowth	3
Total			**30**

Practical

S.N.	Topic	No. of Practicals
1	Identification of equipments, tools and chemicals used in soil science	1
2	Identification of soil profile in field	1
3	Soil sampling method and preparation of monolith	1
4	Determination of soil texture by using mechanical method	1
5	Identification of soil color by using Muncell color chart	1
6	Identification of soil bulk density	1
7	Identification of soil moisture	1
8	Measurement of Soil pH	1
9	Determination of soil total Nitrogen	1
10	Determination of soil available potassium	2
11	Determination of soil available phosphorus	2
12	Determination of soil organic carbon	2
Total		**15**

TEXT BOOKS AND REFERENCES:

1. Baver, L.D., W.H. Gardener, and W.R. Gardener, 1972. Soil Physics. 4th ediition. John wiley and Sons,

2. Nyle C. Brady and Ray R. Well. 2012. The Nature and Properties of Soils. 14th Ed. Prentice Hall of India Ltd.

3. Buol, S.W., F.D. hole and R.J. McCracken, 1989, Soil Genesis and Classification. The Iowa State University Press, Ames.

4. Carson, B., 1992. the Land, the Farmer and the Future: A Soil FertilityStrategy for Nepal.

5. Henhy D. Foth, 1990. Fundamental of Soil Science. 8th Ed., John Wiley & Sons, IInc.

6. Howell, J.H., 1986. F.S.R.O., SoilTechnical Note No. 5 F.S.R.O. Guidelines for Soil Profile Description.

7. Jenny, Hans, 1941. Factors of Soil formation. CcGraw-Hill Book Co. New York.

8. Klute, A., (Edited) 1986. Methods of Soil Analysis, Part I, 2nd ed., Agronomy Mongraph 9, Madison, WI.

9. Lal, Ratan and D.J. Greenland (eds.), 1979. Soil Physical Properties and Crop Production in the Tropics. Jolm Wiley and Sons, U.K.

10. Lal, Ratan, 1996. Methods and Guidelines for Assessing Sustainable Use of Soil and Water Resources in the Tropics. Scientific Publishers, P.O. box 91, Jodhpur, India.

11. Lee, K.E., 1985. Earthworm: Their Ecology and Relationships with Soils and landuse Academic Press, London, U.K.

12. LRMP, 1986. Geological Reoprt. Land Resource Mapping Projects, Kathmandu.

13. LRMP, 1986. Land Capability Report. Land Resource mapping Project, Kathmandu.

14. Samual N. Namowitz and Donald B. Stone, 199? Earth Science.

15. Sanchez, Pedro, A., 1976. Properties and Management of Soils in the Tropics. John Wiley and Sons, New York.

16. Soil Survey manual. Revise Edition. All India Soil and Landuse Survey Organization, I A R I, New Delhi, India

17. Soil Survey Staff, 1962. Soil Survey Manual. U.S. Department Agriculture handbook 18 U.S. Government Printing Office, Washington.

18. Soil Survey Staff, 1975. Soil taxonomy. U.S. Department Agriculture handbook 436. U.S. Government Printing Office, Washington

19. Sthapit, K.M., 1987. Land Capability Classification. Watershed Planning Manual No. 4. Watershed Management Project, Department of Soil conservation, Kathmandu.

20. Sthapit, K.M., 1989. Soil Mapping Handbook Watershed Planning Manual No. 3. Watershed Management Project, Department of Soil conservation, Kathmandu.

21. IRRI, 1991. Biological Nitrogen Fixation for Sustainable Agriculture.

3rd Semester Courses

Course Code : BSH 201

Course Title : Plant Biochemistry and Plant Biotechnology
Credit Hours : 3(2+1) Full Marks : 75

Theory : 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the fundamentals of plant biochemistry and plant biotechnology.

SYLLABUS:

Plant Biochemistry: Introduction: Biological molecules, Molecular interactions as a basis for biological function. Carbohydrates: Definition, classification, structure, simple and complex carbohydrates. Polysaccharides: Structure and Linkages in Di–and polysaccharides, energy reserve and structural polysaccharides. Lipids: structure of fatty acids, lipids, oils fats, fatty acids–palmitic stearic, vitamins–water soluble. Biomolecules: Structure and properties, Amino Acid, Peptides, Peptide bond. Protein Structure: Nature of Amino Acids; The Peptide bond, Determination of Primary sequence and secondary quaternary structure. The nature of tertiary and quaternary structure methods of determining protein structure
.Nucleotides, nucleosides, purines, pyrimidines, structure of nucleic acids, B-Z form of DNA
.Enzymes as catalysts–Types of enzymes–classification. Enzymes and their role in metabolism– anabolism and catabolism.
Plant Biotechnology: Overview of Biotechnology, Introduction, Scope and importance. Plant Tissue Culture Technologies: A brief description, history, introduction of plant tissue culture. In vitro culture technique: Totipotency, basic procedure of

culture composition of media and sterilization technique. Types of plant tissue culture: Protoplast culture, Cell culture, Tissue culture, Organ culture. Application of plant tissue culture: Production of disease free plants through meristem culture, explant, shoot tip grafting. Somatic embryogenesis; Production, Preservation and use of somatic embryos as propagules. Somaclonal and gamatoclonal variation Selection, Sources and causes of variation, Application in crop improvement. Micropropagation in woody plants, Haploid plant production through anther culture; Hardening of tissue culture plants. Cryopreservation– Storage of germplasm; principle, methods and uses. Genetic transformation of plants : Importance of genetic transformation in plants, Basic concepts of GMOs and GM crops (trees),Vectors and marker genes used in genetic transformation of plants ,Techniques of foreign gene insertion in plant. Biopatent, Biopiracy, Biowarand Bioethics .

Course Breakdown

S.N.	Topic	No. of Lectures
	Plant Biochemistry	
1.	Introduction: Biological molecules, Molecular interactions as a basis for biological function	1
2.	Carbohydrates: Definition, classification, structure, simple and complex carbohydrates.	1
3.	Polysaccharides : Structure and Linkages in Di – and polysaccharides, energy reserve and structural polysaccharides.	2
4.	Lipids : structure of fatty acids, lipids, oils fats, fatty acids – palmitic stearic, vitamins – water soluble	2
5.	Biomolecules: Structure and properties, Amino Acid, Peptides, Peptide bond.	2
6.	Protein Structure: Nature of Amino Acids; The Peptide bond, Determination of Primary sequence and secondary quaternary structure. The nature of tertiary and quaternary structure methods of determining protein structure.	2
7.	Nucleotides, nucleosides, purines, pyrimidines, structure of nucleic acids, B-Z form of DNA.	2
8.	Enzymes as catalysts – Types of enzymes – classification. Enzymes and their role in metabolism – anabolism and catabolism.	2
	Plant Biotechnology	
9.	Overview of Biotechnology, Introduction, Scope and importance	1
10.	Plant Tissue Culture Technologies: A brief description, history, introduction of plant tissue culture.	1
11.	In vitro culture technique: Totipotency, basic procedure of culture composition of media and sterilization technique.	1
12.	Types of plant tissue culture: Protoplast culture, Cell culture, Tissue culture, Organ culture.	2
13.	Application of plant tissue culture: Production of disease free plants through meristem culture, explant, shoot tip grafting .	2
14.	Somatic embryogenesis; Production, Preservation and use of somatic embryos as propagules. Somaclonal and gamatoclonal variation Selection, Sources and causes of variation, Application in crop improvement. Micropropagation in woody plants, Haploid plant production through anther culture; Hardening of tissue culture plants.	3
15.	Cryopreservation – Storage of germplasm; principle, methods and uses.	1
16.	Genetic transformation of plants : Importance of genetic transformation in plants, Basic concepts of GMOs and GM crops (trees), Vectors and marker genes used in genetic transformation of plants ,Techniques of foreign gene insertation in plant.	3
17.	Biopatent, Biopiracy, Biowarand Bioethics.	2
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Introduction to laboratory equipments, Unit volume & weight measurements, molarity, molality, Normality	1
2.	pH measurement : Acid-base titrations, Preparation of solutions, buffers – sensitivity, specificity accuracy	1
3.	Spot test for carbohydrates, Estimation of reducing sugars by DNS Method	1
4.	Spot tests for Amino Acids, Quantitative and qualitative methods for amino acid	1
5.	Experiments to learn sterilization techniques	1
6.	Preparations of stocks for nutrients and hormones	2
7.	Preparation of media using stock solution, Explant preparation for inoculation	2
8.	Seed culture ,	1
9.	Explants (shoot tip, node, meristem, anther, Leaf, embryo) culture	1
10.	Isolation of plant genomic DNA	2
11.	Root induction in some woody plants by hormone treatment	1
Total		**15**

REFERENCES:

1. Dubey R.C. 2012. A Text Book of Biotechnology. S. Chand and Campany Ltd.

2. Bhojwani S. S. 1990. *Plant Tissue Culture: Applications and Limitations*, Elsevier Science Publishers.

3. Bhojwani S.S. and M. K. Razdan: (1996). *Plant Tissue Culture: Theory and Practice*. Elsevier Science Publishers.

4. Chawala H.S. 2009.*Introduction to Plant Tissue Culture*. Third Edition. Oxford and IBH Publishing Co. Pvt. Ltd.

5. Lal R. and Lal S. 1995. *Genetic Engineering of Plants for Crop Improvement*. CRC Press.

6. Satyanarayan U. 2005. *Biotechnology*.1st ed. Arunabha Sen books and Allied.

7. William G. H. 2006. *Plant Biotechnology (The Green World)*.: Chelsea House Publications.

8. Boyer, R.F. (2001). Modern Experimental Biochemistry (3rd edition). Benjamin Cummings Publication.

9. Lehninger.A.L., Nelson, D. L. and Cox, M.M. 2004. Lehninger Principle of Biochemistry (3rd& 4th edition). Palgrave Macmillian Indian edition.

10. Voet, D. and Voet. J.D. 2004. Biochemistry (3rd edition) John Wiley and Sons Inc.

Course code : FPU 201
Course Title : Harvesting and Logging
Credit Hours : 3(2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand and develop skills regarding the application of appropriate technology for economical harvesting and logging in Nepal. They will be able to use the appropriate methods of storage and grading of logs and estimate the cost of harvesting products.

SYLLABUS:

Forest Harvesting, Planning, Agencies involved in Harvesting, Harvesting practices, Techniques, Equipments, Maintenance, Applications, Marking, Inventory, Protection, Safety, Log Extraction, Depot, Loading and unloading techniques, tools, Transportation of logs, transportation through surface, water and, aerial. Grading of logs, importance of log grading, rules and grading techniques. Storage of logs their protection and supply mechanism. Market control and industrial raw material supply systems. Ergonomy, application and importance, physical and social impacts. Cost estimation of harvesting products, System analysis on cost, time and market flow system. Community managed harvesting, sustainable harvesting, natural prone products collection. Large harvesting, operation and efficient system. Log bucking, delimbing, debarking, Waste collection and management. Mechanism of International and regional harvesting practices. Harvesting impacts on biodiversity, land surface and habitat. Wood value and waste minimization in harvesting, Recovery of 100% products.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Forest harvesting introduction, principles, history, importance	1
2.	Forest harvesting planning, Agencies involved in harvesting	1
3.	Harvesting practices and systems of felling to transportation	1
4.	Techniques of each systems of harvesting practices	1
5.	Equipments involved in each systems and their efficiency	1
6.	Maintenance and management of equipments	1
7.	Application of equipments and safety measures	1
8.	Pre-harvesting preparation, marking, inventory, block preparation,	1
9.	Systems and principles of Tree felling, delimbing and bucking	1
10.	Log preparation and extraction, systems of extraction, equipments	1
11.	Log grading and valuation	1
12.	Log storage and depot management	1
13.	Sale and disposal of logs	1
14.	Log loading and unloading, equipments, safety and efficiency	1
15.	Market analysis and products supply	1
16.	Industrial raw materials categories, requirement and supply	1
17.	Transportation of logs, systems of transportation through for road, water and air, equipments, physical constraints, safety	2
18.	Ergonomy and its impacts on harvesting workers health and hygiene	1
19.	Debarking of logs, principles and mechanism	1
20.	Harvesting waste as residues, types and collection, management of waste	1
21.	International and regional harvesting management	1
22.	Harvesting impacts on soil loss, degradation and remedies	1
23.	Impacts of harvesting on ground vegetation and biodiversity conservation	1
24.	Wood value and minimization of harvesting loss	1
25.	Cost analysis of harvesting products	2
26.	Community forest products extraction and collection	1
27.	Monitoring and facilitation of community forest harvesting	1
28.	Policy and regulations controlling forest harvesting and supply	1
Total		**30**

Practical:

S.N.	Topic	No. of Practicals
1.	Harvesting Equipments identification exercise	1
2.	Harvesting equipments maintenance exercise	2
3.	Application of harvesting tools with local exercise	2
4.	Field harvesting practices observation and sharing	2
5.	Depot management observation and study	2
6.	Field Log sale practices study	2
7.	Harvesting effects on soil and ground flora field study	2
8.	Log grading and valuation field study	2
Total		**15**

TEXT BOOKS AND REFERENCES:

1. Forest Utilization FRI, Vol I and II, Deharadun, 1970
2. Forest Utilization by Tribhuvan Mehta
3. Hand Book on Appropriate technology for Forestry operation in developing countries (by Mikko Kantola and Klaus Virtanen)
4. Logging and Pulpwood production by J. Denneth Pearce and George Stenzel
5. Logging practices by Steve Conway
6. Logging News, A quarterly Newsletter & Journals
7. Logging of mountain forests. FAO 33, 1982.
8. Appropriate technology in forestry FAO vol. 31 1982.
9. Manual of Forest Utilization by S. Chowdhury, 2003

Course Code : WPR 201
Course Title : Wildlife Conservation
Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical 0

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the wildlife conservation and management in and outside the protected areas

SYLLABUS:

Evaluate the value and importance of wildlife conservation and management. Describe the mechanism of controlling of Poaching and stop the Illegal trade of wild flora and fauna (Anti-poaching Operations), discuss about habitat Management, Wildlife Population, Population dynamics and Wildlife behavior, Human-Wildlife Conflict, Prey-predators relationship, Wildlife rescue, control post-mortem, Biodiversity, Trophy identification, Landscape level management, corridor, connectivity and bottleneck Ex-situ conservation, Conservation Education, Policy, Act, Rules, Regulations, Strategies, Agreement and MOU and negotiation, Trans-boundary coordination and cooperation, International Conventions and its implications in Wildlife conservation and management

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Control of Poaching and stop the Illegal trade of wildlife flora and fauna (Anti-*poaching* Operations)	5
2.	Habitat Management (i) Food	5

(ii) Cover
(iii) Water
(iv) Space

3. Wildlife Ecology, Wildlife Population, 2
Population dynamics and Wildlife Behavior
4. Wildlife research and monitoring 3
(i) Transect survey
(ii) camera trapping
(iii) pellet count
(iv) DNA method
(v) Radio-collar and GPS
5. Human-Wildlife Conflict 2
6. Prey-predators relationship 2
7. Wildlife rescue, control, handling and post-mortem 1
8. Biodiversity 1

9.	Trophy identification	1
10.	Value of ecosystem	1
11.	Landscape level management, corridor, connectivity and bottleneck	2
12.	Ex-situ conservation and Captive Breeding (i) Gharial Breeding Centre (ii) Elephant Breeding Centre (iii) Vulture Breeding Centre (iv) Zoo Management	2
13.	Conservation Education	1
14.	Policy, Act, Rules, Regulations, Strategies, Agreement and MOU, Trans-boundary coordination and cooperation	1
15.	International Conventions, Conference of Parties (COP), Dialogue and Negotiation skill and its implications in Wildlife conservation and management	1
Total		**30**

TEXT AND REFERENCES:

1. GoN, MFSC, Nepal: Nepal Biodiversity Strategy 2002

2. GoN, MFSC, Nepa: Terai Arc Landscape-Nepal 2006

4. The Wildlife Society, Washington, D.C. 1981. Wildlife Management Techniques.

5. Robert H. Giles, Jr. 1978. Wildlife Management, W. H. Feeeman and Company San Francisco.

6. J. B. Sale and K. Berkmuller, 1998. Manual of Wildlife Techniques for India.

7. Garden Woodroffe 1981. Wildlife Conservation and Modern zoo.Stracey, Wildlife in India,

8. Forest Act NPW Act/Regulations

9. Wetlands Biodiversity Strategy

Course Code : SWM 201
Course Title :: Fundamentals of Geology
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand geology, formation of today's earth throughout geological time and geological processes that are shaping today's earth and building their concepts on rock-soil-plant relationship.

SYLLABUS:

Origin and internal structure, characteristics of earth's interior, Concept and branches of geology Definition, chemical composition and physical properties of minerals, Types of rock-forming minerals, Sedimentary rock, Metamorphic rock, Igneous rocks, Concept of plate tectonics, Plate boundaries and their significance, Attitude of geological strata, stress and strain, deformation of earth's material, Fold, fault and joint, Classification of fault, fold and joints, Stratigraphy: definition, principles and classification, Stratigraphic column and correlation, Mode of formation of fossils and types, Geological time scale and major geological events, Weathering and erosion, mass wasting, fluvial, glacial and eolian processes, Change of landforms, erosional and depositional landforms, Relationship between plant growth and earth surface processes, Factors causing landslides and relationship between vegetation and slope stability, Study of landslides, Processes of soil formation, types, significance and controlling factors, Mass balance approach and effect of various factors on chemical weathering, Concept and factors affecting formation of critical zone, Critical zone in Nepal Himalayas and its relation to plant growth,

Geomorphic features and geological framework of Nepal Himalaya, Major tectonic features of Nepal Himalaya, Main surface geological processes and landforms

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Origin and internal structure, characteristics of earth's interior	1
2.	Concept and branches of geology	1
3.	Minerals: Definition, classification (silicate, non silicate) chemical composition and physical properties	2
4.	Sedimentary rock(definition, classification, formation, occurrence)	2
5.	Metamorphic rock (definition, classification, formation, occurrence)	2
6.	Igneous rocks (definition, classification, formation, occurrence)	2
7.	Concept of plate tectonics	1
8.	Plate boundaries and their significance	1
9.	Attitude of geological strata, d(definition, classification, formation, occurrence) formation of earth's material	1
10.	Fold, fault and joint,	1

11.	Classification of fault, fold and joints	1
12.	Stratigraphy: definition, principles, classification	1
13	Stratigraphic column and correlation, mode of formation of fossils and types	1
14.	Geological time scale and major geological events	1
15.	Weathering and erosion, mass wasting, fluvial, glacial and eolian processes,	1
16.	Change of landforms, erosional and depositional landforms	1
17.	Relationship between plant growth and earth surface processes	1
18.	Factors causing landslides and relationship between vegetation and slope Stability	1
19.	Study of landslides	1
20.	Processes of soil formation, types, significance and controlling factors	1
21.	Mass balance approach and effect of various factors on chemical Weathering	1
22.	Concept and factors affecting formation of critical zone	1
23.	Critical zone in Nepal Himalayas and its relation to plant growth	1
24.	Geomorphic features and geological framework of Nepal Himalaya	1
25.	Major tectonic features of Nepal Himalaya	1
26.	Main surface geological processes and landforms	1
Total		**30**

Practical

Laboratory

study

S.N.	**Topic**	**No.of Practicals**
1.	Study of topographic features from topographic maps	1
2.	Study of Geological maps	3
3.	Identification of minerals in hand specimen	2
4.	Identification of rocks in hand specimen	4
5.	Field study and field report Study through excursion geology, critical zone and earth surface processes including landslides from different geological settings of Nepal Himalaya	5
Total		**30**

REFERENCES :

1. Fundamentals of Geology by AB Roy
2. Petrology: Igneous, sedimentary and metamorphic by Harvey Blatt, Robert Tracy and Brent Owens
3. Geology of Nepal by CK Sharma
4. Process Geomorphology by Dale F. Ritter, R. Craig and Jerry R. Miller
5. Landslides: Processes, Prediction and Land Use by Roy C. Sidle and Hirotaka Ochai
6. An outline of the Himalayan Upheaval: A case study of the Nepal Himalayas by Koshiro Kizaki
7. Dynamic Himalaya by KS Valdiya
8. Landslides studies and management in Nepal by BN Upreti and MR Dhital (ICIMOD)
9. Physical Geology by GB Mahapatra
10. Journals
    - Journal of Nepal Geological Society
    - Journal of Asian Earth Science
    - Geology
    - Earth and Planetary Science Letters etc.

Course Code : FSE 201
Course Title : Forest Engineering
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion this course, the students will be able to understand (land transportation, forest road and its environmental components) forest engineering.

SYLLABUS:

Forest Engineering deals with land transportation and it is totally based on forest road. History & importance of forest road, road components, structures, drainage, culverts, and erosion control. Planning issues and environmental analysis of forest roads, design and construction of forest roads. Hydrological analysis of drainage and its design. Retaining walls design and causes of failure, Timber testing and structural analysis for simple timber bridge, types of bridges and road bio-engineering and road materials. In the practical the students will be taught about alignment of forest road, estimating and costing of forest road, structural calculations of bridges, stability analysis of retaining walls.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	History and Importance of Forest Road	2
2.	Road Components (Terminology) Forest Road Components, Road Structural Section and Materials, Surface Drainage, Culverts and Drainage Crossings, Causeway and Low-Water Crossings, Erosion Control, Miscellaneous Terms	2
3.	Forest Road Location & Alignment (Laying out Alignment on Ground and preparing Preliminary Estimate of Cost)	2
4.	Environmental analysis of Forest Road (IEE and EIA)	2

5.	Planning Issues and Special Application	2
6.	Road Engineering (Design & Construction)	3
7.	Hydrology for drainage Crossing Design 3 (Tools for Hydraulic & Road Design)	
8.	Drainage of Forest Road (Culvert, Installation and Sizing, & Fords and Low-Water Crossings)	3
9.	Retaining Wall (Types, Construction, Design and causes of Failure)	2
10.	Timber Testing (Factor of Safety, Timber Mechanics, Structure of Simple Timber Bridges and Calculations)	5
11.	Bridges (Site, Longitudinal Sections, Types)	2
12.	Road Bio-engineering (Erosion Control, Stabilization of Gullies, Slope Stabilization and Stability of Cuts and Fills)	3
13.	Roadway Material and Material Sources	2
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Identification of equipments used for surveying and drafting	1
2.	Leveling and fixing alignment of road	2
3.	Preparation of forest road plan	1
4.	Cross-section leveling and profile leveling	2
5.	Preparation of profile, laying out gradient, earthwork, cutting and fillings	2
6.	Curve design and layout	1
7.	Preparation and design of super elevation	1
8.	Estimating and costing, calculations	2
9.	Calculation of causes of failure of retaining walls	1
10.	Timber testing, structural calculations of simple beam bridge, max bending moment	2
Total		**15**

REFERENCES:

1. Punmia, Dr. B.C. Surveying. Laxmi publications, New Delhi, India.

2. Masani, N.J. Forest Engineering Without Tears, Dehradun, India.

3. Harrison, J.L. Forest Engineering Roads and Bridges, Oliver & Boyd, London.

4. Kellar, G. and J. Sherar 2003. Low-Volume Roads Engineering Best Management Practices Field Guide, USDA, Forest Service.

5. Environmental Protection Agency. 2001. National Management Practices to Control Non-point Source pollution from Forestry. EPA Contract No. 68-C7-0014, Work Assignment #2-20. Prepared for Office of Water, U.S. Environmental Agency by Tetra Tech, Fairfax, Virginia. A comprehensive guide to measures for reducing water pollution from roads and logging activities.

6. USDA, Forest Service, 2001. Best Management Practices for Forest Roads: a performance-based framework. Washington, DC: A cooperative effort between the USDA, Forest Service, and US Environmental Protection Agency.

7. Lewis, L. 2000. Soil Bioengineering – An alternative for Roadside Management, A Practical Guide. Technology & Development program No. 0077-1801-SDTDC, September, Washington, DC: USDA, Forest Service, San Dimas Technology & Development Center, San Dimas, CA.

8. Howell, J. 1999. Roadside Bio-engineering Reference Manual. Nepal-UK Road FAO, UN. Guide to Forest Road Engineering in Mountainous Terrain

Course Code : NRM 201

Course Title : Principles of Forest Economics
Credit Hours : 2 (2+0) Full Marks: 50 Theory

50 Practical 0 OBJECTIVES:

Upon the completion of this course, the students will be able to understand the production, marketing, and usefulness of forest products and services in the context of economic theory, and carry out economic analysis to make decisions on forest management

SYLLABUS:

Concepts of forest economics, multiple uses of forests, project design and evaluation, public finance and welfare economics, marketing of forest products

Course Breakdown

Theory

S.N.		Topic	No. of Lectures
1.	**Introduction**		
	1.1	Concept and usefulness of Forest Economics	1
	1.2	Scope of forests and Agro-forestry in Nepalese economy	1
2.	**Multiple Uses of Forest**		
	2.1	Types of Products and Services (private and public)	1
	2.2	Economic models of multiple products and services	2
	2.3	Time value of money and discount rates	1
	2.3	Optimum rotation and economic rent	1
	2.4	Linear Programming and optimization	3
3.	**Project Design and Evaluation**		
	3.1	Identification and Feasibility	1
	3.2	Financial and Economic Appraisal	
	3.2.1	Production, valuation, and distribution of benefits over time	1
	3.2.2	Various feasible criteria– B/C ratio, NPV, IRR and Land Expectation value	1
	3.2.3	Economic analysis from various stakeholders' perspective	1
	3.2.4	Risk and Uncertainty	2
	3.3	Project Monitoring and Evaluation	

4.	Public Finance and Welfare Economics		
	4.1	Meaning of GDP and its compos	1
	4.2	Budgeting and Public Expenditure	2
	4.3	Pareto Optimality and its limitations	1
	4.4	Public Goods and Externalities	1
	4.5	Provision and production of public goods and services	2
5.	**Marketing of Forest Products**		
	5.1	Demand determinants and derived demand	1
	5.2	Income and price elasticity of forest products	1
	5.3	Measuring demand for non-market goods/services	2
Total			**30**

TEXT AND REFERENCE MATERIALS

1. Ahmed V. and Michael Bamberger.1990. Monitoring and Evaluating Development Projects. The South Asian Experience, The World Bank.

2. Gregersen, Hans M.1992. Economic Assessment of Forestry Project Impacts, Forestry Papers 106. FAO.

3. Gregory, R. 1972. Forest Resource Economics. New York: Ronald Press.

4. Gittinger, J. Price1984. Economic Analysis of Agricultural Projects. The World Bank.

5. Price, Colin.1989. The Theory and Application of Forest Economics. Basil Blackwell Ltd. Oxford,

6. Randall, Alan. 1981.Natural Resource Economics. Lexinton: University of Kentucky Press.

Course Code : SFB 201
Course Title : Silvicultural Systems
Credit Hours : 2 (2+0) Full Marks: 50 Theory 50 Practical: 0

OBJECTIVES:

On completion of this course, the students will be able to understand the techniques of natural regeneration and silvicultural systems and design and apply silvicultural systems for different forest stands and advise both the forest department and forest user groups for scientific and sustainable management of forests

SYLLABUS:

Review of Regeneration Methods, Techniques of natural regeneration Concept and Classification of Silvicultural Systems, General description and Merits and Demerits of the Silvicultural Systems; Clear-felling System, Seed tree System, Shelter-wood System, Selection System, Accessory Systems, Coppice Systems. Conversions, Formulation of Silvicultural Systems, Sivicultural systems applicable to different types of forests and species; Sal, Asana, Khair, Sissoo, Katus, Chilaune, Oaks, Chir pine Blue Pine, Spruce, Fir, and Deodar. Effects of Silvicultural Systems on soil wildlife, biodiversity, recreation.

Course Breakdown

S. No,	Topics	No. of Lectures
1.	Review of regeneration Methods i Natural regeneration from seeds and Coppice ii Techniques of natural regeneration	2

2. Introduction and Classification of Silvicultural Systems 1

i. High forest Systems ii Coppice Systems

3. Clear-felling Systems 4

(A) Definition, Pattern of felling, types of clear felling system

i, Patch felling system

ii, Clear strips system

iii Alternate strips system

(B) Methods of regeneration

i. Artificial regeneration

a. Departmental Plantations

b. Taungya

ii. Natural regeneration

a. Natural regeneration from seed

b. Natural regeneration from advanced growth

iii. Merits and demerits, Considerations for application and examples

4. Seed tree System: 1
   i. Definition, pattern of felling, methods of regeneration, merits and demerits and examples
5. Shelter-wood System 4
   i. Definition, kinds of shelter-wood systems, Pattern of felling
   ii Uniform system, Periodic Blocks, method of regeneration Merits, demerits, applicability, and examples of application
   iii. Irregular, shelter-wood system, patterns of felling, its merits and demerits and example of application
   iv. Strip and group shelter-wood system, pattern of felling, merits and demerits and example of application
6. Selection System 2
   i. Definition, kinds of selection system and pattern of felling
   ii. Merits, demerits, conditions of applicability ,and example of application
7. Accessory Systems: Definition and kinds of accessory system. 2
   i. Two storied high forest system
   ii. High forest with reserve system
   iii. Merits, demerits andexamples
8. The coppice system: 4
   i. Definition, kinds of coppice system (Simple coppice system, coppice with standards, the coppice of two rotation system, the shelter wood coppice system, the coppice with reserve system, the coppice selection system)
   ii. Simple coppicesystem
      a) Definition, pattern, season and method of felling
      b) Merits, demerits and conditions for applicability
      c) Examples of application
   iii. Coppice with standardsystem
      a) Definition, pattern of felling
      b) Merits, demerits and condition of applicability
   iv. Examples of application
   v. Coppice with reserve system
      a) Definition, pattern, season and method of felling
      b) Merits, demerits and conditions for applicability
      c) Examples of application
9. Conversions: 1
   Definition, objective of

conversion, techniques of conversion, pace or speed of conversion, examples of conversion

10. Formulation of silvicultural system 2

a) Introduction and considerations

i) Harmony with goals and characteristics of ownership

11.	Application of Silvicultural Systems. i. Review of silvicultural characteristics of important tree species ii. Sivicultural systems applicable to following species in national or community forests Sal, Asna, Khair, Sissoo, Katus, Chilaune, Oaks, Chir pine Blue Pine, Spruce, Fir, and deodar	6
12.	Effects of Silvicultural systems on i. Soil and water conservation and soil nutrients ii. Wild life, wildlife habitat, biodiversity and recreation	1
Total		30

REFERENCES:

1. Khanna, L.S., 1991. Principle and practice of Silviculture, published by Khanna Bandhu, Tilak Marg, Dehradun, India

2. Khanna, L.S.and Ram Prakash, 1983. Theory and practices of silvicultural Systems, International book distributers, Dehradun, India

3. Troup, R.S., 2008. Silviculture of Indian Trees, Asiatic Publishing house, New Delhi, India

4. Troup, R.S., 2008. Silvicultural Systems, Asiatic Publishing house, New Delhi, India

5. Smith D.M., 1986. The Practice of Silviculture, Published by John Wiley & Sons, U.S.A.

6. Jackson, J. K., Vol. 1 & Vol.11, 1994, Mannual of afforestation, FRSC, MFSC, Kathmandu, Nepal.

7. Kayast, B. P., 1985. Silvics of the Trees of Nepal, Community Forestry Development Project, Kathmandu, Nepal

8. Champion and Seth, 1987. Hand book of Silviculture, Part 11, Silvicultural Systems, Cosmo Publication, New Delhi, India

9. Nepal Australia Community Forestry Project Publication

10. Tree Improvement & Silviculture Component of DANIDA Project Publication, Silvicultural Systems for Community Forests

Course code : NRM 202
Course Title : Forest Mensuration and Biometrics
Credit hours : 3(2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon completion of this course, the students will be able to understand the importance of measuring trees, calculate volume and biomass of tree products, understand forest sampling and inventory methods, predict growth of trees and understand growth and yield, apply experimental designs in solving forestry problems

SYLLABUS:

Introduction, measurement of trees, measurement of form, volume and biomass of trees and products, forest sampling and inventory, growth prediction, growth and yield, experimental designs

Course breakdown

Theory

S.N.	Topic	No. of Lectures
1	**Introduction**	2
	1.1 Definition and scope of forest mensuration	
	1.2 Bias, accuracy and precision	
	1.3 Principles of height measurement	
	1.3.1 Trigonometric principles	
	1.3.2 Principle of similar triangle	
2	**Measurement of trees**	4
	2.1 Diameter measurement	
	2.1.1 DBH measurement and its significance	
	2.1.2 Rules of DBH measurement and instruments used	
	2.2 Height measurement	
	2.2.1 Measurement of height of trees (vertical and leaning) in plane and slope	
	2.2.2 Instruments used in height measurement	
	2.2.3 Instruments used in height measurement	
	2.3 Measurement of logs and fuelwood	

	2.3.1	Measurement of length, diameter and sectional area of logs	
	2.3.2	Formula for log volume calculation	
	2.3.3	Volume of stacked timber and chatta (stacked fuelwood)	
3	**Measurement of form**		3
	3.1	Form factor and its types	
	3.2	Form quotient and its types	
	3.3	Taper table	

4	Volume and Biomass of trees and products	4
4.1	Volume tables (types, preparation of local and general volume tables)	
4.2	Biomass table and equation (root, leaf, stem, and branch biomass and different biomass equations)	
5	Forest sampling and inventory	4
5.1	Definition and scope of sampling	
5.2	Types of sampling (simple random, stratified random, systematic random)	
5.3	Inventory	
5.3.1	Introduction and scope	
5.3.2	Cruising (strip system, line plot system)	
5.3.3	Inventory with point sampling (horizontal and vertical)	
5.3.4	Aerial photographs in forest inventory	
a.	Types of aerial photographs	
b.	Photo interpretation	
c.	Forest classification	
d.	Area determination	
e.	Volume estimation	
6	Growth prediction	5
6.1	Diameter, basal area and volume growth	
6.2	Stand growth	
6.3	Current annual increment (CAI) and mean annual increment(MAI)	
6.4	Stump analysis, stem analysis	
6.5	Stand structure	
7	Growth and yield	4
7.1	Growth and yield of even aged forest	
7.2	Growth and yield of uneven aged forest	
7.3	Different growth and yield modelling approaches (concept only)	
7.3.1	Stand table projection	
7.3.2	Whole stand modelling	
7.3.3	Individual tree modelling (distance dependent, distance independent)	
7.4	Application of growth and yield models	
7.5	Yield table	
8	Experimental design	4
8.1	Completely randomized design (CRD)	
8.2	Randomized complete block design (RCBD)	
8.3	Latin square design8.4 Factorial experiment	
	8.5 Multiple comparisons (LSD and DMRT tests)	
Total		30

Practical

S.N.	Topic	No. of practicals
1	DBH and height measurement	2
2	Form factor estimation	1
3	Preparation of local volume table	2
4	Preparation of general volume table	2
5	Random sampling	1
6	Stratified random sampling	1
7	Line plot method of cruising	1
8	Inventory with point sampling	2
9	Randomized complete block design	1
10	Completely randomized design	1
11	Factorial design	1
Total		**15**

TEXT AND REFERENCE BOOKS:

1. Forest measurements-T.E. Avery and H.E. Burkhart. MacGraw Hill Book Company.

2. Forest mensuration-B.Huch , Charles I. Miller and T.W. Beers

3. Forest mensuration-A.N. Chaturvedi and L.S. Khanna. International Book distributors, Dehradun, India

4. Forest management- L.S. Davis and K.N. Johnson. McGraw Hill Book Company.

5. Experimental design-W.G. Cochran and G.M. Fox

6. Statistical methods-G.W. Snedecor and W.G. Cochran

4th Semester Courses

Course Code : FPU 202
Course Title : Medicinal and Aromatic Plants
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

GENERAL OBJECTIVES:

Upon the completion of this course, the students will understand the value, use and the potentiality of the Medicinal and Aromatic plants.

SYLLABUS:

Introduction, Importance, Important MAPs, Description, Uses, Nursery, cultivation and domestication, harvesting, processing, marketing, policy, enterprises, certification, value addition

Course break down

Theory:

S.N	Topics	Sub-topics	No. of Lectures
1.	Introduction of Map	Introduction	1
		Importance and scope of MAP MAP category	1
2.	Map and Livlihood	Role of MAPs in livelihood	2
3.	MAPs Conservation	MAPs conservation, International conventions on biodiversity , conservation status	2
4.	Ethnobotany	Importance Ethnic value of MAPS	2
5.	Sustainable Harvesting MAPs	Importance Harvesting practicesSustainable harvesting	2
6.	Resource Management Assessment	Importance of InventorySampling method Measurement technique estimation of resources	3

7.	Enterprises & Marketing of Maps	Enterprise development Micro and Macro Business plan	3

8.	Value Addition	Importance of value addition Processing of value addition	2
9.	Nursery practice	Nursery practices of important MAPs	2
10.	Cultivation and domestication	Cultivation and domestication of important MAPs	2
11.	Harvesting and post harvesting treatments	Harvesting and post harvesting treatments of important MAP	2
12.	Policy and regulations	Policy and regulations of MAPs	2
13.	Certification	Certification and trade of MAPs	2
14.	International treaties	International trade and treaties	2
Total			30

Practical

S.N.	Topic	No. of Practicals
1	Identification of at list 10 important MAPs	5
2	Value addition processing exercise (Drying, cleaning, storing etc.)	5
3	Field visit to some MAPs processing and marketing units	5
Total		**15**

REFERENCES:

1. The Indian Forest Utilization, FRI Publication Vol. I & II, Deharadun.
2. Journals of MAPs and NTFPs
3. Minor Forest Products
4. Wealth of India, CSSIR publication
5. Jadi buti, Manjari and Medicinal plants of Nepal
6. Sustainable Management of NTFPS, M.P. Shiva
7. Non Timber Forest Products, I. C. Dutta

Course Code : WPR 202
COURSE TITLE : Protected Area Management
Credit Hours : 2(2+0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES:

Upon the completion of this course, the students will be able to understand modern concepts related to establishing protected areas, examine the management strategies of protected areas for planning, implementation, and evaluation, familiarize with conservation education, communications, and public relations schemes and integrated approaches used in protected area systems, discuss the significance of protected areas in different geographical areas of Nepal and resolve the park-people conflicts with good harmony with the local people's needs.

SYLLABUS:

Introduction, concepts of protected area, tropical rain forest, categories of protected areas, policy, law for managing protected areas, planning, implementation of protected areas, management of natural resources in protected areas, protected areas of Nepal, integrated protected areas in regional land use planning, international cooperation,

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	**Introduction**	7
1.1	Modern concepts of protected areas	
1.2	Categories of protected areas	
1.2.1	Criteria of classifying protected areas	
1.2.2	International system of categories	

1.3 Basis for selecting of Sites for protected areas
1.3.1 Assessment of Global bio-geographical coverage of resources
1.3.2 Genetic and species conservation in selecting sites for protected areas
1.3.3 Implementation of Island bio-geographic theory in selecting areas for protection at a National Level
1.3.4 Criteria for consideration when selecting protected areas
1.4 Policy, law and administration for managing protected areas
1.4.1 Policy matters relating to protected areas
1.4.2 Legal aspects of protected areas management
1.4.3 Administrative matters relating to protected areas
1.4.4 Broadening participation and cooperation in management of protected areas

2. Planning, Implementation, and Evaluation of Protected area **4**

Management System

2.1 Planning for protected areas
2.1.1 National strategies for conservation
2.1.2 Management plans
2.1.3 Annual operation plans
2.1.4 Site plans
2.1.5 Planning research programs for protected areas
2.2 Implementing Management
2.2.1 Allocation of duties and staff selection
2.2.2 Management of staff
2.2.3 Inspection and supervision
2.2.4 Maintenance of physical structure and stores
2.2.5 Patrolling
2.2.6 In-service training
2.2.7 Concession services
2.2.8 Controlling resource utilization
2.2.9 Law enforcement
2.3 Evaluating the effectiveness of management
2.3.1 Comparing expenditure and budget
2.3.2 Assessing attainment of goal
2.3.3 Evaluation of cost -effectiveness
2.3.4 Use of checklists in evaluating management

3. Management of Natural Resource in Protected areas **8**

3.1 Balance of ecosystem
3.2 Maintenance of genetic diversity
3.3 Management of gene banks
3.4 Management of rare and endangered animals
3.5 Protecting Island Resources
3.6 Management of over abundant populations
3.7 Control of problems animals originating from PAs
3.8 Rehabilitation of Captive animals
3.9 Introductions, reintroductions, and translocations (Case studies with reference to Nepal)
3.10 Control of exotic species
3.11 Restoration of vegetation
3.12 Fire as a management tool
3.13 Grazing by domestic animals as a management tool
3.14 Harvesting of plant products in protected areas
3.15 Hunting in and around protected areas
3.16 Wildlife farming and utilization
3.17 Management for the maintenance of hydrological regime
3.18 Protection of aesthetic values and geological sites
3.19 Directing Research activities for benefit of management
3.20 Need for inventory and monitoring
3.21 Management trails and experiments

4. Protected areas of Nepal		2
1.1	Protected areas and their categories	
1.2	Protected areas of Nepal(NP,WR,BZ,CA,HR)	
1.3	Analysis of problems and prospects of protected areas.	
1.4	Comparison of management approaches	
5. Integrated Protected area in Regional Landuse Lanning		6
5.1	Contribution of protected areas in regional development	
5.1.1	Protected areas and hydrological relationship	
5.1.2	Protected areas and harvesting of wildlife and other natural resources	
5.1.3	Protected areas and tourism	
5.1.4	Development of protected areas and Buffer Zone	
5.1.5	Integrating protected in regional development programme	
5.2	Local people and protected areas	
5.2.1	Protected area and indigenous people	
5.2.2	Human enclave within protected areas	
5.2.3	Protection of cultural sites	
5.2.4	Harvesting from protected areas and Buffur Zone	
5.2.5	Grazing in protected areas	
5.2.6	Local preference in employment	
5.2.7	Provision of social services	
5.3	Communication and public relations for protected Areas	
5.3.1	Visitor information and interpretation services	
5.3.2	School and Education Services	
5.3.3	Local village extension services	
5.3.4	Publicity and public relationship	
6. International Cooperation		3
6.1	Needs for international assistance Introduction	
6.2	Types of assistance	
6.3	Source of help: Technical assistance agencies and organization	
6.4	UN agencies	
6.5	Multinational Organizations	
6.6	Bilateral assistance	
6.7	Volunteer Organization	
6.8	National Government Agencies with International programmes	
6.9	International and Regional co-operation and conventions	
Total		30

REFERENCE :

1. John & Kathy MacKinnon,Graham Child & Jim Thorsell 1982. Managing Protected Area in the Tropics, Natraj publishers, Dehradun.

2. Mc Neely J.A.2003. Protected Areas ,Poverty y & Sustainable Development, IUCN.

3. Kalemani Jo Mulongoy & Staurt Chape 2004. Protected areas & Biodiversity. UNEP,WCMC.

Mac Kinnon: Buffer Zone Management in the

tropics.

Course Code : NRM 203

Course Title : Forest Management

Credit hours : 3 (2 + 1) Full Marks: 75

Theory 50 Practical 25 OBJECTIVE:

Upon the completion of this course, the students will be able to understand basic concept and develop skills in forest management techniques, estimate the growing stock of a given forest and learn the importance of sustainable forest management

SYLLABUS:

Forest management including basic knowledge and skills in fundamental concepts on forest management and its implications in forest planning and operations focusing on forest planning principles such as sustained yield, growing stock, site quality, rotational age and annual allowable cut, sustainable forest management, and tools of sustainable forest management

Theory:

S.N.	Topic	No. of Lectures
1.	Theory History of Forest Management in Nepal	1
2.	High Forest management system and its importance to the Nepalese forest and forestry	1
3.	Multistory forest management system - one of the best tools of maintaining richness of forest biodiversity	2
4.	Classification of forests and its purpose	1
5.	Classification of forest of Nepal on different basis (geographical and climatic, legal, territorial/administrative, silvicultural, and functional)	2
6.	Definition and concept of normal forests	1
7.	Attributes of normality	1
8.	Implication of normality concept in even aged and uneven aged forests	1
9.	Definition of growing stock, increment and its type	1

10.	Determination of actual growing stock	1
11.	Determination of growing stock by various methods (men annual increment and yield table)	2
12.	Site quality and its determination	
13.	Definition and concept of rotation	1
14.	Types of rotation (physical and silvicultural, rotation of maximum volume duction and technical rotation, rotation of highest income and financial rotation)	3
15.	Concept of rotation in regular and irregular forests	1
16.	Choice of rotation	1

17.	Rotation and conversion period	1
18.	Yield and its type	1
19.	Principle of sustain yield management	1
20.	Concept of yield regulation (by area, by volume)	1
21.	Yield table and its uses	1
22.	Definition and concept of sustainable forest management	1
23.	Principle of sustainable forest management and its impacts in the Nepalese context	1
24.	Criteria and indicators of sustainable forest management	1
25.	Concept of forest certification	1
26.	Various forest certification schemes	1
Total		**30**

Practical:

S.N.	Topic	No. of Practicals
1.	Observation and classification of forest on different basis (such as ecological and legal)	5
2.	A group of 5-6 students provided with a forest stand to apply all management tools for sustainable management in a given objective of the forest uses	4
3.	Calculate actual growing stock of forest (measure height, diameter and calculate volume of stand trees)	5
4.	Compute density of regeneration	1
Total		**15**

REFERENCES:

1. Forest Management – Ram Prakash

2. Forest Management – Davis and Johnson

3. Forest Resource Management – William A. Leuschner

Course Code : EES 201
Course Title : Forest Ecology
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the fundamentals of forest ecology, interactions between different factors and application of ecological knowledge in management of natural resources.

SYLLABUS:

Introduction and application of Forest Ecology, Ecosystem concept: levels of organization hierarchy, attributes, trophic Structure and classification of ecosystems. Energy in ecological system: Sources of energy for living organisms, trophic level, food chain, food webs, ecological pyramids, gross and net productivity and their measurement. Biogeochemical cycle of C, N, P, K and S. Variations in plants and concept of ecotype. Law of minimum and role of ecological factors: solar radiation, temperature, wind, soil, water, fire and site and animals. Types of interactions, competition, tolerance, and forest stand structure. Forest succession and retrogression. Carbon sequestration andconcept of Kyoto Protocol (carbon trade)

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Concept and application of Forest Ecology and Ecosystem	1
2.	Levels of Organization Hierarchy, attributes	1

3.	Trophic Level, Biomass Food Chain and Webs, Ecological Pyramids Biomass Productivity: Gross and net Productivity, Methods to measure Productivity Introduction to major Ecosystem (forests, fresh-water and grassland)	4
4.	Ecological role of Solar Radiation	2
5.	Temperature as an Ecological Factor	1
6.	Forest succession: Stages, causes and types, retrogression	1
7.	Biogeochemical Cycle: Nitrogen Cycle Phosphorus , Potassium Cycle Sulfur Cycle Carbon Cycle	4
8.	Phenotypic variation and Plasticity	1
9.	Sources of Variation	1

10.	Genetics and evolutionary sequence	1
11.	Concept of ecotype	1
12.	The role of animals/plants including lower plants in forest ecosystem	1
13.	Wind: Ecological Effect of Atmospheric Movement	1
14.	Soil: The Least Renewable Component of the Ecosystem	1
15.	Water: The material That Makes Life Possible	1
16.	Fire: A Pervasive and Powerful Environmental Factor	1
17.	Site index, environmental factors as a measure of site	1
18.	Multiple factors methods of site classification	1
19.	Types of interaction Between Two Species	1
20.	Competition, Tolerance, Forest stand structure	1
21.	Ecological assessment techniques (diversity and richness)	1
22.	Forest Ecosystem Services Concept of Payment of Ecosystem Services (Case studies)	2
Total		**30**

Practical

S.N.	Topic	No. of Practical
1.	Estimation of Species Diversity	1
2.	Estimation of Species Richness,	1
3.	Estimation of Species Evenness	1
4.	Estimation of leaf litter input	1
5.	Estimation of leaf litter accumulation	1
6.	Demonstration of leaf litter decomposition	1
7.	Case study writing on ecosystem services	2
8.	Demonstration of intra and inter specific competition	1
9.	Observation of forest sites: Terai and Hills forest	1
10.	Observation of impact of abiotic factors on distribution of plants	2
11.	Human and animals disturbance on species diversity	3
Total		**15**

REFERENCES :

1. Aber J.D. and Melillo. 2001. Terrestrial Ecosystem 2nd edition .Harcourt Academic Press NY

2. Fisher R. F. 2012. Ecology and Management of Forest Soils. Wiley Blackwell

3. Kimmins J. P. 2003. Forest Ecology 3rdEdition .Macmillan Publishing NY.

4. Leary R. A. 1985. Interaction Theory in Forest Ecology and Management. Springer

5. Newton Adrian 2007.Forest Ecology and Conservation 1st Edition.Oxford University Press.

6. Perry D. A., Oren R and Hart S. C. 2008. Forest Ecosystems 2nd Edition. The Johns Hopkins University Press

7. Rao N. A. 2007. Forest Ecology in India: Colonial Maharasthra, 1850-1950. Cambridge University Press India Pvt. Ltd.

8. Sala O.E., Jackson H. A. and Howarth R.W. 2000. Methods in Ecosystem Science. Springer Publication, NY

9. Scheiner S.M. and Gurevitch J. 2001. Design and Analysis of Ecological Experiments 2nd Edition. Oxford University Press

10. Singh G. B. 1987. Forest Ecology of India. Rawat Publication.

11. Smith R.L. and Smith T. M. 2009. Ecology and Field Biology. Benjamin Cummings. An important of Addison Wesley Longman Inc.

12. Spurr S. H. and Barnes B. V. 1992. Forest Ecology. Krieger Publishing Company Malabar, Florida.

Course Code : SFB 202

Course Title : Agro forestry Systems and Management

Credit Hours : 3 (2+1), Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the concept and issues and develop skills of agro forestry land use including diagnosis & methodologies.

SYLLABUS:

Agroforestry systems-perspectives, classification national and global importance, benefits and limitations. Land use systems in shifting cultivation, taungya and plantations. Choice of species and management practices for live fences, hedgerows, protein "banks," alley cropping, windbreaks and shelterbelts, hill-slopes and terrace cultivation, watersheds and woodlots. Diagnosis and design of agroforestry systems. Tree/Crop interface and resource utilization. Agroforestry under different productivity levels and economic aspects of cost benefit analysis. Measurement procedures and yield optimization in agroforestry models. Field visits to agroforestry projects or areas.

Course Breakdown:

Theory:

S.N.	Topic	No. of Lectures
1.	**Introduction to Agro forestry**	3
	1.1 Concept, Definition and Principles of Agro forestry	
	1.2 Origins of Agro forestry	
	1.3 Benefits from Agro forestry: Environmental or Biological, Social and Economic Benefits	
	1.4 Limitations of Agro forestry: Environmental and Socio-economic Aspects	
	1.5 Components of Agro forestry and their interaction	
2.	Description and Classification of Agro forestry Systems	5

	2.1	Purpose and Criteria of Classification	
	2.2	Structural Basis for Classification:	
	2.2.1	Nature of Components: Agri-silviculture, Horti-silviculture, Silvipasture, Agri-horti- silviculture, and Aqua silviculture	
	2.2.2	Arrangement of Components: Spatial and Temporal Arrangements	
	2.3	Functional Classification of Agro forestry Systems:	
	2.3.1	Productive Function,	
	2.3.2	Protective Function	
	2.4	Socioeconomic Classification of Agro forestry Systems	
	2.5	Ecological Classification of Agro forestry Systems	
3.	Soil Productivity Aspects of Agro foresty		3
	3.1	Systems for Improving Soil Productivity and Land Sustainability:	

	3.1.1	Permanent intercropping with N-fixing trees;	
	3.1.2	Trees for soil conservation;	
	3.1.3	Cropping Systems; Rain fed based Agriculture	
	3.2	Systems concerned with improvement and stabilization of farm income: *Multistory Cropping.*	
4.	Biomass Energy/Fuel wood Production in Agro forestry		**2**
	4.1	Firewood Species:	
	4.1.1	Properties of Fuel wood Species	
	4.1.2	Energy from Biomass	
	4.2	Agro forestry Program Options	
	4.2.1	Farm Forestry	
	4.2.2	Community Forestry	
	4.2.3	Wood Lots.	
5.	Multipurpose Trees in Agro forestry		**2**
	5.1	Benefits from MPTs: *Food, Water, Energy, Shelter, Raw Materials for Processing,*	
	5.2	Characteristics of MPTs suitable for Agro forestry;	
	5.3	Management of MPTs.	
6.	Agro forestry Management and Practices		**3**
	6.1	Farming Systems in Nepal and Their Linkage with Agro forestry	
	6.2	Plantation Crops under Shade of Trees: Tea, Coffee, Cardamom and Others.	
	6.3	Shifting Cultivation	
	6.4	Hedgerow Cultivation	
	6.5	Alley Cropping	
	6.6	Taungya Systems.	
7.	Tree/Crop Interface		**3**
	7.1	Symbiotic Relationship	
	7.2	Allelopathic Relationship	
	7.3	Aboveground Relationship	
	7.4	Underground Relationship	
8.	Agroforestry Diagnosis and Design (D & D)		**5**
	8.1	Criteria of Good Agroforestry Design:	
	8.1.1	Productivity,	
	8.1.2	Sustainability,	
	8.1.3	Adoptability	
	8.2	A Diagnostic Approach to Agroforestry Design	
	8.3	Information Requirements for Agroforestry Design	
	8.4	Basic D & D Procedures for Project Planning and Implementation	
	8.5	Components of Project Design Incorporating the Iterative Process of D&D	
9.	Economic Aspects of Agroforestry		**4**
	9.1	Benefits, Cost and Productive Objectives	
	9.2	Cost/Benefits Analysis in Agroforestry	
	9.3	Valuation of Inputs and Outputs	
	9.4	Distribution of Costs and Benefits.	
Total			30

Practical

S.N.	Topic	No. of Practicals
1.	Identification and herbarium preparation of agroforestry species found in the locality.	2
2.	Methods of estimate productivity of herbs, shrubs and trees.	2
3.	Survey and analysis of land use systems in adjoining areas.	1
4.	Study of agroforestry systems, windbreak, and shelterbelts	1
5.	Crop Intensity, crop area and crop yield measurement.	1
6.	Calculations and estimates (seeds, saplings, fertilizers).	1
7.	Design and plan of suitable models for important.	2
8.	Visit nearby agroforestry projects and farm activities.	1
9.	Project report preparation of two typical agroforestry models (Terai & Hill)	2
10.	Leasehold Forestry as Agroforestry Model	1
11.	Leasehold forestry as stabilizing shifting cultivation	1
Total		**15**

REFERENCES:

1. Agroforestry Principles and Practices. A.P.Dwivedi
2. Agroforestry in India. K.G.Tejwani
3. Agroforestry: Classification & Management. Kenneth G.MacDicken, Napoleon T. Vergara.
4. Agroforestry in Nepal. Dr. S. M, Amatya
5. Tree Fodder& Fodder Trees in Nepal. K. K.Pandey
6. Text Book of Agroforestry. D. S. Chundawat, S. K. Gautam
7. An Introduction of Agroforestry. Nair P. K. R.
8. Agroforestry System. Nair P. K. R.
9. Hand Book of Agroforestry. S. P.Singh.

Course Code : SFB 203
Course Title : Forest Protection
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of the course, the students will be able to describe different factors harmful to forest and seedlings in the nurseries and explain various protective and preventive measures to control damaging agents and also describe characteristics of harmful insects and diseases damaging some principal species in the natural and plantation forest.

SYLLABUS:

Introduction and importance of forest protection, problem in forest protection. Protection against environmental agencies like rainfall, wind, landslides, drought, frost and poisonous gas etc. Protection against damage caused by humans such as deforestation, encroachment, shifting cultivation, illegal felling and squatter resettlement. Heavy constructions inside forest lands such as road, transmission lines, hotel, buildings, reservoir etc. Highlight on various important Forestry Sector Acts and Regulation for forest protection. Declaration of protected areas for forest protection. Forest fires and its control measures. Protection against grazing. Protection against injurious plants (weeds, climber etc). Protection against insect damage and control measures like natural and artificial control. Nursery pest. Life cycles and control of important forest insects. Plant disease symptom and control measures. Protection against damage by forest tree diseases. In Practical the students will be taught about region of insect

body. Study of external morphology of honeybee, silk worm, house fly, mosquito, and other common insects with the help of slides and set specimens. Visit local nursery and nearby forest to study the insects, pests and diseases symptoms & its control. Visit nearby protected area (National Park) and Buffer Zone management area to understand about forest protection activities in the government forest and protected forest. Collection and preservation of insects and fungi. Identification of important diseases of forest trees. Histo-pathological study of diseased plant material.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	**Introduction and importance of forest protection** (i) Problems in forest protection.	1
2.	**Protection against environmental agencies** (i) Rainfall, Frost, Drought, Wind, Landslides, Lighting, Temperature & Poisonous gas etc.	2
3.	**Protection against damage caused by human:** (i) Encroachment, deforestation and illegal felling (ii) Shifting cultivation practices and heavy constructions inside the forestlands such as Hydro-power, road, transmission lines, hotel, buildings, reservoir etc and wrong forest policies	3
4.	**Highlight on important Forest Sector Acts and Regulation for forest protection:** (i) Forest Act 2049, Regulation, 2051, (ii) Soil & water conservation Acts, 2039 and regulation, 2042 (1985) (iii) National Parks and Wildlife Conservation Act 2029, regulation, 2030 (iv) Buffer Zone Management Regulation, 2054 (v) Environment Protection Act 2053 and Regulation, 2054 (vi) Declaration of Protected Areas for forest protection	4
5.	Forest fires and its control measures: (i) Causes of fires, classification of fires, damages by fires, factor Influencing the spread and severity of forest fire. (ii) Prevention and control measures: Mechanical, Biological, Social, Political and educational awareness, Beneficial effect of fires as management tools, Rehabilitation of burnt areas.	3
6.	Protection against grazing: (i) Forest grazing intensity, Physical effect of grazing, Effect on reproduction, Effect of fire control, benefit versus injurious from grazing. (ii) Regulation of forest grazing, Protection from grazing by wild animal like deer, porcupine, rabbits and Squirrels etc.	3
7.	Protection against injurious plant: (i) Forest invasive species like weeds, climbers and phenerogamic parasite and excessive numbers of plants.	1

8.	Protection against insect damage:	**4**
	(i) Introduction and general harmful characteristics of insects and Damages to forest resources.	
	(ii) Development and metamorphosis of insects & types of insects larvae-pupae.	
	(iii) Control method of insects through natural by climate, topography, predators, parasites and insect diseases.	
	(iv) Control methods of insects through artificially by chemical, mechanical, biological, silvicultural and legal.	
9.	Nursery pests and its control measure	**1**
10.	**Life cycles and control of important forest insect:**	5
	(i) Sissoo leaf-roller, bamboo borer, Sissoo bark-borer, Cockchafers, Chirpine borer, conifers bark beetle and Sal borer	
	(ii) Simal shoot borer, Deodar defoliator, Teak defoliator, Teak Sceletoniser, Greasy cutworm and sissoo defoliator	
	(iii) Crickets and white ants	
11.	**Protection against trees damage by diseases**	3
	(i) Classification of forest tree diseases e.g. Root diseases, Heart diseases, and Wilt diseases.	
	(ii) General understanding on diseases like Ganoderma, Fomes, Armillarea, Pythium, Polyporous, Lenzites and fuszrium and their control measures	
	(iii) Symptoms, Mode of infection of pathogenic organism and their life cycle and control measures for Sal, Sissoo, Chir pine, Blue pine, Utis, Eucalyptus, Deodar, Khair, Teak and poplars.	
Total		**30**

Practical

S.N.	**Topic**	**No. of Practical**
1.	Identification of equipment, tool , chemicals, slides and set specimens to be used in forest protection activities.	1
2.	Identification of Regions of insect body e.g. Simple and compound eyes, types of antenna, mouth parts and legs.	1
3.	Study of external morphology of honey bee, silk worm, mosquito, and other common insects with the help of slides and set specimens.	1
4.	Study of insect Order and family	1

5.	Identification of larvae-pupae of tree damaging insects from the collected specimens.	1
6.	Collection and identification of forest invasive species e.g. various forest harmful weeds, climber and parasite.	1
7.	Identification of Sissoo leaf-roller, bark-borer and Sissoo defoliator from the set specimens.	1
8.	Identification of chirpine borer Conifer bark beetle & Teak sceletoniser, Teak defoliator from the set specimens.	1

9.	Collection exercise of Sissoo and Teak borers, defoliator and bark beetles from the nearby diseased forest areas.	1
10.	Identification of root diseases, heart diseases and wilt diseases of important tree species from the set specimens.	1
11.	Identification of pictorial and specimens of tree and plant disease type like Ganoderma, Armillarea, Fomes, Pythium, Polyporous, Lenzites etc.	1
12.	Visit local nursery to study the insects, pest and diseases symptom.	1
13.	Visit nearby government forest to study insect, pest and disease symptoms.	1
14.	Visit nearby Protected Area (National Park) in order to visualize forest protection.	1
15.	Visit nearby buffer Zone management area to understand how it was helping in forest protection.	1
Total		**15**

TEXT AND REFERENCES BOOKS:

1. Forest Protection, L.S. Khanna.

2. Forest Pathology, B.K. Bakshi.

3. The Ecology and Control of Forest Insects of India and Neighboring countries, C.F.C. Beeson.

4. Plantation Forestry in the Temperate Regions, Peter Savil and Julian Evans.

5. Principles of Forest Entomology, S.A. Graham and F.B. Knight.

6. Forest Protection – Ralph C. Howley & Paul W. Shilkel, John wiley & sons Inc N.Y. Champman & hall Ltd. London

7. Forest Ecology – Spurr & Barnes (1880)

8. Forest Invasive species, Indian Council of Forest Research and Education, Deharadun,India. Publication No. 1179.

9 Environment Protection rules,1997. Ministry of Population & Environment, Kathmandu

10. Forest regulation 2051. Ministry of Forest and Soil conservation, Singhdarbar, kath.

11. Soil & water conservation Acts, 2039 and regulation, 2042 (1985). Ministry of Forest and Soil Conservation, Singadarbar

Course Code : SWM 202
Course Title : Forest Hydrology
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the concept of the hydrologic cycle and learn working knowledge and analytical techniques on the components of hydrologic cycle to apply in forestry and natural resources planning and management.

SYLLABUS:

Hydrology and other related sciences, historical background, hydrologic cycle and man's influence on it, precipitation types, process, conditions for precipitation, techniques and equipments for measurement of precipitation (rainfall and snowfall), computation of equivalent uniform depth of precipitation, rainstorm characteristics, interception and net precipitation, interception process, concept of evaporation and evapotranspiration, estimation/ measurement methods/techniques of evaporation and evapotranspiration, control of evapotranspiration, concepts and process of infiltration, measurement/ estimation of infiltration capacity, definition and concepts- soil moisture and ground water, measurement of soil moisture, energy and movement of soil/ground water, ground water balance, ground water flow, ground water in Nepal, management of groundwater resources, runoff terminology, streamflow classification, stream order, concepts of runoff process- Horton overland flow and Variable source area concept, equipment and techniques of measurement of runoff, hydrographs, Unit

hydrograph and S-hydrograph derivation, flood forecasting techniques, concept of water quality, water quality parameters, polluted water, water quality standards, Acts and regulations related to water, effects of forest and rangeland on interception, infiltration, soil moisture, ground water and stream flow and water quality, importance of hydrologic knowledge in natural resource planning, vegetation management/ manipulation for water yield, hydrologic models – introduction, types of hydrologic models & their applications.

Course Breakdown:

Theory

S.N.	Topic	No. of Lectures
1.	Hydrology and Other related sciences, historical background	1
2.	Hydrologic cycle and man's influence on it	1
3.	precipitation types, process, conditions for precipitation	1
4.	Techniques and equipments for measurement of precipitation (rainfall and snowfall)	2
5.	Rainstorm characteristics, Interception and net precipitation, interception process	1
6.	Concept of evaporation and evapotranspiration, control of evapotranspiration	2
7.	Estimation/measurement methods/techniques of evaporation and evapotranspiration	2
8.	Concepts and process of infiltration	1
9.	Measurement/ estimation of infiltration capacity	1
10.	Definition and concepts- soil moisture, measurement of soil moisture	1
11.	Energy and movement of soil/ground water	1
12.	Definition and concepts- ground water, ground water balance, ground water flow	1
13.	Ground water in Nepal, management of groundwater resources	1
14.	Runoff terminology, streamflow classification, stream order	1
15.	Concepts of runoff process- Horton overland flow and Variable source area concept	1
16.	Equipment and techniques of measurement of runoff	2
17.	Hydrographs, Unit hydrograph and S-hydrograph derivation, flood forecasting techniques	1
18.	Concept of water quality, water quality parameters, polluted water	2
19.	Quality Standards, Acts and regulations related to water	1
20.	Effects of forest and rangeland on interception, infiltration, soil moisture, ground water	2
21.	Effects of forest and rangeland on stream flow and water quality	1
22.	Importance of hydrologic knowledge in natural resource planning, Vegetation management/ manipulation for water yield	1
23.	Hydrologic models – introduction, types of hydrologic models & their applications	2
Total		**30**

Practical/Exercises

S.N.	Topic	No. of Practicals
1.	Time series, moving mean, double mass analysis	1
2.	Frequency analysis of precipitation and stream stage , return period	1
3.	Field trip to visit and understand the meteorological station layout and the equipment	1
4.	Exercises in measuring precipitation and calculation of total amount,duration and intensity of precipitation, using a weighing rain gauge drum chart	1
5.	Computation of equivalent uniform depth of precipitation, and missing precipitation	2
6.	Estimation of evapotranspiration byThornthwaite, Blaney Criddle formula, etc. to determine net consumptive use	1
7.	Infiltration measurement and determination	1
8.	Soil moisture determination	1
9.	Rational formula, Manning-Chezy formula	1
10.	Derivation of Unit Hydrograph	1
11.	Ground water movement	1
12.	Field trip to visit and understand river gaging station	1
13.	Exercise in measuring stream flow	1
14.	Collection of water samples and treatment for analysis	1
Total		**15**

REFERENCES :

1. Black, P.E. 1991. Watershed Hydrology. Prentice-Hall, Inc., Englewood Cliffs, NewJersey, 408 p.

2. Brooks, K.N., P.F. Ffolliott, H.M. Gregersen and L.F. De Bano. 2003. Hydrology and theManagement of Watersheds. 3rd. ed. Iowa State Press, Ames.

3. Chang, Mingteh, 2012. Forest Hydrology: An Introduction to Water and Forests, Third Edition, CRC Press, Boca Raton, FL 33487, USA

4. Chow, V.T., Maidment D.R., Mays L.W., 1995. Applied Hydrology, McGraw Hill Publications, New York,

5. Chow, Ven Te, 1995. Hand Book of Hydrology, McGraw Hill Publications, New York,

6. Das, Madan Mohan and MD Saikia, 2009. Hydrology, ISBN8120337077

7. Dunne, T. & L. B. Leopold. 1978. Water in Environmental Planning. W. H. Freeman Publishers, New York.

8. Garg, Santosh Kumar, 2010. Hydrology and Water Resources Engineering, ISBN8174090614, 15th Revised Edition, Khanna Publishers, Darya Ganj, Delhi.

9. Hewlett, J.D. 1982. Principles of Forest Hydrology. The University of Georgia Press,Athens, GA, 183 p.

10. Ojha, C.S.P, Berndtsson, R and Bhunya, P., 2008. Engineering Hydrology, Oxford University Press, NewDelhi.

11. Ragunath , H.M., 1994. Hydrology, Wiley Eastern Ltd., New Delhi.

12. Rama Reddy, P Jaya, 2012. A Textbook of Hydrology, ISBN9380856049, Third Reprint, Laxmi Publications, New Delhi, India.

Course Code : FT 201
Course Title : Field Training
Credit Hours : 2(0+2) Full Marks: 50 Theory: 0
Practical: 50

OBJECTIVES:

Equip the students with field condition and expose optimum to state of art in the forestry and allied areas particularly relating to course coverage.

COURSE:

The course will be based on the field training linking to different forestry based programs and developmental activities. Expose student maximum with field forestry practices, forest industries and wildlife and soil conservation activities under this program of study.

The field training program will be developed for about 7 days covering the field practices in Nepal. The faculty deputed as incharge of the field training will develop the program and conduct it. The incharge will be responsible for assessing the tour report and assign task to the students

5th Semester Courses

Course Code : FPU 301

Course Title : Wood Products Utilization
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50
Practical: 25

OBJECTIVE:

The objective of this course is to provide knowledge and skills regarding the concept of the proper utilization of forest products.

SYLLABUS !

Wood structure, Properties, Uses, Conversion, Wood and water relation, Wood Seasoning, Wood Defects, Grading, Bio and Alternate Energy

Course break down

Theory:

S.N	Topics	Sub-topics	No. of Lectures
1	Wood Structure Gross	structure	1
		Minute Structure	1
2	Wood Properties	Physical Properties of Wood	2
		Chemical Properties (Constituents) of Wood	1
		Mechanical Properties of Wood	2
3	Uses of Wood of Wood	Structural Uses of Wood	1
		Decorative Uses of	1
		WoodSpecialized Uses	1
4	Wood Conversion	Importance, Principles and Planning	1
		Types of Conversion Equipments	1
		Methods of Wood Conversion	2
		Safety and Maintenance	1
5	Wood and Water	Wood and Water: Free Water and Bound	1
6	Wood Seasoning	Water Importance and Principles of Wood	1
		Seasoning Types of Wood Seasoning and	1
		Stacking MethodMethods of	

		Wood Seasoning: Air, Solar, Kiln, Chemical.	2
7	Wood Defects	Natural Defects	1
		Seasoning Defects	1
		Machining and other Defects	1
8	Wood Grading Importance and Principle		1
		Methods of grading	1

9	Bio and Alternate Energy and Renewable and Non renewablel, Bio-energy, bio-fuel, wood energy, Bio gas, Wood charcoal, Wood and bio-briquette, Dendr-Thermal Alternate Energy: Solar, Hydro, Wind, Atomic, Mine coal, Petroleum	Importance of Energy,	5
Total			30

Practical

S.N.	Topic	No. of Practicals
1	Identification of wood structure	1
2	Wood Properties, Specific gravity determination	2
3	Wood uses observation	1
4	Wood Seasoning, Moisture contents determination	1
5	Wood Conversion observation	2
6	Wood Seasoning Practice and observation	2
7	Wood grading practice	1
8	Wood defects observation	1
9	Bio-Energy observation	2
10	Alternate Energy observation	2
Total		**15**

TEXT BOOKS AND REFERENCES:

1. Indian Forest Utilization, FRI Publication, Vols. I & II, Deharadun, India.

2. John G. Haygreen and Jim L. Bowyer.1982. Forest Products and Wood Science: An Introduction, , Iowa State University Press/Aims.

3. A.J. Panshin, C. D. Zeeuw, and H. P. Brown.1964. Textbook of Wood Technology. McGraw Hill Book Company, 1964.

4. Kolamann FFP and W. A. Cote Jr. Principle of Wood Science and technology of Solid Wood

5. Journals of Wood Products and Wood Sciences.

6. S. Chowdhury, 2003.Manual of Forest Utilization,

7. Manual Important of Woods of Nepal, D. Parajuli, S. Chowdhury, A.R. Gyawali & B.M. Shrestha

Course Code : WPR 301

Course Title : Tourism and Recreation

Credit Hours : 3 (2+1) Full Marks: 75

Theory 50 Practical 25

OBJECTIVE:

Upon the completion of this course, the students will be able to understand the basic philosophy and principles of tourism, Familiarize with recreational activities, attractions and related services, know the status of tourism in Nepal and analyze its potentials and pitfalls, demonstrate ability for planning and developing tourism, and evaluate the impacts of tourism and actions to minimize impacts.

SYLLABUS:

History and scoe of tourism, visitors and tourists motivation, factor influencing demand and the growth of tourism, Tourist attraction, facilities and services, Tourism potentials, growth and contribution in Nepal, Tourism pokicy and legislations in Nepal, Impact of tourism on host country, Tourism planning and management and evolutionof ecotourism. Tourism sustainarility and evvironmentalism.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	History and scope of tourism in the world, SAARC region and Nepal	2
2.	The visitors, tourists, excursionists and motivation of travel	2
3.	Factors influencing demand for tourism and the growth of tourism	2
4.	The tourism product: attraction, facilitiesand services	4

	4.1	Recreational facilities and activities: Natural attractions, National parks and protected areas, Man-made attractions, Amusement and other parks, Social and cultural diversity, Tours and Sporting events	
	4.2	Recreational services and amenities: Transportation, Accommodation, Food, Shopping, Financial services, Publication/information, Entertainment, Conference facilities, Rescue and medical services, Security	
5.		Tourism potentials, growth and contribution in Nepal	4
	5.1	Special attractions, natural and cultural diversity, man-made	
	5.2	Tourism services and its contrition to the national economy	

	5.3	Tourism in the protected areas of Nepal and their contribution	
	5.4	Travel and tourism industries in Nepal and their contribution	
	5.5	Current status of domestic and international tourism	
6.	Tourism policy and legislations in Nepal		2
7.	Tourism, sustainability and environmentalism		2
8.	Impact of tourism on host country		4
	8.2	Impacts of tourism: Economic impacts, Social impacts, Physical/ environmental impacts	
	8.3	Analysis and mitigation of negative impacts of tourism	
9.	Tourism planning and management		4
	9.1	Planning needs, scope of tourism planning, carrying capacity assessment, APPA, LAC and ROS	
	9.2	Tourism management: zoning, extension services, infrastructure development, human resource training, research	
10.	Evolution of ecotourism		4
	10.1	Definition, principles, and limitation of ecotourism	
	10.2	Role in conservation and development	
Total			30

Practical

S.N.	Topic	No. of Practicals
1.	Excursion: observation and evaluation of tourism facilities and services	1
2.	Visitor survey	1
3.	Local community and tour operator survey	1
4.	Visit protected/recreational area to study tourism planning and management	2
5.	Case study: impact analysis	2
6.	Group work and report writing	4
7.	Individual term paper	4
Total		**15**

TEXT BOOKS AND REFRENCE MATERIALS

1. Allan Collier. 1989. *Principles of Tourism.* Pitman publishing, NewZealand.

2. Mathieson A. and G. Wall 1982. *Tourisjm: Economic, Physical and Social Impacts.* Longman.

3. Mill, R. C. and A. M. Morrison 2002. *The Tourism System.* Kendall/Hunt Publications.

4. George McIntyre Arlene Hetherington, Edward Inskeep, 1993. *Sustainable Tourism Development: Guide for local planners.* World Tourism Organization (WTO).

5. Inskeep, E. 1991. *Tourism: Local and Regional Planning*. In C. Michael Hall ed. *Tourism Planning: Policies, processes and relationships* (2nd ed.) Pearson.

6. Elizabeth, Boo 1990. *Ecotourism: The potentials and pitfalls*, vol. 1 and 2. World Wildlife Fund (WWF).

7. Shah, K. and Gupta, V. 2000. (Ed Boyd, C.) *Tourism, the poor and other stakeholders; experience in Asia.* ODI-Fair trade in tourism paper. Pp 57.

8. Nepal Tourism Statistics, Department of Tourism. Nepal Tourism Board.

9. Nepal tourism policy, tourism legislation, immigration laws and wildlife conservation laws

10. Simpson, M. C., 2008. *Progress in tourism management: Community based tourism initiatives – A conceptual oxymoron?* Tourism Management, 29: 1-18.

11. Honey, M. 1998 and 2008 (2nd ed). *Ecotourism and Sustainable Development: Who Owns the Paradise?* Island Press.

12. Goeldner, C. R. and J. R. Brent Ritchie. 2009. *Tourism: Principles, Practices, Philosophies* (11th Ed), John Wiley and Sons, Inc.

13. Wearing, S. and J. Neil, 2000. *Ecotourism Impacts, potentials and possibilities*. Butterworth & Heinemann, Oxford, UK

14. Upadhyay, R.P. 2008. *Readings in rural tourism*. Sunlight publication, Kathmandu.

15. Kunwar, R.R 2006. *Tourist and tourism: Science and industry interface*. International School of Tourism and Hotel Management, Kathmandu.

16. Mowforth, M, and Munt, I. 2003. Tourism and Sustainability: *New Tourism in the Third World*, 2nd Edition, Taylor & Francis Group, Routledge, London and New York.

Course Code : NRM 301
Course Title : Range Management
Credit Hours : 2(2+0) Full Marks: 50 Theory 50 Practical: 0

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the concept of range and pasture land and learn working knowledge and analytical techniques on the inventory, vegetation manipulation, stocking rate/carrying capacity, and grazing management to apply and insure the sustainability of rangeland ecosystem goods and services.

SYLLABUS:

Overview of Rangelands and Range management, Importance of rangeland, Characteristics of rangelands, Types of rangelands/grasslands, their distribution and evaluation; Range ecology/ecosystems: Concepts, Community composition, Succession and grazing; Human and natural disturbances, Physiological and morphological effects of grazing; Management complications; Plant competition, Altering forage-livestock ecosystems; Range ecosystems of Nepal, Livestock population, distribution and importance in Nepal agro- ecosystems, Range plant physiology: Basic concepts; Plant morphology and growth; Resistance to grazing; Grazing optimization theory; Managing animals on rangelands: Nutritional and habitat requirements, Grazing/ foraging behaviors of livestock and wildlife, Plants and herbivory, Preference and palatability of forage species; Rangeland improvement practices, Nutrient management / Nutrient cycle, Methods of manipulating range vegetation, Invasive and problem plants and their control, Fire as a

management tool; Range inventory and monitoring: Vegetation mapping and analysis– weight or biomass, Area or cover, Grazing/ Carrying capacity, Grazing utilization, Range condition, Stocking rate (SR), Concept of animal unit, Methods of SR determination, Grazing intensity; Rangeland management- concept and issues, multiple use of rangeland resources, Conflict management; Herding systems in Nepal, Socio-economic factors influencing livestock population and structure; Range condition classification for Nepal, Policy and Tenure System in rangeland, Forage resource management and development in community forests, Management of overstorey/understory vegetation, Multiple uses of forest grazing land, Pasture development and management in common land; Integrated forage management, Forage resources of Nepal, Linkages of farm/forest/livestock systems, Problems and prospects of forage resource development.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Overview of Rangelands and Range management, Importance of rangeland, Characteristics of rangelands	1
2.	Types of rangelands/grasslands, their distribution and evaluation	1
3.	Range ecology/ecosystems: Concepts, Community composition	1
4.	Succession and grazing; Human and natural disturbances, physiological and morphological effects of grazing; Management complications	2
5.	Plant competition, Altering forage-livestock ecosystems	1
6.	Range land ecosystems of Nepal, Livestock population, distribution and importance in Nepal agro-ecosystems	2
7.	Range land plant physiology: Basic concepts; Plant morphology and growth	1
8.	Resistance to grazing; Grazing optimization theory	1
9.	Managing animals on rangelands: Nutritional and habitat requirements	1
10.	Grazing/ foraging behaviors of livestock and wildlife, Preference and palatability of forage species	1
11.	Rangeland improvement practices	1
12.	Nutrient management / Nutrient cycle,	1
13.	Methods of manipulating range vegetation, Invasive and problem plants and their control	1
14.	Fire as a management tool	1
15.	Range inventory and monitoring: Vegetation mapping and analysis– weight or biomass, Area or cover	2
16.	Grazing/ Carrying capacity of grazing land, Grazing utilization, Range condition	1
17.	Stocking rate (SR), Concept problems of animal unit, Methods of SR determination, Grazing intensity	2
18.	Rangeland management- concept and issues, multiple use of rangeland resources, Conflict management	1
19.	Herding systems in Nepal	1
20.	Socio-economic factors influencing livestock population and structure; Range condition classification for Nepal, Policy and Tenure System in rangeland	2
21.	Forage resource management and development in community forests.	1
22.	Management of overstorey/understory vegetation	1
23.	Multiple uses of forest grazing land, Pasture development and management in common land; Integrated forage management	1
24.	Forage resources of Nepal, Linkages of farm/forest/livestock systems, Problems and prospects of forage resource development	1
25.	Rules/land and practial issues related to range pasture management in Nepal.	1
Total		**30**

REFERENCES :

1. Barnes R.F., C.J. Nelson, M. Collins and K.J. Moore. Forages: Volume I. An Intro duction to Grassland Agriculture –6th Edition, Iowa State University Press, Ames, IA.

2. Chatterjee B.N. and P.K. Das. 1989. Forage Crop Production. ISBN: 9788120403987, South Asia Books, Columbia, MO 65205.

3. Crowder L.V. and H.R. Chheda. 1982. Tropical Grassland Husbandry, Longman, London, UK.

4. Pariyar, D. et al. 1996. Pasture and Forage Research and Development, NARC, Kathmandu.

5. Pariyar, Dinesh, 2008. Country Pasture/Forage Resource Profiles: Nepal, FAO, Rome.

6. HMG/ADBN, 1993. Livestock Master Plan, Volume –II and III. HMG/ADBN, Kathmandu.

7. Hodgson, John G. 1990. Grazing Management: Science into Practice. Longman Sci entific & Technical, Longman Group, London. 203 pages.

8. Hodgson, John G. and Andrew W. Illius, 1996. **The Ecology and Management of Grazing Systems,** CAB International, Wallingford. 466 pages.

9. Holechek, Jerry, Rex D. Pieper and Carlton H. Herbel. 2010. Range Management, Principles and Practices. Prentice Hall. New Jersey. 444 pp.

10. ICAR. Handbook of Agriculture, 6th Revised Edition, New Delhi.

11. Kingsbery, Bob. 1989. How to Plan, Implement & Practice Controlled Grazing on Your Place. Kingsbery Communications, Woodinville, Washington. 57 pages.

12. Lal, R B., 1990. Principles and Practices of Range Management, International Book Distributors, New Delhi.

13. Miller, Daniel J. and Sienna R. Craig (Eds.). 1997. Rangelands and Pastoral Devel opment in the HKH : Proceedings of a Regional Experts' Meeting. ICIMOD, Kathmandu, Nepal., 268 p.

Course Code : FPU 302

Course Title :

Ethnobotany

Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50
Practical: 25

OBJECTIVES:

Upon the completion of the course, the students will be able to understand the concepts, methods and different aspects of ethnobotany, and they will be acquainted with important examples of ethnobotanical contribution in resource uses and conservation.

SYLLABUS:

History,Concepts,Scope and Objectives of Ethnobotany Ethnobotany as an interdisciplinary science, Branches of Ethnobotany(Ethnoecology, Ethnobiology, Ethnopharmacology, Medical Ethnobotany. Methods and approaches of Ethnobotany.
Ethnobotanical lessons learnt from case studies in South Asia. Role and applications of Ethnobotany in resource development (particularly in modern medicine) and community development, Traditional conservation strategies. Role and application of Ethnobotany in conservation and sustainable management of plant resources, The local perspective on Ethnobotanical Research .Traditional knowledge and Biodiversity and cultural diversity. Indigenous knowledge and Intellectual Property Rights.

Course Breakdown

S.N.	Topic	No. of Lectures
1.	History, Concepts, Scope and Objectives of Ethnobotany	2
2.	Ethnobotany as an interdisciplinary science, Branches of	3

	Ethnobotany (Ethnoecology, Ethnobiology, Ethnopharmacology, Medical Ethnobotany)	
3.	Tools of Ethnobotanical studies	3
4.	Approaches in Ethnobotany	1
5.	Ethnobotanical lessons learnt from case Studies in South Asia	3
6.	Role and applications of Ethnobotany in resource development (particularly in modern medicine)	3
7.	Ethnobotany and community development, Traditional conservation strategies	3
8.	Role and application of Ethnobotany in sustainable management of plant resources.	2
9.	The local perspective on Ethnobotanical Research	2
10.	Ttraditional knowledge and Biodiversity	3
11.	Traditional knowledge and cultural diversity.	3
12.	Indigenous knowledge and Intellectual property Rights	2
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Study of living and preserved plant species used by local communities for various purposes such as food, fibers , medicine ,cultural ceremonies, ecological restoration, etc.	3
2.	Ethnobotanical proposal writing,	2
3.	Ethnobotanical questionnaire development.	2
4.	Preparation of Ethnobotanical reference collection and submission of ethnobotanically important plants of a particular area. Hypothesis testing.	3
5.	Ethnobotanical data collection, Record keeping of Ethnobotanical data	2
6.	Conduct a Ethnobotanical study of the selected indigenous community of the local area with the application of Rapid Rural Appraisal (RRA) and prepare a report.	3
Total		**15**

REFERENCES

1. Manandhar,N P. 2002. Plants and People of Nepal. Timer Press,Oregon,USA.

2. Marrtin C J. 1995.Ethnobotany: A People and Plants Conservation Manual, WWF and Chapman & Hall,London.

3. Jain,S K. 1995.Manual of Ethnobotany.Sientific Publishers,Jodhpur,India. Rajbhandari,K R. 2001. Ethnobotany in Nepal. Ethnobotanical Society of Nepal, Kathmandu.

4. Shrestha, K. K. Jha, P. K. Pei Shengji, Rastogi, A, Rajbahandari, S. And Joshi, M. 1998.Ethnobotany and Conservation for Community Development. Ethnobotanical Society of Nepal and ICIMOD, Kathmandu.

5. National Research Council, 1994. Rangeland Health: New Methods to Classify, Inventory, and Monitor Rangelands. Committee on Rangeland Classification, National Research Council, National Academy Press, Washington. 180 pages.

6. Paul R. Krausman (Ed.), 1996. Rangeland Wildlife. Society for Range Management, Denver, CO.

7. Paul T. Tueller,1988. Vegetation Science Applications for Rangeland Analysis and Management. Kluwer Academic Publishers, Dordrecht, the Netherlands. ISBN 90-6193-195-9. 642 pages.

8. Singh, L.N., A Singh and J. Singh.1998. Forage Grasses and Legumes. Scientific

Publishers, Jodhpur, India.

Course Code : EES 301
Course Title : Fire Ecology
Credit Hours : 3 (2+1) Full Marks: 75Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand forest fires and their management and they have basic theoretical and practical knowledge on nature and behavior of forest fires, and familiarize with implications and management of forest fires.

SYLLABUS:

Nature of Fires: Introduction, physical and chemical nature of fires, fire behavior, fire regimes; Types of Fire: surface fires, crown fires, ground fires; vegetation fires and burning of agricultural residues; causes of forest fires. Effects of fire on soil (soil organic matter and nutrients, soil moisture, soil pH, soil temperature, soil biota .Effects of fire on ecosystems: fire and vegetation interaction, fire resilience in plant community, fire and wild fauna, effects of fire on forest and grassland ecosystems in Nepal.

Combustion and Smoke: Nature of flames: temperature, velocity, species composition, flame height. Fuel chemistry and combustion: fuel, combustion chemistry, pyrolysis, phase of combustion .Smoke production: release of carbon, formation of particles, emission of trace gases, minimizing smoke production.

Climate, Weather and Fire: Weather and area burned-synoptic surface feature; Weather and area burned-upper air features: upper air circulation, vertical structure of the atmosphere

.Forest fire and root necrosis; tree mortality forest fire causes;.
Implications of Fire and its Management: Practical implications of fire: promotion of desired species, maintaining species diversity, improving forage quality, removing organic debris, improving seedling growth, controlling insects and diseases, restoration of wildlife habitat
.Human influence on wildfire; prescribed burns and the reintroduction of fire; community interventions of forest fires (e.g. Nepalese case); forest fires and climate change; forest fire and food security .Forest fire: prediction, prevention, preparedness and suppression; forest fire monitoring using Remote Sensing Technology.
Benin effect of Fire: Prescribed Burning for Habitat Management, species composition

Course Breakdown:

S. N.	Topic	No. of Lectures
1.	Introduction, physical and chemical nature of fires, fire behavior, fire regimes; Types of fire: surface fires, crown fires, ground fires; vegetation fires and burning of agricultural residues; causes of forest fires	3
2.	Effects of fire on soil (soil organic matter and nutrients, soil moisture, soil pH, soil temperature, soil biota, atmospheric chemistry	2
3.	Effects of fire on ecosystems: fire and vegetation interaction, fire resilience in plant community, fire and wild fauna, effects of fire on forest and grassland ecosystems in Nepal	3
4.	Effect of fire in: Plant succession and as one of the efficient forest management tools in maintaining specific species for biodiversity and other economic benefits of the species	3
5.	Combustion and Smoke: Nature of flames: temperature, velocity, species composition, flame height	1
6.	Fuel chemistry and combustion: fuel, combustion chemistry, pyrolysis, phase of combustion	2
7.	Smoke production: release of carbon, formation of particles, emission of trace gases, minimizing smoke production	2
8.	Climate, Weather and Fire: Weather and area burned-synoptic surface feature; Weather and area burned-upper air features: upper air circulation, vertical structure of the atmosphere	2
9.	Forest fire and root necrosis; tree mortality	1
10.	Implications of Fire and its Management: Practical implications of fire: promotion of desired species, maintaining species diversity, improving forage	3

	quality, removing organic debris, improving seedling growth, controlling insects and diseases, restoration of wildlife habitat	
11.	Forest Fire Hazard Mapping Tools and Techniques	2
12.	Forest fire: Monitoring, detection, Response System: prevention, preparedness and suppression	2
13.	Forest Fire Damage Assessment, Community Based Fire Management (CBFiM)	2
14.	Human influence on wildfire; prescribed burns and the reintroduction of fire; Community interventions of forest fires (e.g. Nepalese case) forest fires and climate Change.	2
Total		30

Practical

S.N.	Topic	No. of Practicals
1.	Estimate soil pH at a natural site recently affected with fire and compare it with that of no fire site.	1
2.	Fuel Measurement using appropriate technology	2
3.	Fire Hazard Mapping using GIS/RS tools	2
4.	Estimate soil organic matter content at a natural site recently affected with fire and compare it with that of no fire site in relation to carbon.	2
5.	Study soil nutrient contents (N, P, K) at a natural site recently burned.	2
6.	To study the composition and concentration of gases collected from an area under fire.	2
7.	Study plant species diversity in a forest/grassland community affected by fire	1
8.	Study of faunal species diversity in a forest/grassland community affected by fire	1
9.	Study of microbial diversity in a fire affected area.	1
10.	Study of fire management strategy of the nearest forest/community forest.	1
Total		**15**

REFERENCES

1. Odum EP and Barrett GW. 2005. Fundamentals of Ecology. Thompsom Books/Cole

2. Singh JS, Singh SP and Gupta SR. 2006. Ecology, Environment and Resources.Anamya Publishers. New Delhi

3. Jurvélius, M. 2004. Forest Fires: Prediction, Prevention, Preparedness andSuppression Forestry Department, FAO, Rome, Italy. Elsevier Ltd.

4. Edward AJ and Kiyoko M (Eds). 2001. Forest Fire. Elsevier Inc. Forest fire – behavior and ecological effects. Academicpress.

Course Code : FSE 301

Course Title : Soil and Water Conservation Engineering
Credit Hours : 3(2+1) Full Mark: 75 Theory: 50
Practical: 25

OBJECTIVE :

By the end of the course, the student will gain knowledge and skills regarding the concepts and practices of watershed management in the context of the mixed farming livestock system of Nepal.

SYLLABUS:

Land degradation problems, erosion, design and construction of erosion control structures, check dams, retaining wall, spur, embankment, drainage, bund, terraces etc, bioengineering techniques, conservation techniques, conservation farming techniques, erosion process and monitoring.

Course Breakdown

Theory

S. No	Topic	No. of Lectures
1.	**Land Degradation**	5
1.1.	Introduction to Land Degradation and its consequences	
1.2	Causes of land degradation	
1.3	Types of land degradation	
1.4	Process of land degradation	
1.5	Degradation by wind and water	
2.	Design of Erosion Control measures	10
2.1	Introduction to mechanical control measures	
2.1.1	Check dams	
2.1.1.1	Types of check dams	
2.1.1.2	Design of check dams	
2.1.1.3	Stability analysis of check dams	
2.1.2.	Retaining wall	
2.1.2.1	Types of Retaining wall	

2.1.2.2 Design of Retainingwall
2.1.2.3 Stability analysis of Retainingwall
2.1.3 Spurs
2.1.3.1 Types of spurs
2.1.3.2 Design of spurs
2.1.3.3 Stability analysis of Spurs
2.1.4 Embankments

5. Conservation Farming Techniques		3
5.1.	Shelter Belts / Green Belts	
5.2.	Hedgerows	
5.3.	Minimum tillage	
5.4.	Relay cropping	
5.5.	Mixed cropping	
5.6.	Multiple cropping	
5.7.	Strip cropping	
5.8.	Cover cropping	
5.9.	Mulching	
5.10.	Green manure	
5.11.	Compost manure	
5.12.	Nitrogen fixing plants	
6.	Erosion Process and Monitoring	2
6.1	Erodibility of soil	
6.2	Erosivity to Rainfall-fact	
6.3	Revised Universal Soil Loss Equation	
6.4	Erosion Monitoring	
6.4.1.	Run-off Plot Monitoring	
6.4.2.	Paired Catchment Studies	
6.4.3.	Sedimentation survey	
Total		30

Practical

S.N.	**Topic**	**No. of Practicals**
1.	Case study of check dams and other conservation structures	5
2.	Field observation and design of hydraulic channel for peak flow for a small catchment	5
3.	Design and comparison between bioengineering practices and mechanical protection works.	5
Total		15

Recommended Textbooks and References:

1. Alford, D. 1992. Hydrological Aspects of the Himalayan Region. ICIMOD Occasional Paper No. 18.

2. Bruijnzeel, L. A. and C. N. Bremmer, 1989. Highland - Lowland Interactions in the Ganges Brahmaputra River basin: A review of Published Literature. ICIMOD Publication Occasional Paper No. 11..

3. FAO, 1977. Guidelines for Watershed Management. FAO Watershed Management Field Manual. FAO Conservation Guide 1. Food and Agriculture Organization of the United Nations(FAO/UN).

4. FAO, 1985. Vegetative and Soil Treatment Measures. FAO Watershed Management Field Manual. FAO Conservation Guide 13/1. FAO/UN.

5. Pereira, H. C., 1989. Policy and Practices in the Management of Tropical Watersheds. Westview Press.

6. Rimal, B. K. and M. D. Joshi, 1991. Soil Conservation and Watershed Management. In Background papers to the National Conservation Strategy for Nepal - Volume 1. National Planning Commission / HMG and IUCN, Kathmandu.

7. Sharma, P. N. (edited) 1997. Recent Developments, Status and Gaps in Participatory Watershed Management and Training in Asia, PWMTA-FARM Field Document No. 6. FARM Programme and Participatory Watershed Management Training in Asia, Kathmandu.

8. Sthapit, K. M., 1987. Land Capability Classification. Watershed Planning Manual No. 4. Watershed Management Project, Department of Soil Conservation, Kathmandu.

9. Sthapit, K. M. 1988. Flood Control and Watershed Management. A paper presented to the workshop on "River Training / Embankment Protection". Organized by Department of Irrigation and UNDP-ILO. 9 to 13 May, 1988, Kathmandu.

10. WECS, 1987. Erosion and Sedimentation in the Nepal Himalayan. Water and Energy Commission Secretariat, Kathmandu.

Course Code : BSH 301

Course Title : Elementary Statistics and Computer Application
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50
Practical 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand basic concepts and limitations of standard statistical procedures by computing different descriptive measures, probability distributions of various events, hypothesis testing, regression models and their applications using computer software in applied research.

SYLLABUS:

Introduction to statistics including the nature of statistical methods, exploratory data analysis, frequency distributions, the rules of probability, probability distributions (Binomial, Poisson, uniform, normal), estimation, and hypothesis testing, one- and two-sample procedures, simple and multiple regressions models. Learning to do statistical analysis using computers is required for all students and is an integral part of the course. Computer applications include the creative use of plots, application of standard methods to real data, screening data for errors, manipulating data, transformations, estimation, testing and building regression models.

Course Breakdown

S.N.	Topic	No. of Lectures
1	Origin, definition, scope and limitation of statistics	1
2	Statistical notation, population and sample, parameter and statistic, variables	1
3	Diagrammatic and graphical presentation of data	2
4	Measure of central tendency: Introduction, types, properties, merits, demerits and uses of mean, median and mode	2
5	Measure of dispersion: Introduction, types, properties, merits, demerits and uses of range, quartile deviation, mean deviation,	2

	standard deviation, coefficient of variation and Lorenz curve	
6	Measures of skewness, kurtosis, moments and their uses	1
7	Correlation: Introduction, simple linear correlation (scatter diagram, Karl Pearson's and Spearman's rank), properties of correlation coefficients.	2
8	Regression: Introduction, simple linear regression, properties of regression	2
9	Probability: Introduction, addition and multiplicative theorems	3
10	Conditional probability and Bayes' theorem	1
11	Random variables, mathematical expectations, discrete and continuous probability distributions	2
12	Discrete probability distributions: Binomial, Poisson and multinomial	3
13	Continuous probability distributions: Uniform and normal	3
14	Point and interval estimation	2
15	Testing of hypothesis: Z-test, T-test, F-test and Chi-square test	3
Total		**30**

Practical

S.N.	Topic	No. of Practical
1	Variable definition, coding, editing and data entry in statistical software	1
2	Frequency distribution, diagram and graphs	1
3	Computations of various measures of central tendencies and their interpretations	1
4	Computation of various measures of dispersions and their interpretations	1
5	Comparing groups and computation of the measures of skewness and kurtosis	1
6	Plotting data and test for correlation coefficients	1
7	Regression and linear regression models	1
8	Analysis of residuals and model selection	1
9	Binomial test and logit regression models	1
10	Probit and multinomial models Binomial test	1
11	Normal distribution and tests of normality	1
12	Testing hypothesis about a single mean	1
13	Testing hypothesis about two related means	1
14	Two independent mean test	1
15	Cross tabulation and Chi-square test	1
Total		**15**

REFERENCES

1. Gupta, S. C. Kapoor , V.K. 1994. Fundamentals of Mathematical Statistics, 4th edition. Sultan Chand & Sons; 23, Daryagunj, Delhi.

2. Triola, F. M. 1989. Elementary Statistics, 4th edition. The Benjamin Cumming Publishing Company, Inc., California.

3. FAO 1999. A Statistical Manual For Forestry Research. Forestry research support program, for Asia and the Pacific, Food and Agricultural Organization of the United Nations Regional Office for Asia and the Pacific, Bangkok.

4. Shrestha S. and Silwal D.P.2003. Statistical Methods in Management. Taleju Prakashan, Bhotahity Kathmandu.

5. Snedecor G.W. and Cochran, W.G.1994. Statistical Methods, eighth edition. Iowa State University Press, Ames Iowa.

Course code : SFB 301
Course title : Nursery Management
Credit hours : 3(2+1) Full marks 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon completion of this course, the students will be able to understand the concept, practice and management of nursery.

SYLLABUS:

Forest nursery : definition and importance of forest nursery, objectives and classification, site selection of nursery:- Area , location ,soil, water supply, availability of suitable soil, natural zonation, topography aspect, transport, labour supply, nursery materials, machinery, tools and equipments. Layout of nursery: survey and demarcation, clearance of site; layout and construction: leveling of terraces, construction of nursery. Nursery beds: types of beds: raised beds, sunken beds, level beds, transplant beds, preparation of seed beds: soil management and use of manure: organic manure, commercial fertilizers, application of fertilizers, introduction of mycorrhiza, inoculation. Seed: seed production and seed collection: from the forest, seed stands, seed orchard. Time of seed collection: calendar preparation, methods of seed collection: from the floor, by lopping, from freshly felled trees, standing tree. Seed extracting: by drying, removal of pulp; seed drying: in sun, under shade, oven. Seed cleaning; seed testing: determination of genuineness, purity, viability, direct inspection, physical test, chemical test, germination test for minute seed, medium and large sized seeds. X-ray technique. Seed treatment: weathering, water

treatment, mechanical treatment, scorching or fire treatment, stratification, fermentation. Plant propagation: natural methods, artificial methods, soil preparation, treatment of soil. Soil acidification, with proctant fungicides, fertilization. Container system: types of containers: dona, moss cylinder and fibre cubes, basket, tubes, earthen pots, polythene bags. Potting soil mixture: potting mixture, container filling quantity of seed: calculation of quantity of seed to be sown. Seed sowing: broad cast sowing, drill sowing. Time of sowing: winter, summer and rainy season. Covering the seed beds: by weeds, leaf liters, polythene sheet. Irrigation of seed beds: can irrigation, percolation, automizer, sprinkler, and flood irrigation. Weeding of seedling beds; precaution during weeding operation. Shading against sun, frost, rain and hail, fungus. Methods of pricking out and transplanting in nursery. Vegetative propagation methods: by cutting, grafting, layering, budding, tissue culture. Common diseases and pests: introduction, seed care, seed treatment with fungicides, seedling care. Common seedling diseases: collar rots, root rots, diseases of aerial parts. Control of seedling disease. Nursery pests: cut worms (Lepidoptera), chafers (colcopters), mites, crickets and grasshoppers (Orthoptera), termites (isoptera), nematodes (nematode), defoliating beetles and caterpillars. Harding off.

Course breakdown

Theory:

S.N.	Topic	No. of Lectures
1.	Definition, importance of forest nursery	1
2.	Objectives and classification of nursery	1
3.	Site selection of nursery; area, location, soil, water supply, availability of suitable soil, natural zonation, topography, aspect, transport, labour supply.	3
4.	Nursery materials, machinery, tools and equipments	1
5.	Layout of nursery, survey and demarcation, clearance of site, soil working, leveling, terracing.	2
6.	Nursery beds, types of beds, soil management and use of manures, introduction of mycorrhiza, inoculation.	2
7.	Seed production, seed orchards establishment and management, seed collection from different sources and time of seed collection.	2
8.	Methods of seed collection and methods of seed extraction.	1
9.	Seed drying methods, seed cleaning, seed storage and seed testing.	2
10.	Seed treatment methods.	1
11.	Plant propagation natural and artificial methods.	2
12.	Types of containers and potting soil mixtures and container filling.	2
13.	Calculation of quantity of seed, seed sowing, types of seed sowing.	1
14.	Times of seed sowing, covering the seed beds/ shading, irrigation of seed beds, methods of irrigation.	2
15.	Pricking out and transplanting of seedlings in nursery.	1
16.	Vegetative propagation methods	1
17.	Common diseases and pests and their control.	2
18.	Hardening off seedling.	1
19.	Green house nursery concept and system	1
20.	Cost effective seedling transportation (bare root seedling)	1
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Nursery visit (if possible green house nursery also), preparation of nursery design and layout	1
2.	Layout of different types of nursery beds and their preparation.	1
3.	Seed tree selection	1
4.	Seed collection practice	1
5.	Seed testing determination of genuineness, purity and viability by physical, chemical and x-ray technique	2
6.	Seed treatment – cold water, boil water treatment, acid treatment, scorching or fire treatment, stratification, fermentation	2
7.	Soil treatment, fertilization soil mixing and container filling	1
8.	Determination of quantity of seed, seed sowing practice of different sized seeds in beds, in seed tray and in containers	2
9.	Mulching and irrigation practice	1
10.	Study and determination of germination percentage, germination capacity	1
11.	Weeding and pricking out practice	1
12.	Transplanting in containers and in beds, hardening off practice	1
Total		**15**

Text and Reference Books:

1. Principle and practice of silviculture –L.S.Khanna
2. Technology of Forest Nurseries – Khanna Bandhu
3. Hand Book of Forest Nursery – J.N. Yadava
4. Practice of Silviculture – D.M.Smith
5. Principle of Silviculture – J.W.Daniels, J. Helms, F.S.Baker
6. Agricultural and Forest Pests and their management – Prem Chand

6th Semester Courses

Course Code : FPU 303

Course Title : Wood Science and Technology

Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVE:

The objective of this course is to provide knowledge and skills regarding the concept of the wood science and technology.

SYLLABUS:

Wood as raw materials, science and technology to convert in products of use, composite products, pulp and paper technology, Resin tapping and processing, Katha and Cutch manufacturing, Wood match making, Nemoparquet, Wood preservation, Fire retardant, Other wood products

Course break Theory:

S.N	Topics	Sub-topics	No. of Lectures
1	Wood science and technology	Wood as raw materials, science and technology to convert in products	1
2	Composite products	Plywood, importance, raw materials, processing, manufacturing, uses Particles boards, importance, raw materials, processing, manufacturing, uses Fiber boards, importance, raw materials, processing, manufacturing, uses Other composite boards (Flake board, straw board, block board etc), importance, processing, manufacturing, uses	8
3	Pulp and Paper Technology	Raw materials, Pulping process (Mechanical, chemical and semi	5

4	Resin Tapping and Processing	Importance, sources, tapping methods, processing to rosin and turpentine, other value added products, uses and markets	2
5	Katha Making	Importance, Raw materials and resources, raw material preparation, methods of katha extraction, extraction of Cutch as byproducts, uses, markets and value	2
6	Parquets	Importance and principles, raw materials, parquets manufacturing, laying of parquets, finishing, uses, advantages and disadvantages	2
7	Wood Preservation	Importance and principles, Wood and preservation, Preservatives Methods of preservative treatments, Advantages and disadvantages	3
8	Match Industry	Importance, Wood as raw materials, manufacturing process, uses and market	1
9	Fire retardant	Importance, Chemicals, Application method, Value	1
10	Other Wood based Products	Raw material, processing and uses of the following wood based products: Furniture, Toys, Sports goods Carving, Agriculture tools, Home appliances and pots Joints and fixtures, Doors, windows, framing etc	6
Total			**30**

Practical

S.N	**Topic:**	**No. of Practicals**
1	Composite products	2
2	Pulp and paper	2
3	Resin tapping	1
4	Katha making	1
5	Parquetting	1
6	Wood preservation	2
7	Match industry	1
8	Fire retardant	1
9	Furniture, toys and sports good, tools and appliances	2
10	Carving, Framing, joints and fixtures	2
Total		**15**

TEXT BOOKS AND REFERENCES

1. Indian Forest Utilization, FRI Publication, Vols. I & II, FRI, Deharadun, India.

2. Haygreen JG and Bowyer JL. 1982. Forest Products and Wood Science: An Introduction. Iowa State University Press/Aims.

3. Panshin AJ, Zeeuw CD, and Brown HP. 1964. Textbook of Wood Technology. , McGraw Hill Book Company.

4. Kolamann FFP and Cote Jr WA. ??. Principle of Wood Science and technology of Solid Wood.

5. Forest Products Journals and e- publications on Wood Science and technology

Course Code : FSE 302

Course Title : Remote Sensing and Photo Interpretation

Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVE:

After completion of this course, the students will understand and apply several aspects of remote sensing in natural resources planning and management.

SYLLABUS:

Introduction of the course, its scope and limitation, Development of Aerial photography, Types of Aerial photos and their use in natural resource management (NRM). Basic Optics for photogrammetry: Reflection and refraction of light, Thin and Thick lenses, lens formula (Focus), Scheimpflug condition, Real and Virtual images, Lateral magnification, Depth of field, Lens quality.

Basic photographic process, Processing of Black and White films, Films & Filters, Simple lens Camera, Exposure, Relation between aperture and shutter speed, F/STOP, Aerial Camera, and its main parts.

Geometry of Aerial Photos (APs), Define Fiducial marks, Principal Point, Nadir, Isocenter and establish photo coordinates on APs and their measurements, Refinement of measured APs coordinates from shrinkage, expansion, Radial lens distortion, Atmospheric effects and Earth curvature.

Introduction of Scale, Types of Scale, Determine APs Scale, Measurement of Horizontal distance, Height and Slope, Area, and direction as well as Angle from APs coordinates.

Types of Stereoscope and their uses, Depth of perception, Conditions for viewing APs

stereoscopically, Y-Parallax, Vertical Exaggeration, Define Relief Displacement of a vertical feature and its measurement method, Define Parallax and Monoscopic and Stereoscopic methods of parallax measurements.

Define photo-interpretation, Fundamentals of photo-interpretation, Preparation of APs for photo-interpretation, Various steps required in photo-interpretation, Basic equipment used in Interpretation, Land use and land cover mapping, Use of APs in Forest inventory, Geologic and soil mapping, Wetland mapping, Environmental Impact Assessment.

Ground control for Aerial Photography, Use of Ground control in determining Flight height, Airbase of APs, Flight Planning.

Concept and Foundation of Remote Sensing: Introduction, Energy Source and Radiation, Energy interaction in atmosphere and with Earth Surface Features, , Real and Ideal Remote Sensing, Status of Remote Sensing.

Remote Sensing Sensors and Scanning Systems: MSS, TM, IRS, IKONOS, Quick Bird, Data acquisition and Distribution, Digital Data rectification and registration, Image Enhancement, and Data classification, Spectral pattern recognition, Supervised and Unsupervised classification.

Application of RS data: Land use and land cover mapping, Temporal change detection, Soil classification, Interpretation of Satellite Imageries.

Microwave Remote Sensing: Introduction of Radar, Radar Operating System, Use of Radar Imageries, Future prospect of Radar Remote Sensing.

Course Breakdowns: Theory

S.N.	Topic	No. of Lectures
1.	Introduction of the course, its scope and limitation, Development of Aerial photography, Types of Aerial photos and their use in NRM	1
2.	Basic Optics for photogrammetry: Reflection and refraction of light, Thin and Thick lenses, lens formula (Focus), Scheimpflug condition, Real and Virtual images, Lateral magnification, Depth of field, Lens quality.	2
3.	Basic photographic process, Processing B&W films, Films & Filters, Simple lens Camera, Exposure, Relation between aperture and shutter speed, F/STOP, Aerial Camera, and its main parts	3
4.	Geometry of Aerial Photos (APs), Define Principal Point, Nadir, Isocenter and establish photo coordinates on APs and their measurements, Refinement of measured APs coordinates for shrinkage, expansion, Radial lens distortion, Atmospheric effect, and Earth curvature	2
5.	Introduction of Scale, Types of Scale, Determine: APs Scale, measurement of Horizontal distance, Height and Slope, Area, and direction as well as Angle from APs coordinates	2
6.	Types of Stereoscope and their uses, Depth of perception, Conditions for viewing APs stereoscopically, Y-Parallax , Vertical Exaggeration, Define Relief Displacement of a vertical feature and its measurement method, Define Parallax, Monoscopic and Stereoscopic methods of parallax measurement	3
7.	Define photo-interpretation, Fundamentals of photo-interpretation, Preparation of APs for photo-interpretation, Various steps required in photo-interpretation, Basic equipment used in Interpretation, Land use and land cover mapping, Use of Aps in Forest inventory, Geologic and soil mapping, Wetland mapping	4
8.	Ground control for Aerial Photography, Use of Ground control in determining. Flight height, Airbase of APs, Flight Planning	3
9.	Concept and Foundation of Remote Sensing: Introduction, Energy Source and Radiation, Energy interaction in atmosphere and with Earth Surface Features, Real and Ideal Remote Sensing, Status of Remote Sensing. Remote sensing plateform: terrestrial, airborne, spaceborne	2
10.	Remote Sensing Sensors and Scanning Systems: MSS, TM, LISS series. Data acquisition and Distribution, Digital Data rectification and registration, Image Enhancement, and Data classification, Spectral pattern recognition, Supervised and Unsupervised classification. Image interpretation.	4
11.	Application of RS data: Land use and land cover mapping, Temporal change detection, Soil classification, Interpretation of Satellite Imageries	2
12.	Active Remote Sensing: Introduction of Radar, Radar Operating System, Use of Radar Imageries, Future prospect of Radar Remote Sensing. Introduction to LiDAR and its application in NRM	2

Total	**30**

Practical:

S.N.	Topic	No. of Practicals
1.	Familiarization about various types of APs and equipments	1
2.	Establish photo coordinates and measure them and perform their refinements, photo coordinate adjusting for errors	2
3.	Determine APs Scale, measure distance between given points, find area on APs by using Dot Grids as well as on ground	2
4.	Prepare APs for photo interpretation, determine tree crown closure, crown diameter, tree height, and forest type & areas,	3
5.	Prepare detailed Flight Planning for a given area	2
6.	Visual interpretation of multiband Remote sensing Data (Color imagery) Familiarization of RGB layers.	2
7.	Vegetation classification using NDVI (Normalized Difference Vegetation Index)	3
Total		**15**

TEXT BOOK:

1. Remote Sensing and Image Interpretation by Thomas M Lillesand and Ralph W Kiefer. Publisher: John Wiley & Sons. Inc

2. Element of Photogrammetry by Paul R. Wolf Publisher: McGraw-Hill

REFERENCE BOOKS:

1. Text book of Photogrammetry, K. K. Rampal

2. Interpretation of aerial photographs, Thomas Eugene Avery

3. Aerial Photography and Remote Sensing, A.B.Bhatta

4. Forester's Guide to Aerial Photo Interpretation, Thomas Eugene Avery

5. Remote sensing and GIS by B.Bhatta

Course Code : NRM 302
Course Title : Forest Business Management
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of this course, the students will understand the basic concept on Forest business management with main focus on: Typology of economic systems, Management theory, Management cycle, Management levels in Forestry business, Normative Management, Strategic Management, Entrepreneurial thinking and decision-making in the production and industrial sectors of forestry science.

SYLLABUS:

Factors of production, basics of production decision, production relations, planning methods of firm, objectives of management, courses of action, cost concepts and decision making, taxes and subsidies, profit maximizing, treatment of time, accounting and economic costs, forest enterprises, cost benefit analysis, risk and uncertainty in forest investment, financial analysis, economic analysis, linear programming (graphical and simplex), multi criteria evaluation methods, marketing of forest products. In practical the students will be taught about different aspects of forest business management as well as the principles and methods of preparing forest business plan.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures

1.	Characteristics of a business: primary factors of production, size of production unit, decision making, changes in prices, standardization of practices and products, turn over, financing, fixed and variable costs	2
2.	Business environment: Inelastic and elastic demand, time rigidities in consumption of forest products, changing economic environment and farming, importance of knowledge in business, management learning and adjustment, requirements in business profession	2
3.	Multicriteria Evaluation(MCE) Methods: Introduction, Assessment of cost Benefit analysis, use of MCE, classification of MCE methods, steps in application of MCE	3
4.	Plan, Planning, Programme and Projects: Project characteristics, Sources of project, project cycle, project preparation, technical, financial and economic analysis, appraisal, financing and investment & design, project implementation	3

5.	**Marketing for forest products:** Determinants of demand for forest products, level of income, population, end market indicator, availability and substitutes, taste and preferences, measuring elasticity of forest product demand, price elasticity of demand, derived demand by a firm, approaches to marketing	2
6.	**Planning in forestry**: Concept of planning, scope of planning, tiers of planning in forestry, planning process, plan structures	2
7.	**Linear programming (graphical and simplex with duality)**: Graphical solution, use of linear programming model in determining optimal production mix for increasing farm income	3
8.	**Forecasting parameters of a firm** (input, output& products): Concept, forecasting process, techniques, fundamentals of forecasting, statistics and graphs	2
9.	**Risk and uncertainty in forest investment**: Risk management, decision making with uncertainty, concept, terminology, differences between risk and uncertainty, sources of risk, rational decision and criterion, mean expected value	3
10.	**Investment decisions**: Net present value, logic of using NPV in selecting projects, Example of using NPV, Internal rate of return, Calculation of IRR, benefit cost ratio, calculation of B/C ratio, selection of investment projects	3
11.	**Planning, writing and completing reports and proposals**: Planning reports and proposals, writing reports and proposals, completing reports and proposals	3
12.	**Managing new ventures and entrepreneurship**: The nature of entrepreneurship, its role in society, entrepreneurial organizations, structure of entrepreneurial organizations, the preference of entrepreneurial organizations	2
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Calculation of NPV, IRR, B/C ratio, break even point	3
2.	Preparation of Business plan of a forestry enterprise	2
3.	Mean Expectation Value (Risk and uncertainty)	2
4.	Elasticity of demand and price elasticity of demand	2
5.	Practice of Multi criteria Evaluation	3
6.	Presentation of a business plan report	3
Total		**15**

REFERENCES:

1. Griffin R. W. Management, eighth edition, Biztantra.

2. Bovee C.L., Thill, J.V. and Chaturvedi M. Business Communication Today. Ninth Edition

3. Colin Price, The theory and application of forest economics, Basil Blackwell, Oxford

4. S.S. Johl and T.R.Kapur, Fundamentals of farm business management, Kalyan Publishers

5. Bram Filius, Economic aspects of trees and forests in tropical land use. Wageneningen University.

Course Code : NRM 303

Course Title : Community Forestry and Governance

Credit hours : 3 (2 + 1) Full Marks: 75 Theory 50 Practical 25

COURSE OBJECTIVE:

Upon the completion of this course, the students will be able to understand the concept of community forestry and its practices focusing to Nepal and also learn the process of implementing community forestry program in Nepal.

SYLLABUS:

This course provides knowledge and skills in community forestry development and management including concept and definition of community forestry, evolution of community forestry, rural livelihoods and their relation with community forestry, necessary skills required working in a village, what is RRA/PRA, why use RRA, tools and techniques of RRA/PRA, process of user group formation, documents required for handing over national forest as community forest, forest protection system in community forestry, decision making process in community forestry, gender and social inclusion in forest management practices, evolution of community forestry policy ad legislation, governance and good governance, elements of good governance, networking and institutions, capital formation through community forestry, and role of community forestry in MDGs.

Breakdown:

Theory

S.N.	Topic	No. of Lectures

1.	Concept and definition of community forestry	1
2.	Emergence and evolution of community forestry in Nepal	1
3.	Forest users (primary/secondary/tertiary), user group, user group committee, user assembly	1
4.	Rural livelihoods and their relation with community forestry	1
5.	Art of building rapport in rural village	1
6.	RRA/PRA, why use RRA, principle of RRA and its procedures	2
7.	Tools and techniques of rapid rural appraisal and participatory rural appraisal (SSI, KII, resource mapping, transects and participatory well being ranking)	2
8.	Process of user group formation	1
9.	Forest constitution and operational plan; components of forest constitution and operational plan	2
10.	Steps for preparing forest constitution and operational plan (investigation, negotiation, review and revision)	2
11.	Planning and process for registering community forestry	1

12.	Indigenous forest management system	1
13.	Forest protection system in community forestry	1
14.	Harvesting/silvicultural operation and forest products distribution mechanism in community forest	1
15.	Different models of income generation from community forestry	2
16.	Decision making process in community forestry	1
17.	Gender and social inclusion in forest management practices (why gender equity and social inclusion, policy approach for women development)	2
18.	Communication and information flow in community forestry	1
19.	Evolution of community forestry policy and legislation	1
20.	Master plan for forestry sector Nepal 1988 (focus related to community forestry) and national community forestry workshops	1
21.	Governance and good governance; components of good governance (participation, transparency, accountability, responsiveness, redictability, rules of law, efficiency and effectiveness)	1
22.	Networking and institution	1
23.	Capital formation through community forestry (natural, physical, human, social and financial)	1
24.	Role of community forestry in MDGs	1
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Visit nearby community forest user group; prepare community Profile by using different tools and techniques of RRA/PRA (SSI, KII, social mapping transect walk and seasonal calander)	5
2.	Visit nearby community forest; prepare forest profile by using Rapid vegetation assessment.	5
3.	Visit nearby community forest user group; review constitution and operational plan by interacting with executive committee members; prepare executive committee members profile for assessing governance status in community forestry.	5
Total		**15**

REFERENCES

1. CPFD 1991. *The Community and Private Forestry Program in Nepal*, Community and Private Forestry Division, Department of Forests, Kathmandu

2. Chapagain, D., Kanel, K. R. and Regmi, D. C. 1999. Current policy and legal context of the forestry sector with reference to the community forestry program in Nepal, *Working Paper*, Kathmandu/Nepal: SEEPORT AND PRO PUBLIC: pp. 70.

3. Grandstaff, T. B. and Messerschmidt, D. A. 1995. A manager's guide to the use of RRA (Rapid Rural Appraisal), Thailand: FARM programme, FAO/UNDP and Suranaree University of Technology

4. Pokharel, R. K., Upadhyaya, C.P. and Singh, A. 1997. *Community Forestry: A Handing Over Process*, Pokhara/Nepal: Munal Offset Printers.

5. Pokharel, R. K. 2000. Indigenous forest management practices in some community forests of Nepal, *Banko Jankari*, **10** (1): 36 – 39.

6. Pokharel, R. K., Rayamajhi, S. and Tiwari, K. R. 2012. Nepal's Community Forestry: Need of Better Governance, (Book Chapter), In C. A. Okia (ed.), *Global Perspectives on Sustainable Forest Management*, INTECH Open Access Publisher:43–58.

Course Code : EES 302

Course Title : Mountain Ecology
Credit Hours : 3 (2+1) Full Marks : 75
Theory : 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand different aspects of structure and functions of mountain ecosystem, and resources.

SYLLABUS:

Introduction: Land forms, and Classification Characteristics. Importance to mountain to human kind. Major mountains of the world..Global changes at high elevation. Environmental factors in effecting mountain ecosystems: Climate, Altitude, Soil, Radiation, Nutrient cycling and nutrient budget, Plant biomass production. Life under snow, tree line ecology, Growth trends near tree lines .Physical dimension of Himalaya and Hindukush mountain (HKH),Drivers of environmental changes in HKH. Status of Forest and Biodiversity, adaptations in plants, animals and man in mountains. Transformation in mountains (environmental, climatic change, demographic). Mountains Resources:Water resources, minerals, Forest and NTFPs, tourism,agriculture. Ecosystem Services, REDD initiative.

Course Breakdown

S N	Topic	No. of Lectures
1.	Introduction: Land forms, classification and characteristics.	2
2.	Importance to mountains to human kind.	1
3.	Major mountains of the world..Global changes at high elevation	2
4.	Environmental factors in affecting mountain ecosystems : Climate,	2
5.	Altitude, Soil, Radiation, Nutrient cycling and nutrient budget.	2
6.	Plant biomass production	2
7.	Life under snow, tree line ecology, Growth trends near tree lines.	2

8.	Physical dimension of Himalaya and Hindu Kush Himalaya (HKH), Mountain specialty (e.g. fragility, marginality)	2
9.	Drivers of environmental changes in HKH	2
10.	Status of Forest and Biodiversity, particularly in mountains	2
11.	Adaptations in plants, animals and man in mountains	2
12.	Transformation in mountains (environmental, climatic change, demographic)	2
13.	Mountains Resources and Ecosystem Services	1
	I. Water resources.	1
	II. Minerals.	1
	III. Forest and NTFPs	1
	IV. Tourism.	1
	V. Agriculture.	1
	VI. Carbonseqyestration	1
Total		30

Practical

S.N.	Topic	No. of Practicals
1.	Study of topographic map to characterize the area.	2
2.	Analysis of climate pattern (temperature and precipitation) using data from nearby meteorological station.	1
3.	Estimation of field capacity to analysis of soil water availability.	1
4.	Study of population structure using population pyramid.	1
5.	Study of water quality of river/lake/pond by estimating turbidity, pH, DO	2
6.	Study of vegetation composition and species diversity in forests at different altitude.	2
7.	Study Agroforestry systems in the mountain.	1
8.	Study of landslide areas and their restoration efforts.	1
9.	Study adaptability in plants of high altitudes.	2
10.	Record phenology of plants at different altitudes.	2
Total		**15**

REFERENCES

1. Beniston,M. 2000. Environmental Change in Mountains and Uplands.Arnold,London..
2. ICIMOD.1993.Mountain Environment and Development.ICIMOD,Kathmandu.
3. Ives, J D. 2006. Himalayan Perceptions: Environmental Challenges and Well being of the Mountain People.
4. Korner,C. 2003. Alpine Plant Life: Functional Plant Ecology of High Mountain ecosystem.
5. Mani,M S. Fundamentals of High Altitude Biology.Oxford and IBH Publishing Co.,Delhi,India.
6. Nagy,L and Grabherr,G.2009. Tree Biology of Alpine Habitats.Oxford University Press, New York.
7. Pandey, R K.1995.Himalayan Heights:AltitudeGeography.ratna Book Distributors,Kathmandu.
8. Gupta PK. Methods in Environmental Analysis: Water, Soil and Air. Agrobios.India.
9. Zobel, D. B.,Jha, P. K. Behan, M. J. and Yadav, U. K. R. 1987. A Practical Manual of Ecology.
10. Southwood, T.R. E. & Henderson, P. A. 2000. Ecological Methods (3rd ed.). Blackwell Science.

Course Code : EES 303
Course Title : Biodiversity Conservation
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand biodiversity conservation, its current status, overall ecological significance and various conservation modalities adopted and its impact on overall biodiversity conservation and livelihood of the population.

SYLLABUS:

Concepts of Plant and Animal Biodiversity. Importance of biodiversity conservation. Ecological succession of both plants and animals. Sustainability aspects of overall biodiversity (seed orchard, gene bank). In situ and ex situ conservation. Biodiversity conservation at Landscape level. Concept of corridor and connectivity. Hot spots and its significance.
History and current status of wildlife conservation in Nepal. Protected areas of Nepal (National parks, Wildlife reserves, Bio-reserves) and its impact on biodiversity conservation, livelihood resources. Wetland biodiversity, its prospects and challenges and mitigation measures. Various issues (park and people conflict, ecosystem services, user rights) of protected area management and its sustainability.
Conservation effort: Trans-boundary issues. Research on various issues of biodiversity conservation and livelihood sustainability. Census methods applied for mega animals. Brief history on the translocation of Rhino and its current status and possibilities of translocation of other Mega animal. Climate change and its effect on

biodiversity conservation.

Various Acts and Regulations concerning biodiversity conservation. Buffer zone management and other biodiversity management options. Role of International organizations (IPGRI, UN, FAO) in biodiversity conservation.

International conventions on biodiversity conservation (CBD, CITES and RAMSAR). Management categories of protected species, vulnerable, threatened endangered and endemic bio-resources of Nepal IUCN and CITE categories and their significance.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Concepts of Biodiversity Introduction to biodiversity (Ecosystem diversity, Species diversity and Genetic diversity Importance of biodiversity conservation. Bio-diversity hot spots, key stone species and its significance. Ecological succession of both plants and animals Status of ecosystem and species diversity in the country	3
2.	Wildlife Conservation in Nepal. History of Wildlife Conservation in Nepal Current status and overview of Protected areas in Nepal (National parks, Wildlife Reserves, Conservation Areas) Issues related to protected area management in Nepal (Human Wildlife Conflict, Park and People Conflicts, Use right) Buffer-zone Management (concept) and Community Engagements (community forestry and conservation groups, community based anti-poaching activities etc) Impacts of Protected Areas on the Livelihoods of Local communities and Economic Development of the country.	7
3.	Wetland biodiversity Definition of wetlands Ramsar convention on Wetlands and Ramsar sites in Nepal Flora	2

	and Fauna in wetlands Challenge and Opportunities in wetland conservation in Nepal	
4.	Special approach to Biodiversity Conservation In situ and ex situ conservation Seed orchard and gene bank Biodiversity conservation at Landscape level. Concept of corridor, bottleneck and connectivity Current effort of Nepal in biodiversity conservation	4
5.	Trans-boundary issues of mega animals Bilateral issues Multilateral issues Agreements Effort of Nepalese Government to address the issue jointly	1
6.	Monitoring and Research on biodiversity conservation Introduction of Community based bio-diversity monitoring and registration Census methods applied for mega animals. Brief history on the translocation of Rhino and its current status Possibilities of translocation of other Mega animal Invasive Species and their impacts in Biodiversity Conservation Issue and opportunities for research related to biodiversity conservation	4

7.	**Climate change and its effect on biodiversity conservation.** Impacts of Climate Change in Biodiversity (on habitat and behavior) conservation Cases of Impacts of CC on animal and plan diversity Possible mitigation and adaptation measurers	2
8.	**Key Policies and regulations related to Biodiversity Conservation in** Nepal (key provisions) National Parks and Wildlife Conservation Act, 1973 Forest Act, 1993 Regulations (National Park and wildlife Conservation- 1973; Buffer zone Management-1995;Conservation area Management-1996) Policies and Strategies (National Wet Land Policy 2002; National Biodiversity Conservation Strategy 2002; Wildlife Farming, Breeding and Research Strategy-2003) Guidelines (Buffer zone Management-1999; Compensations of Damages) Nepal Environment Policy and Action Plan, 1993	2
9.	**Role of International organizations (IPGRI, UN, FAO, IUCN) in** biodiversity conservation in Nepal. Management categories of protected species, vulnerable, threatened endangered and endemic bio-resources of Nepal IUCN and CITES categories and their significance. Role of specific organizations in biodiversity conservation	1
10.	**International conventions on biodiversity conservation** (Key outcomes) Three Rio Conventions (CBD, UNFCCC, UNCCD) CBD CITES RAMSAR Kyoto Protocols World Summit on Sustainable Development (2002) History and Outcomes of Conference of Parties (COP) under UNFCCC	3
11.	**Challenges and Opportunities for Biodiversity Conservation** Lessons learned so for from past initiatives Challenges on biodiversity conservation (Impact of CC, Habitat loss, Human Wildlife conflicts, Illegal trade, Poaching, Technologies and Resources etc) Opportunities (Government commitment and international support, Way forward	1
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Visits to National Parks and Protected Areas of the country to observe the interrelationship between animal and plants. The students would be familiar with the Importance of biodiversity conservation. Hot spots and its significance	2
2.	Learn the impact of protected areas on livelihood resources. Park and people conflict, Ecosystem services, User' right Indigenous knowledge	3
3.	Current approaches of biodiversity conservation Approaches currently been applied for biodiversity conservation In situ and ex situ conservation Seed orchard and gene bank Biodiversity conservation at Landscape level Concept of corridor and connectivity	4
4.	Conservation efforts Concept of Park and People Buffer zone management Community-based conservation Annapurna Conservation Area	4
5.	Climate change and its effect on biodiversity conservation. Issues of climate change Vulnerability of climate change in biodiversity	2
Total		**15**

REFERENCES

1. DNPWC 1997. Nepal's Biodiversity and Protected areas, Kathmandu, Nepal

2. DNPWC 2006. Protected areas of Nepal (fact sheet), Kathmandu, Nepal

3. HMG/Nepal, Ministry of Forests and Soil Conservation 2002 : Nepal Biodiversity Strategy

4. IUCN/UNEP 1986. Managing protected areas in the tropics

5. IUCN-Nepal 1996. An inventory of Nepal's Wetlands, Kathmandu

6. IUCN-Nepal 2004. Conservation and sustainable development in mountain areas

7. Shrestha T.B. and R. M. Joshi 1996. Rare, Endemic and Endangered plants of Nepal, WWF-Nepal Program

Course Code : SWM 301
Course Title : Watershed Management
Credit Hours : 2+1 Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the concept of watershed, its characterization features, upstream downstream linkages, scope of watershed management in climate change context, watershed management approaches and policy in Nepalese context and principles of integrated watershed management.

SYLLABUS:

Definition and concept of Watershed, delineation approach, Participatory watershed management, Watershed monitoring and approaches, Vulnerable watershed, application of GIS in WM, watershed conditions in Nepal, silent features of watershed management in hilly areas of Nepal, program and approaches adopted for WM in Nepal, Watershed resources and peoples dynamics, Sloping Agriculture land Technology (SALT), Concept and scope of World Overview of Conservation Approaches and Technologies, Concept and scope of World Overview of Conservation Approaches and Technologies, Current programs/plans of watershed management, Soil and water conservation, Causes of watershed degradation, Concepts of land degradation and impacts, Concepts of landslide susceptibility, Low cost soil bioengineering techniques, Upstream and downstream linkages, concepts of Payment for environmental services (PES)

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Definition and concept of watershed, micro watershed, sub-watershed, and basin level understanding	1
2.	Watershed delineation approaches (contour map based)	1
3.	Concepts of watershed management, participatory watershed management	1
4.	Watershed characterization	1
5.	Watershed Monitoring and Approaches	1
6.	Concepts if critical, vulnerable watersheds with illustrative examples.	1
7.	Application of GIS in watershed management	2
8.	Watershed conditions in Nepal: Examples of critical and vulnerable watersheds	1
9.	Salient features of Watershed conditions in Churia/Terai,Midhill & High Himal	1

10.	Integrated watershed resources management in High himal, Mid hill and Churia region of Nepal	2
11.	Program & approaches adopted for watershed management in Nepalese context	1
12.	Watershed resources and peoples dynamics/linkages	1
13.	Sloping Agriculture land Technology (SALT), concepts and its types for watershed Rehabilitation	2
14.	Concept and scope of World Overview of Conservation Approaches and Technologies (WOCAT) World Overview of Conservation Approaches and Technologies (WOCAT) and Nepal Conservation approaches and Technologies (NEPCAT) for watershed management.	2
15.	Current programs/plans of watershed management: Department of soil conservation, ICIMOD, and other relevant agencies.	2
16.	Project level experiences sharing implemented under different ministry	1
17.	Soil and water conservation: Concepts of soil properties, erosion, mass wasting, and their impacts on watershed health.	2
18.	Causes of watershed degradation, Indicators of watershed deterioration, climate change impacts on watershed resources.	2
19.	Concepts of land degradation and impacts on watershed conditions	1
20.	Concepts of landslide susceptibility mapping for identification of potential land sliding zone	2
21.	Low cost soil bioengineering techniques for watershed rehabilitation	
22.	Upstream and downstream linkages, concepts of Payment for environmental Services	2
Total		**30**

Practical

S.N.	Topic	No. of Practicals
1.	Watershed delineation based on contour map using topographic map, understanding contour properties (GIS based analysis)	6
2.	Filed visit and identification of watershed problems, and rehabilitation solution (project work)	9
Total		15

REFERENCES:

1. Logical framework of Department of Soil Conservation and Watershed Management, 2007

2. Watershed Management, publication series of FAO

3. Publication series of ICIMOD on SALT, WOCAT and NEPCAT related issues.

Course Code : FT 301
Course Title : Field Training
Credit Hours : 2(0+2) Full Marks: 50 Theory: 0
Practical: 50

OBJECTIVES:

Equip the students with field condition and expose optimum to state of art in the forestry and allied areas particularly relating to course coverage.

COURSE:

The course will be based on the field training linking to different forestry based programs and developmental activities. Expose student's maximum with field practices, and forestry operations, national park management and watershed management practices under this program of study.

The field training program will be developed for maximum of 7 days covering the field practices in Nepal. The faculty deputed as incharge of the field training will develop the program and conduct it. The incharge will be responsible for assessing the tour report and assign task to the students

7th Semester Courses

Course Code : BSH 401

Course Title : Entrepreneurship Development and Communication Skill

Credit Hours : 2 (2+0) Full Marks: 50

Theory: 50 Practical: 0

OBJECTIVES:

Upon the completion of this course, the students will be able to understand entrepreneurship; analyze creativity and innovation; assess business opportunity, enterprise establishment and its management; familiarize with characteristics of Small & Medium- sized Forest Enterprises (SMFEs) and enabling environment; understand components of business plan and craft a winning business plan; and have basic knowledge on communication skills and strategy.

SYLLABUS:

Foundation of entrepreneurship, definition, concept, innovation, creativity, enterprise establishment, characteristics, assessment of policy, community based forest enterprise, market and market assessment, business plan, communication,

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	The Foundations of Entrepreneurship	
	• Definition and concept: Entrepreneur, entrepreneurship, and characteristics of entrepreneur	1
	• The benefits and drawbacks of entrepreneurship	1
	• Common mistakes of entrepreneurship, putting failures into perspectives and avoiding pitfalls	1

2. Innovation: The Creative Pursuit of Ideas
   - Creativity, innovation and entrepreneurship, barriers to creativity and enhancing creativity — 1
   - Creativity techniques — 1
3. Assessing enterprise opportunities and options
   - Business concept and its benefits/importance, characteristics of good business opportunity — 1
   - Types of enterprises, types of business ownership, and their advantages and disadvantages — 1
   - Assessing business opportunity, identification & prioritization, SWOT analysis — 2
4. Enterprise establishment and its management; organizing community for enterprise — 1

5.	Characteristics, challenges and opportunities of SMFEs	1
6.	Assessment of policy, regulatory and institutional environment for SMFEs	1
7.	Community-based forest enterprises, impact on local livelihood and conservation	1
8.	Market, market assessment and marketing	1
9.	Crafting a winning business plan	1
	• Introduction to a business plan (definition, importance, elements)	1
	• Marketing Plan	1
	• Production plan	1
	• Organization and Management Plan	1
	• Financial Plan	1
	• Risk analysis and Action plan	1
10.	Communication - concepts, models and functions	2
11.	Elements of communications and their characteristics	1
12.	Types and means of communications and functions	2
13.	Methods of communication (individual, group and mass)	2
14.	Business communication	2
Total		30

REFERENCES :

1. Zimmerer T.W. and Scarborough N.M. 2008. Essentials of entrepreneurship and small business management, 5th ed, Pearson Education Inc, New Jersey, USA

2. ANSAB. 2010. Entrepreneurship Development of Natural Resource Dependent communities. Asia Network for Sustainable Agriculture and Bioresources, Kath, Nepal.

3. ANSAB. 2010. Business Planning for Community Based Natural Product Enterprises. Asia Network for Sustainable Agriculture and Bioresources, Kathmandu. Nepal

4. ANSAB. Forest Connect and FAO. 2009. Challenges and opportunities for Nepal's small and medium forest enterprises (SMFEs), FAO, p89

5. ANSAB, FRAME and IRG. 2007. Local Communities and Natural Products: A manual for organizing natural resource management groups for resource management planning, enterprise development and integration into value chains, USAID, p61

6. Subedi B.P. *et al*. 2000. Enterprise Development for Natural Products Manual. Asia Network for Sustainable Agriculture and Bioresources, Kathmandu, Nepal

7. Subedi B.P. 2006. Linking Plant-based Enterprises and Local communities to Biodiversity Conservation in Nepal Himalaya, Adroit Publishers, New Delhi, p244.

8. Macqueen, D. (ed) 2012. Supporting small forest enterprises–A facilitator's toolkit. Pocket guidance not rocket science! IIED Small and Medium Forest Enterprise Series No. 29. IIED, Edinburgh, UK.

Course Code : NRM 401
Course Title : Experimental Design and Statistical Analysis
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the concept of experimental design, plan and execute to test hypotheses ,use a statistical package for data analysis, apply of appropriate statistics to evaluate data and present and communicate results

SYLLABUS:

Basic concepts in experimental design - Introduction, definition of different terminology in experimental design, Principals of experimental design Completely Randomized Design (CRD)- Introduction, The experimental plan and layout, Allocation of treatments to experimental units, Linear model and assumptions, Statistical Analysis and interpretation, Randomized Complete Block Design (RCBD) -Introduction The experimental plan and layout, Allocation of treatments to experimental units, Linear model and assumptions, Statistical Analysis and interpretation, Latin square Design (LSD) -Introduction The experimental plan and layout, Allocation of treatments to experimental units, Linear model and assumptions, Statistical Analysis and interpretation, Multiple comparisons, Planned pair and Unplanned pair comparison, Least significance difference (LSD) test and Ducan's new multiple range test (DNMRT), Factorial experiments-Introduction, The 2x2, 2x3 and other factorial experiments, plan and layout (based on Factors with levels), Statistical Analysis and Generalization of factorial experiments, Split Plot design-Introduction,The experimental plan and layout, Allocation of

treatments to experimental units, Linear model and assumptions, Statistical Analysis and interpretation.

Theory

S.N.	Topics	No. of Lecturers
1.	Basic concepts in experimental design -Introduction	4
	(i) Definition of different terminology in experimental design	
	(ii) Principals of experimental design	
2.	Completely Randomized Design (CRD) -Introduction	4
	(i) The experimental plan and layout	
	(ii) Allocation of treatments to experimental units	
	(iii) Linear model andassumptions	
	(iv) Statistical Analysis and interpretation	
3.	Randomized Complete Block Design (RCBD) -Introduction	4
	(i) The experimental plan and layout	
	(ii) Allocation of treatments to experimental units	
	(iii) Linear model andassumptions	
	(iv) Statistical Analysis and interpretation	

4.	Latin square Design (LSD)-Introduction	4
	(i) The experimental plan and layout	
	(ii) Allocation of treatments to experimental units	
	(iii) Linear model andassumptions	
	(iv) Statistical Analysis Analysis and interpretation	
5.	Multiple comparisons	3
	(i) Planned pair and Unplanned pair comparison	
	(ii) Least significance difference (LSD) test and Ducan's new multiple range test (DNMRT)	
6.	Factorial experiments	6
	(i) Introduction	
	(ii) The 2x2, 2x3 and other factorial experiments, plan and layout (based on Factors withlevels)	
	(iii) Statistical Analysis and Generalization of factorial experiments	
7.	Split Plot design-Introduction	5
	(i) The experimental plan	
	(ii) Allocation of treatments to experimental units	
	(iii) Linear model, assumptions, hypothesis	
	(iv) Statistical Analysis and interpretation	
Total		30

B.Practicals

S.N.	Topic	No. of Practicals
	Using different treatments (control and experimental groups) in Nursery and field level with short timing output in	
1.	Completely Randomized Design (CRD)	
	(i) Growth performance of seedling w.r.t. shed, tunnel and open (treatments) in Nursery	1
	(ii) Growth performance of seedling w.r.t. different fertilizers, varieties, light intensity, mode of generation (branch cutting, seed)	2
2.	Randomized Complete Block Design (RCBD)	
	(i) Out put of above treatments with respect to spacing, age at planting	1
	(ii) Field level application of treatments w.r.t. altitude, aspect,	1
3.	Latin square Design (LSD)	
	(i) Output of above treatments w.r.t spacing, age at planting, weed control methods in nursery and glass houses	1
	(iii) Field level application of treatments w.r.t. altitude, aspect, and slope	1
4.	Two or more than two factors Factorial experiments	2
	(i) Growth/yield performance w.r.t. levels of N.P. K in field	

levels/nursery/green houses/tunnels

5.	Split plot design		2
	(i)	Using main and sub plot factors in different replication fertilizer, variety type and management practice in field level and determine more précised factor‘s performance	
6.	Field visit to experimental plots		
	(i)	Silvicultural treatments applied field-thinning. running , lopping effects	2
	(ii)	Agriculture centres where different insecticide, pesticide, herbicides as well as different crop/vegetables, fertilizers treated as in the form of experimental design Use of statistical software(SPSS, R) in the experimental design to analyze the obtained data.Prepare mini report from the practical data.	2
Total			15

REFERENCES :

1. Gomez, K.A. and Gomez, A.A., 1993. Statistical procedures for Agricultural Research, 2nd edition. John wiley and sons, New work, Chichester, Brisbane, Toronto, Singapore

2. Jayaraman, K.A, 2000. A statistical manual for forestry research. FORSPA-FAO Publication, Bangkok

3. Gupta, S.C. and Kapoor, V.K. 2000. Fundamentals of Applied statistics, Sultan Chand and Sons, New Delhi

4. Lentener M. and Bishop, T.A. undated. An introduction to analysis of variance and Experimental design. Press.

5. Cochran, W.G. and Cox, G.M. undated. Experimental Design. Press.

6. Montgomery, D. C., 1976. Design and analysis of experiments, third edition. John Wiley and Sons New Work, Chichester, Brisbane, Toronto, Singapore.

Course Code : FPU 401
Course Title : Utilization of Non Timber Forest Products
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVE:

Upon the completion of this course, the students will be able to explain the importance and scope of NTFPs, understand the economic cultivation and processing of NTFPs, explain the importance of medicinal plants, select and recommend the uses of harvested /marketed NTFPs and explain the importance of value addition

SYLLABUS:

Importance, livelihoods, NTFP based sustainable forest management, ethnobotany, sustainable harvesting, resource assessment, value addition, trade and marketing, resin tapping, MAP, enterprises etc.

Course break down

Theory:

S.N.	Topics	Sub-topics	No. of Lectures
1	Introduction of NTFPS	Introduction, Importance and scope of	2
		NTFPS Category and classification	1
2	NTFPs and Livelihood	Role of NTFPS in livelihood	1
		Employment and income generation in NTFPs	1
		Uses of NTFPs	1
3	Sustainable management of NTFPs	Sustainable management of NTFPs,	2
		NTFPs oriented Forest Management	1

4	Policy Issues	Importance policy, regulations, regulations regulating NTFPs production, trade etc.	3
5	Sustainable harvesting of NTFPs	Importance Harvesting practices	2
		Sustainable harvesting	2
6	Resource assessment	NTFPs Inventory, Sampling. Measurement Estimation	2

7	Enterprises and Marketing of NTFPs	Enterprise development Micro and Macro Business plan	2
8	Value addition & post harvesting Technology	Importance Processing	2
9	Resin Collection and Processing	Importance of resin collection in rural income, Resin collection practices Improved technology in resin collection, Processing of resin to manufacture rosin and turpentine, Grading and marketing of rosin and turpentine, Uses of rosin and turpentine	2
10	Value chain Analysis	Value chain analysis of important NTFPs	2
Total			**30**

Practical

S.N	Topic	No. of practicals
1	Identification of at list 10 important NTFPs species	3
2	Value addition processing exercise (Drying, cleaning, storing etc.)	5
3	Field visits to some NTFP processing and marketing	7
Total		**15**

REFERENCES

1. The Indian Forest Utilization, FRI Publication Vol. I & II, Deharadun.

2. Chaudhary, S. 2003. Manual of Forest Utilization. Institute of Forestry, Hetauda

3. Parajuli, DP, Gyawali, AR and Shrestha, BM. 1998. Manual of Important NTFPS of Nepal. Institute of Forestry, Nepal.

4. Shiva, MP. Undated. Sustainable Management of NTFPS. Press.

5. Dutta, IC. 2007. Non-timber Forest Products. Institute of Forestry, Pokhara.

6. Wealth of India series, CSSIR publication, and related journals of NTFPs, MFPs etc.

Course Code : EES 401
Course Title : Environmental Science
Credit Hours : 3(2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

Upon the completion of the course, the students will be able to understand concepts of environmental science and its interrelationship with other disciplines, and learn about environmental impacts and management tools in development activity using IEE/EIA.

SYLLABUS:

Recent concept and scope of environmental science. Environmental education in Nepal. Introduction to environmental degradation; causes of environmental degradation (Overpopulation, deforestation, pollution, waste, urbanization, acid rain, chemical radioactive materials, desertification),human-environment interaction. Environmental management(concept, need and approaches, environment and sustainability, international cooperation, environmental policies and law (national and international).
Introduction to environmental assessment and monitoring, IEE, EIA, environmental auditing. Introduction to global environmental change, adaptation and mitigation measures of global environmental impacts, global warming, climate change, ozone layer depletion

Course Breakdown

Theory

S.N.	Topic	No. of Lectures

1.	Recent concept and scope of environmental science	1
2.	Environmental education in Nepal	1
3.	Elements of environment1	
4.	Components of natural environment	1
5.	Causes environmental degradation	1
6.	Human –environment interaction	1
7.	Environmental pollution (concept, effects and controlling measures)	
	Air pollution	1
	Water pollution	1
	Land pollution	1
	Noise pollution	1
	Solid waste pollution	1
8.	Hazardous waste including Chemical waste Pollution	1
9.	Environmental management (concept, need and approaches)	1
10.	Environment and sustainability (issues and scientific principle)	1
11.	Environmental ethics	1
12.	Environmental institutions	1

13.	International cooperation	1
14.	Environmental policies and law (national and international)	1
15.	Introduction to environmental assessment and monitoring	1
16.	Initial Environmental Examination (IEE)	1
17.	Environmental Impact assessment (EIA)	3
18.	Environmental Auditing	1
19.	Introduction to global environmental change	1
20.	Factors contributing in global environmental change	1
21.	Adaptation and mitigation measures of global environmental impacts	1
22.	Global warming	1
23.	Climate change	1
24.	Ozone layer depletion	1
Total		**30**

Practical

S.N.	**Topic**	**No. of Practicals**
1.	Measurement of water temperature and pH	1
2.	Collection, processing and storage of effluent samples	1
3.	Estimation of biochemical oxygen demand (BOD).	1
4.	Determination of total dissolved solids in waste water sample	1
5.	Observation and remedial measure of water polluted Lake or pond	1
6.	Observation and study waste management system such as hospitals, hotels, industries	2
7.	Observation and remedial measure of air pollution near bus park or polluted area	1
8.	Measurement of dust fall.	1
9.	Determination of sound level	1
10.	Review reports of IEE/EIA of forest based industries and conduct IEE	5
Total		**15**

REFERENCES:

1. Krishnamoorthy B. 2009. Environmental management 2nd edition, PHI
2. IUCN Nepal. 1995. EIA Forestry Sector Guidelines. IUCN, Nepal
3. IUCN Nepal. 1996. EIA Training Manual for Professionals and Managers. IUCN, Nepal,
4. IEM. 2004. EIA training resource kit. Institute of Environmental Management/ ESPS/DANIDA,
5. Eldon D. E. and Bradley F. S. 2010. Environmental Science study of interrelationship 12th edition McGraw Hill Higher education
6. IEM. 2004. IEE training resource kit. Institute of Environmental Management/ ESPS/DANIDA,
7. Kamal V. 2008. Environmental Management 1st edition Maxford, Delhi
8. Rana S.V.S. 2007. Essentials of ecology and environmental science 3rd ed. PHI
9. Ranen S. 2009. Environmental management; Economics and technology 1st edition. Levant Books
10. Tyler G. M. & Scott S. 2009. Introduction to environmental science by, Cengage Learning.

Course Title : EES 402

Course Title : Ecosystem Services and Climate Change
Credit hour: 2 Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVE:

After completion of this course, the students will be able to understand concepts of ecological/environmental services explain the main theory and practices in different countries and also understand the applications of ecosystem services in different sectors in Nepal

SYLLABUS:

Concept of ecological services: Provisioning services, Regulatory Services, Cultural Services and supporting services. Environmental services: carbon sink functions, hydrological functions, biodiversity and landscape aesthetic/ecotourism.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	**Concept of Ecosystem Services** • Definition of Goods and Services • Various types of Ecosystem Services such Provisioning services, Regulatory services, Cultural Services and Supporting services.	3

2. Ecosystem Services: National and International Cases 4

- Carbon sink functions and carbon trade in different countries and Nepal
- Biodiversity: terrestrial, wetlands/aquatic and its importance in different countries and Nepal (e.g. Chitwan NP)
- Hydrological functions: International practices and its application in different sectors in Nepal such as tourism, (Phewa Lake), hydroelectricity, drinking water, irrigation etc.
- Landscape esthetic/ecotourism: Trekking in Nepal in Himalayan region (e.g. Mustang or Annapurna area, Sagarmatha etc.

3. Climate Change Science 3

- Global Warming and Climate Change
- Ozone Depletion and Global Warming
- Cause of Global Warming, Sources of Green House Gas
- Impact of Climate Change

4.	**Global Initiation to Address the Climate Change** • Earth Submits/Three Reo Conference: UNCCD, UNFCCC and CBD • Kyoto Protocols and Its Provisions • Concept and emergence of RED, REDD, REDD++ as an effective tool for CC mitigation • REDD+ process and development from Global to National • Concept of Climate Change Adaptations	4
5.	**Clean Development Mechanisms** • Concept • Activities under CDM and their role in CC mitigation • Payment Mechanism Under CDM	3
6.	**Role of Forests in CC Mitigation** • Earth Carbon Storage, major Source and Sink • Carbon storage through Photosynthesis • Forest Carbon Pools • How a forest can be a source of carbon (GHG)	2
7.	**Understanding REDD+ Mechanisms** • Major activities under REDD+ • Requirements for REDD+ • Monitoring, Reporting and Verification (MRV) • Various Markets for Forest Carbon Trade • Benefit sharing in REDD+ • Social and Environmental Safeguard • Development of REDD+ Process in Nepal (policies and process)	6
8.	**Deforestation and Forest Degradation in Nepal** • Definitions • Forest status of Nepal and Deforestation and Forest Degradation in Nepal • Drivers and Underlying Causes of Deforestation and Forest Degradation • Strategy to address Drivers of Deforestation and Forest Degradation	2
9.	**Climate Change Adaptation** • Definitions • Role of Forests in CC Adaptation • Activities and Policies related to CC adaptation (Climate Change Policy, • NAPA, LAPA and CAPA)	3
Total		**30**

REFERENCES :

1. IPCC 2012 Renewable Energy Sources and Climate Change Mitigation. Cambridge University Press, UK.

2. IPCC Fourth and Fifth assessment report.

3. Karki M., Dangi, R., and Karki, B., 2009. Nepal's Experience in REDD with CommunityForestry.

4. Mayrand, K. and M. Paquin 2004 Payments for Environmental Services: A Survey and Assessment of Current Schemes. Prepared for the Commission for Environmental Cooperation of North America.Unisféra International Center, Montreal.

5. MEA 2005Ecosystems and Human Wellbeing: A Framework for Millennium Ecosystem Assessment". World Resource Institute, Washington, D.C.

6. MOE 2011: Climate Change Policy 2011 in Nepal, MOE, Kathmandu Nepal.

7. MOFSC, 2010.*Nepal's Readiness Preparation Proposal: REDD 2010-2013*. Ministry of Forests and Soil Conservation (MOFSC), Kathmandu, Nepal.

8. Pagiola S.; J. Bishop, and N. Landell-Mill *2002 Making Market-based Mechanisms Work for Forests and People. In Selling Forest Environmental Services: Market-based Mechanism for Conservation and Development.* London: Earthscan Publications P.264.

9. Pagiola S.; J. Bishop, and N. Landell-Mill 2002 Selling Forest Environmental Services: Market-based Mechanism *for Conservation and Development. London: Earthscan Publica*tions Ltd. P. 299

10. Pagiola Stefano 2007 Payments for Environmental Services in Costa Rica. Published in *Ecological Economics* 65 (2008) 712-724. www.sciencedirect.com

11. Pagiola, S. (2006) *Payments for Environmental Services: Combining Science an Economics for Sustainable Conservation.* World Bank Environment Department, Kayhryn Fuller Sconce for Nature Symposium, Washington, D.C.

12. Pagiola, S. and G. Platais 2007 Payments for Environmental Services: From Theory to Practice, World Bank, Washington

13. Singh, B. K.; B. Adhikari& H. Singh 2009 *Seeing the Community and Leasehold Forestry from the perspectives of Environmental Services and its Contribution in Food Security in Nepal: A Case of Sathighar, Kavre*. Paper presented in International Community Forestry Workshop held in Pokhara Nepal from 15-18 Sept 2009.

14. Tiwari, KR 2011. Global Environmental Change. Teaching materials for MSc Forestry Course, Institute of Forestry Pokhara, Nepal

15. Wunder S. 2005 Payments for Environmental Services: Some Nuts and Bolts. *CIFOR Occasional Paper No. 42*, Bogor, Indonesia.

Course Code : NRM 402
Course Title : Natural Resource Economics
Credit Hours : 3 (2+0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES:

At the end of the course, the students will have the knowledge of Natural Resource Economics to enable them to utilize the theory and tools of economics for the management of Natural Resources.

SYLLABUS:

Introduction, property rights, climate change, ecosystems, economics of natural resources, production function, institutional economics and natural resource management, climate change economics, economic valuation of natural resources, environment and development,

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1	**Introduction to Natural Resources**	3
	1.1 Meaning and types of natural resources	
	1.2 Property rights and their classification	
	1.3 Climate Change: Mitigation and Adaptation	
	1.4 Irreversible change, source and sink	
	1.5 Ecosystems, their function and services	
2	Economics of Natural Resources	4
	2.1 Production Function: Cobb-Douglas and other production functions	
	2.2 Externalities and Public Goods in Natural Resource Management: Forests, Watersheds, Biodiversity, Wetlands, Ecotourism	
	2.3 Policies and incentives to manage externalities Control and Command VS Market Instruments Payment for Environmental Services	
3.	Institutional Economics and Natural Resource Management	6

3.1 Characteristics of property rights, Institutions and their robustness
3.2 Market and Policy Failure and their rectifications
3.3 Concept of transaction cost, moral hazard, asymmetrical information

4	Climate Changes Economics	4
	4.1 Climate Change and its impacts	
	4.2 The Economics of REDD+ (Mitigation by forests)	
	4.3 Vulnerabilities and hazards, and Climate Adaptation to them	
5	Economic Valuation of Environmental Resources	10
	5..1 Valuation as a helping tool to make decisions	
	5.2 Typology of values: Use versus Non-use value, Use versus Exchange value, Consumptive versus non-consumptive value, Option value, Existence value, Bequest value	
	5.3 Various direct and indirect valuation methods	
	5.4 Application of valuation methods in valuing/evaluating various ecosystem benefits	
6	Environment and Development	3
	6.1 Criteria and indicators of sustainable development	
	6.2 Poverty and environment linkages	
	6.3 Pitfalls in measuring GDP as an indicator of development	
Total		30

TEXT AND REFERENCE MATERIALS

1. Camille B, Kanel KR and Upadhyaya S. 2011. An Economic Valuation Tool for Wetlands. Ministry of Forestry of Forests and Soil Conservation, Conservation and Sustainable Use of Wetlands in Nepal, Kathmandu, Nepal.

2. Ghate R, Jodha NS, and Mukhopadhyaya P (eds). 2008 Promise, Trust, and Evolution: Managing the Commons of South Asia. Oxford; New York: Oxford University Press.

3. Hanley N, Shogren JF and White B. 1997. Environmental economics in theory and practice. Macmillan Press LTD.

4. Enamul HAK, Murty MN, and Shyamsunder P (eds.) 2011. Environmental Valuation in South Asia. Cambridge University Press.

5. Ostrom E. (1990). Governing the Commons: The evolution of Institutions for Collective Action. Cambridge Publication.

6. Joseph ES, Sen A and Fitoussi JP 2009. The Measurement of Economic Performance and Social Progress Revisited: Reflections and Overview. Report by

the Commission on the Measurement of Economic Performance and Social Progress.

Course Code : SFB 401
Course Title : Silviculture of Important Trees
Credit hours : 2 (2 +0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES:

Upon completion of this course, the students will be able to understand about basic silvicultural character and ecological understanding of important forest tree species of Nepal.

SYLLABUS:

Introduction: silvics and its importance, morphology, phenology, geographic distribution, economic importance and silviculture of indigenious species in Terai *: Shorea robusta, Dalbergia sissoo,Dalbergialatifolia, Acacia catechu, Bombax ceiba, Adina cordifolia, Gmelina arborea, Terminalia tomentosa, Terminalia belerica, Terminalia chebula, Albizzia procera, Albizzia lebbek, Albizzia chinensis, Anthocephalus chinensis, Azadirachta indica, Melia azadirach, Anogeisus latifolia, Ougenia dalbergoides, Lagerstromea parviflora, Cederella toona, Diospyros melanoxylon Bamboo and Rattan.*Midhills*: Castanopsis indica, Castanopsis hystrix, Castanopsis tribuloides, Schima wallichii, Alnus nepalensis, Michelia champaca, Pinus roxburghii, Quercus semicarpifolia, Quercus incana, Quercus lamellose.* High hills*: Pinus wallichina, Juglans regia, Abies pindrow, Picea smithiana, Cedrus deodara, Taxus bacata, Juniperus spp., Cupressus spp., Tsuga dumosa, Betula utilis,Rhododendron spp., Populus ciliata* silviculture of exotic species*: Eucalyptus spp., Tectona grandis, Populus deltoids,Acacia auriculiformis, Cassia siamea, Cinnamomum camphora, Grevillea robusta, Pinus petula, Pinus carebea, Pinus oocarpa, Loblolly pine casuarina spp., Leucaena leucocephala*, Silviculture of important fodder spp.*: Acacia nilotica, Artocarpus lakoocha, Bauhinia variegata, Bauhinia purpurea, Morus alba, Sesbania grandiflora, Ficus nemoralis, Ficus cunia, Ficus glomerata, Garuga pinnata, Celtis australis, Litsea monopetala.*

Course break down

S.N.	Topic	No. of Lectures
1.	Silviculture of shorea robusta, Dalbergia sisso and Dalbergia latifolia	1
2.	Silviculture of Acacia catechu, Bombax ceiba	2
3.	Silviculture of Adina cordifolia, Gmelina arborea	1
4.	Silviculture of Terminalia tomentosa, Terminalia belerica, Terminalia chebula	1
5.	Silviculture of Albizzia procera, Albizzia lebbek, Albizzia chinensis	1
6.	Silviculture of Anthocephalus chinessis, Azadirachta indica, Melia azadirach	1
7.	Silviculture of Anogeisus latifoli, ougenia dalbergoides	1
8.	Silviculture of Lagerstromia parviflora, cederella toona and Diospyros melanoxyton	1
9.	Silviculture of Bamboo and Ratttan	2
10.	Silviculture of Castenopsis indica, Castenopsis hystrix, Castenopsis tribuloides	1
11.	Silviculture of Schimawallichii, Alnus nepalensis	1
12.	Silviculture of Michelia champaca, Pinus roxburghii	1
13.	Silviculture of Quercus semicarpifolia, Quercus incana, Quercus lamellose	1
14.	Silviculture of pinus wallichiana, Jugluns regia, Abies pindrow	1
15.	Silviculture of Picea smithiana, Cedrus deodara	1
16.	Silviculture of Taxus bacata, Juniperus spp.	1
17.	Silviculture of cupresus spp., Tsuga dumosa, Betula utilis	1
18.	Silvicultureof Rhododendron arboreum, Populus ciliata	1
19.	Siviculture of Eucalyptus spp. (Eucalyptus Camaldulensis, Eucalyptus Tereticornis, Eucalyptus Citriodora, Eucalyptus grandis), Tectona grandis, Populus deltoides, Acacia auriculiformis, cassia siamea	3
20.	Silviculture of Cinnamomum camphora, Grevillia robusta	1
21.	Pinus patula, Pinus caribea, Pinus oocarpa, loblolly pine	1
22.	Silviculture of Casuarina spp., leucaena leucocephala	1
23.	Silviculture of Acacia nilotica, Artocarpus lakoocha	1
24.	Silviculture of Bauhinia variegat, Bauhinia purpurea, Morus alba	1
25.	Silviculture of Sesbania grandiflora, Ficus nemoralis, Ficus cunia, Ficus glomerata	1
26.	Silviculture of Garuga Pinnata, celtis australis, litsea monopetala.	1
Total		**30**

TEXT AND REFERENCE BOOKS:

1. Silvics of the trees of Nepal – B.P.Kayastha
2. Manual of Afforestation in Nepal 1st.edition, 1987 – J.K.Jackson
3. Manual of Afforestation in Nepal 1st. edition, vol. 2, 1994 – J.K.Jackson
4. Silviculture of Indian trees – R.S.Troup
5. A compendium of tree species of Nepal – R.B.Thakur
6. NARMSAP, 2002. Forest and Vegetation types of Nepal. NARMSAP, TISC Document Series 105, Kathmandu

Course Code : FSE 401
Course Title : GIS in Natural Resource Management
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion this course, the students will be able to understand the concept and practice of data acquisition, storage, analysis and presentation of spatial information using Geographic Information Systems (GIS).

SYLLABUS:

Introduction to Geographic Information System (GIS) , Spatial information system

– An overview, Definition, development and components of GIS, Questions that GIS can answer, GIS software (Open source vs. Proprietary), GIS data model, GIS data structure, Spatial analysis, Errors in GIS, GIS Application in Natural Resource Management, Conceptual model of spatial information, Object based, network based and field based models, Raster spatial data model, Compact methods of storing raster spatial data (Chain codes, run length codes, block codes and quadtree tessellation), Vector spatial data model (point, line and area entities), Topology, Raster vs. vector data model, Database management concept , Database management system (DBMS), Alternatives for DBMS, Relational data model, Querying a relational database, Using GIS and DBMS together, Spatial data capturing, Direct spatial data acquisition, Digitizing paper maps, Scanning process, Vectorisation process, Spatial data already in digital raster form, Editing: Error detection & correction, Identifying and correcting digitizing error, Map projection and transformation, Spatial referencing, Spatial

reference system, Spatial reference surfaces, Datum transformation, Map projection and its properties, Classification of map projection, Projection system used in Nepal (MUTM), Spatial data analysis, Concept of spatial data analysis, Vector based spatial analysis: Extraction (clip, select), Proximity (buffering), Overlay (point, line & polygon overlay), Raster based spatial analysis, Digital Elevation Model (DEM), Error, Accuracy and Policy in GIS database, Source of errors, Process of error minimization, Data policy (metadata, patent right, dissemination), Map production, Cartographic concept and principle, Map cosmetics, Map output: Export, printing and dissemination

Course breakdown

Theory:

S.N.	Topic	No. of Lectures
1	Introduction to Geographic Information System (GIS) – An overview, Definition, development/history and its application	2
2	Components of GIS, Questions that GIS can answer, Overview of GIS software (Open source vs. Commercial)	2
3	Data model, data structure, Spatial and non spatial	2
4	Raster data model (Pixel based/resolution)	1
5	Vector data model (point, line and polygon entities)	1
6	Concept of topology in GIS	1
7	Database management concept: Overview of Database management system - Geo-database, DBMS (MS Access)	2
8	Relational data model, Querying a relational database	1
9	Using GIS and DBMS together	1
10	Spatial data capturing from GPS and analogue to digital (scanning process)	1
11	On screen digitization of paper maps, Google map and aerial photo. Error and accuracy of digitization	1
12	Map projection and transformation, Spatial referencing, Map datum	2
13	Classification of map projection, Projection system used in Nepal (Modified UTM)	1
14	Concept of spatial data analysis	2
15	Vector based spatial analysis: Overlay analysis, Extraction, Proximity, distance, area and perimeter calculation	2
16	Raster based spatial analysis	2
17	Digital Elevation Model (DEM), slope, aspect, distance, perimeter and area	2
18	Source of errors. Process of error minimization	2
19	Data policy: metadata, patent right, dissemination-online source data, standardization of data	1
20	Map production: cartography (layout), export, printing and dissemination	1
Total		**30**

Practical

S.N.	Topics	No. of Practicals
1.	Overview ArcGIS software	1
2.	Working with ArcMap and ArcTool box	2
3.	Introduction to Data capturing (Scanning, GPS)	1
4.	Georeferencing and projection	2
5.	Spatial data entry – digitization, creating and editing shape files	2
6.	Non spatial data entry/attribute data	1
7.	Query and Analysis	1
8.	Spatial analysis: DEM/DTM slope, aspect and hill shade calculation)	2
9.	Vector data analysis: extract, overlay, proximity	2
10.	Map layout, export and presentation	1
Total		**15**

REFERENCES:

1. Chang, K. 2002. Introduction to Geographic Information Systems. Tata McGraw-Hill Publishing Company Limited, New Delhi, India .

2. Shrestha, B., Bajracharya, B., Pradhan, S. 2001. GIS for Beginners, Introductory GIS Concepts and Hands–on Exercises. MENRIS, ICIMOD, Kathmandu, Nepal 2001.

3. De By Rolf A. (2001). Principle of Geographic Information System. ITC Educational Textbook Series.

4. Burroughs, PA., and Donnel, MC. (1998). Principles of Geographical Information System. Oxford University Press.

5. Demers, Michael N. (2000). 'Fundamentals of Geographic Information Systems (2nd Edition). John Wiley & Sons, Inc., ISB No. 47131423-4.

Course Code : FT 401
Course Title : Field Training
Credit Hours : 3 (0+3) Full Marks: 75 Theory: 0 Practical: 75

OBJECTIVES:

Equip the students with community based forest management practices and make able to develop its management or business plan.

COURSE:

The course will be based on the field training linking to community based forest management in group and make community forest management plan or business plan of the products of community forests.

The field training program will be developed for maximum of 10 days covering an area of community based forestry in Nepal. The faculty incharge of the field training will develop the program and conduct it. The incharge will be responsible for assessing the tour report and assign task to the students.

8th Semester Courses

Course Code : EES 403
Course Title : Global Environmental Change
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to understand the key issues and debates in Global Environmental Change and skill to demonstrate the relationship between Global Environmental Change and the characteristics of the Earth's surface processes and landscapes.

SYLLABUS:

Earth and its physical features, Environmental Study, Ecosystem and habitat, Environmental change through Earth history, Global Climate Change, Environmental degradation and its consequences and strategies, Systems management. In practical the students will be taught about Environmental assessment the Initial Environmental Examination (IEE) and the Environmental Impact assessment (EIA) processes in Nepalese perspectives and will have field visits to carry out case studies.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1	Earth and its physical features	3
	(i) The Atmosphere, Isolation and Temperature, Atmospheric Pressure and wind, Climatic zones and types, Hydrosphere	
	(ii) Biosphere, Cycles and patterns in the biosphere	

2	Environmental Study	**4**

(i) Concept of Environmental studies, Importance of Environmental studies

(ii) Past Environmental Records on

(a) Deep frozen: the ice core record

(b) Land forms and landscapes: the terrestrial record

(c) Bogs and biota: the biological record

(d) Cores and corals: the oceanic record

(e) Minerals and rocks: the geological record

3	Ecosystem and Habitat	5
	(i) Community diversity, Species diversity and Landscape diversity	
	(ii) Adaptive mechanism (Species displacement and extinction) for plants and animals	
	(iii) Habitat approach; Fresh water ecology, Marine ecology, Estuarine ecology, Terrestrial ecology	
	(iv) Perspectives in radiation ecology and Microbial ecology	
4	Environmental change through Earth history.	2
	(i) Environmental change over geological time	
	(ii) Ecological changes	
5	Global climate change.	3
	(i) Sea level rise, Global temperature rise, Warming oceans, Shrinking ice sheets, Declining sea ice, Glacial retreat	
	(ii) Circulation, Acidification, Cumulative effects, Glacial lake outburst floods (GLOF)	
6	Environmental degradation and its consequence and strategies	8
	(i) Natural Hazard: Land degradation, Perception of land degradation, Development and concern for land degradation, Problems of Land degradation, Forms of land degradation and their severity, Process of land degradation, Causes of land degradation, Land Sensitive to degradation and Environments stability, Occurrence of land degradation beyond limits	
	(ii) Sustainability and sustainable development, Concept of sustainable development, Rio 1992 and Agenda	
	(iii) Dry lands, Johannesburg World Summit 2002	
	(iv) Desertification	
7	Systems management	5
	(i) Managing the unavoidable, Ecosystem adaptations, Gene bank for a warming World, Reducing emission from deforestation and forest degradation	
	(ii) Avoiding the unmanageable, Geo-engineering, Carbon capture and storage,	
Total		30

B. Practical

S.N.	Topic	No. of Practicals
1	Initial Environmental Examination of any Community Forests	5
2	Environmental Impact Assessment of any wood based industries or road constructions Individual student will complete two case studies (one in IEE another in EIA) based on primary and secondary data. In this work, the students will identify the issues, set proposal, rationale, objectives, methodologies and techniques with the help of guidance of case study supervisor. The student will independently observe the case, collect and analyze data and finally prepare the report.10 marks for IEE Report and 15 marks for EIA Report are allocated for Case studies.	10
Total		**15**

REFERENCES:

1. Bradely, R.S. and P.D.Jones 1995. Climate since A.D. 1500. Routledge

2. Dawson, A.G.1992. Ice Age Earth: Late quarternary geology and climate. Routledge

3. Goudie, A.1992. Environmental Change (3rd Edition) OUP

4. Houghton, J.T. 1997. Global Warming: the complete briefing (2nd Edition) CUP

5. Mackenzie, F.T. 2003. Our Changing Planet: An Introduction to Earth System Science and Global Environmental Change. Prentice Hall (ISBN: 0-13-065172-9)

6. Odum, E.P. 1996. Fundamentals of Ecology, Dehradun, Natraj Publication, India

7. Pradhan,P.K. and B.Pradhan 2006. Environment and Natural Resources: Concepts, Methods, Planning and Management, Quest Publication, Kirtipur, Kathmandu, Nepal.

8. Muhammed, A and Aslanks (2003). Climate Change and Water Resources in South Asia Proceedings of year, End workshop, Kathmandu, Nepal. Agro Dev International, Islamabad, Pakistan

9. McMullen,C. and J.Jabbour (Eds.) 2009. Climate Change Science, Compendium., UNEP

10. Environment Management Guidelines – Rural Energy Development Program NEP. 95/016, HMG, UNDP

11. Environment Conservation Act, 1996 and Environment Regulation1997, HMG, Ministry of Population and Environment.

Course Code : SWM 401
Course Title : Soil Survey and Degraded Land Management
Credit Hours : 3 (2+1) Full Marks: 75 Theory 50 Practical 25

OBJECTIVES:

After successfully completing this course, the students will be familiar with soil survey and degraded land management; be able to make a technically accurate soil survey; have a basic understanding of land degradation process and its elements; have a working knowledge of degraded land rehabilitation.

SYLLABUS:

Concept of soil and soil survey, importance and scope of soil survey, development of soil survey, soil survey methodology, soil mapping and soil classification

Definition of land degradation, causes of land degradation, land degradation types and processes: soil erosion (by water and wind), soil compaction, soil crusting, sedimentation, stoniness, urbanization, water logging, lowering of water table, soil fertility decline, soil salinity, soil toxicity, loss of vegetation cover, loss of biodiversity, desertification, sensitivity and resilience of land, field assessment of land degradation, level and scale of land degradation, degraded land rehabilitation. In practical the students will be taught about application of various tools and methods of soil survey, soil sampling and soil analysis, soil classification, assessment of land degradation, planning for degraded land rehabilitation, and degraded land rehabilitation measures.

Course Breakdown

Theory

S.N.	Topic	No. of Lectures
1.	Concept of soil and soil survey	
2.	Importance and scope of soil survey	1
3.	Development of soil survey	1
4.	Soil survey methodology	2
5.	Soil mapping	2
6.	Soil classification based on soil survey	2
7.	Introduction and definition of land degradation	1
8.	Causes of land degradation	1
9.	Land degradation types and processes:	
	(i) Natural (flooding, wind etc)	1
	(ii) Human induced (deforestation, overgrazing, fire etc	1
	(iii) Soil erosion (by water and wind)	1
	(iv) Soil compaction and soil crusting	1
	(v) Increased stoniness and sedimentation	1
	(vi) Urbanization and water logging	1
	(vii) Lowering of water table and soil fertility decline	1
	(viii) Soil salinity and soil toxicity	1
	(ix) Loss of vegetation cover and of biodiversity	1
	(x) Desertification	1
10.	Sensitivity and resilience of land	1
11.	Field assessment of land degradation	2
12.	Level and scale of land degradation	1
13.	Planning for degraded land rehabilitation and management	2
14.	Degraded land management principles	1
15.	Degraded land rehabilitation measures	2
Total		**30**

Practical

S.N.	Topic	No. of Practical
1.	Identification of equipment and tools used in soil tests and analysis	1
2.	Soil sampling, soil profile digging and description in the field	1
3.	Experiments on soil sampling and tests (soil pH, NPKC analysis)	2
4.	Analysis of soil texture (sieve and hydrometer method)	1
5.	Classification of soils (based on field data)	1
6.	Mapping of soil	1
7.	Visit to degraded area for identification of causes & types of land degradation	2
7.	Assessment severity of land degradation	2
8.	Planning for degraded land rehabilitation in a package	2
9.	Field exericise on how to apply degraded land rehabilitation plan	2
Total		**15**

REFERENCES:

1. Barrow, C.J. 1990. Land Degradation Development and Breakdown of Terrestrial Environment. Cambridge University press: 295p.

2. Brady, N. C., 2001.Nature and Properties of Soils. 10th edition. Prentice – hall of India, Private Limited, New Delhi 11001:621p.

3. Conacher A. J. (edited) 2001. Land Degradation. Kluwer Academic Publishers

4. Dent, D. and A. Young 1981. Soil Survey and Land Evaluation. E. and FN Spon, Reprint 1993 (A standard handbook on soil survey and land evaluation)

5. FAO 1990. Guideline for Soil Description. FAO, Rome, Italy

6. FAO, 1996. Assessment of Status of Human induced Soil Degradation in Southeast Asia (ASSOD): Process report in proceeding of the expert consultation of the Asian network on problem soils. Manila Philipines,23 27 October,1975 : 39p

7. FAO, 1994. The Collection and Analysis of Land Degradation Data, Report of the expert consultation of the Asian network on problem soils. Bangkok, Thailand, 25 29 October 1993:261p

8. FAO, 1994. Land Degradation in South Asia: Its Severity, Causes and Effect upon the People. world soil resources reports No.78.ISSN 0532 0488:102p

9. Singh, J. S. (edited) 1993. Restoration of Degraded Land: Concepts and Strategies. 321 p

10. US Department of Agriculture, 2009. Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 51 Version 1.0. National Soil Survey Center, Rebecca Burt and Natural Resources Conservation Service

11. Wong, M. H. 1999. Remediation and Management of Degraded Lands. CRC Press - 392 P, Hong Kong Baptist University

Course Code : PP 401
Course Title : Project Paper
Credit Hours : 6 (0+6) Full Marks: 150
Theory: 0 Practical: 150

OBJECTIVES:

Experience the students with writing project proposal, working on project, information collection, analyzing, report preparation and presentation.

SYLLABUS:

The course will be based on the project work under a faculty supervisor. The student will develop proposal, seek funding, work as per proposal, prepare report and make submission. The supervisor will examine the project paper as internal and externally will be examined with concerned expert. Average marks of the both examiner will go to his/her grade.

Course Code : SM 401

Course Title : Seminar

Credit Hours : 1 (0+1) Full Marks: 25

Theory: 0 Practical: 25

OBJECTIVE:

Upon the completion of the course, the students will be able to prepare seminar paper, power point slides for seminar and present scientific paper.

SYLLABUS:

The output of the Project paper will be presented orally by each student in the class before the audience of students, faculty and other relevant. The faculty assigned for conducting the Seminar will evaluate the presentation with a team of evaluators. The marks of presentation given by the team will go to his/her grade.


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