

Tribhuvan University
Institute of Engineering
Pulchowk Campus, Lalitpur, Nepal
M. Sc. Engineering in Renewable Energy Engineering

OUTLINES OF COURSES

Year : I

Part : I

Teaching Schedule				Examination Scheme			Total	Remarks
S. N.	Course Code	Course Title	Credit	Theory				
				Assessment Marks	Final			
					Duration hours	Marks		
1	801 ME	Fundamentals of Thermal Engineering	4	40	3	60	100	
2	802 ME	Fluid Mechanics with Engineering Applications	2	40	3	60	100	
3	803 ME	Applied Sociology	2	40	3	60	100	
4	804 ME	Renewable Energy Resources	4	40	3	60	100	
5	805 ME	System Mathematics	4	40	3	60	100	
Total			16	200	15	300	500	

Year : I

Part : II

Teaching Schedule				Examination Scheme		Total	Remarks
S. N.	Course Code	Course Title	Credit	Theory			
				Assessment	Final		

				Marks	Duration hours	Marks		
1	851 ME	Research Methodology	4	40	3	60	100	
2	852 ME	Energy Finance and Economics	4	40	3	60	100	
3	853 ME	Elective I	4	40	3	60	100	
4	854 ME	Elective II	4	40	3	60	100	
Total			16	160	12	240	400	

Elective I

Elective II
 Renewable Energy Systems Technology
 Solar Thermal Technology
 Solar PV Technology
 Micro-hydro
 Bio gas Technology
 Bio fuel Technology
 Wind Energy Technology

Year : II

Part : I

Teaching Schedule				Examination Scheme		Total		Remarks
S. N.	Course Code	Course Title	Credit	Theory		Marks		
				Assessment Marks	Final Duration hours			
1	902 ME	Elective III	4	40	3	60	100	
2	903 ME	Elective IV	4	40	3	60	100	
3	901 ME	Group Project	4	100	-	-	100	
Total			12	180	6	120	300	

Elective III

Project Planning and Management
 Operations Research/Management Science

Elective IV

New Renewable Energy Technologies (NRETs)

Environmental Impacts and Climate Change
 Energy Planning and Management
 Energy Auditing, Analysis and Conservation
 System Integration
 Human Resource Management and Communication Skills
 Design and Manufacturing
 Instrumentation and Measurement System

Year : II

Part : II

Teaching Schedule				Examination Scheme		Total	Remarks
S. N.	Course Code	Course Title	Credit	Theory			
				Assessment Marks	Final Marks		
1	951 ME	Thesis	16	40	60	100	

Year: I Part: I

801 ME: Fundamentals of Thermal Engineering (4 Credit)

Laws of Thermodynamics, Basics of Heat Transfer, Heat Exchangers, Combustion Process, Fuel Conversion Efficiency, Emission Control and Analysis, Applications of Thermodynamic Processes and Heat Transfer for Renewable Energy Devices.

802 ME: Fluid Mechanics with Engineering Applications (2 Credit)

Basic Equations of Fluid for Incompressible and Compressible Fluid with their Applications, Basic Flow Field, Streamlines, Velocity Potential, Stream Function, Flow Net. Similitude and Dimensional Analysis. Turbine (Impulse and Reaction) Principles, Components, Force Calculation. Pumps and related Theories.

803 ME: Applied Sociology (2 Credit)

Basic Concepts of Applied Sociology, Structures, Roles of Community, Socio- economic Impacts due to Development of Energy, Gender and Ethnic issues, Applications of Sociology with Reference to Energy.

804 ME: Renewable Energy Resources (4 Credit)

Classifications of Energy Resources, Conventional and Non-conventional Energy Resources, Fossil Fuels, World Energy Scenarios, Potential of Different Sources of Energy in Nepal, Supply and Demand of Energy in World, Asia, South Asia and Nepal
Renewable Energy Resources: Solar Energy, Biomass/Bio-energy, Energy Generation from Waste, Micro hydropower, Wind Energy, Geothermal Energy, Wave Energy, Tidal Energy, OTEC, Fuel-cell, Nuclear Energy and Hydrogen Energy
Energy Policy of Nepal, Energy Supply and Demand Side Management, Subsidy Policy for Renewable Energy in Nepal, Service and Subsidy Delivery Mechanism, Carbon Trading, CDM, Marketing and Non-marketing Approach.

805 ME: System Mathematics (4 Credit)

Linear System, Non Linear System and Stability, Probability and Statistics, Mathematical Programming/Optimization Techniques, System Modeling and Simulations, Forecasting, Geographical Information System.

Year: I Part: II

851 ME: Research Methodology (4 Credit)

Types of Research, Defining Research Problem, Research Design, Sampling, Measurement and Scaling Technique, Methods of Data Collection, Processing and Analysis, Testing of Hypothesis, Analysis of Variance, Multivariate Analysis Technique, Proposal Writing, Thesis Writing, Preparation of Research Paper.

852 ME: Energy Finance and Economics (4 Credit)

Energy Organization, Energy Finance, Cost and Revenue, Financial Statement Analysis of Energy Firms, Capital Budgeting, Benefit Cost Analysis, Financing Renewable Energy Projects, Carbon Trading, CDM, Market and Non-market approaches.

853 ME: Elective I (4 Credit)**Elective I: Renewable Energy Systems Technology**

Biomass Technologies (Improved Cook Stoves, Briquette Making Machines, Gasifiers, Bio-fuel Technologies, Biogas Plant), Solar Thermal Devices (Application of Active and Passive Solar Thermal Systems, Flate and Solar Concentrator Type Devices, Design of Solar Water Heater, Solar Dryer and Solar Cooker), Solar PV System (Application of Photovoltaic Systems, Design of Solar PV Appliances), System Design of Micro hydro Power System, Design and Feasibility of Wind Energy Generation, Available Harnessing Geothermal Resource Technology, OTEC Devices, Wave Power Extraction Devices, Tidal Power Generation Devices, Fuel-cells, Hybrid Energy Systems, Environmental Impact Assessment of Renewable Energy Technologies.

854 ME: Elective II (4 Credit)**Elective II: Micro-hydro**

Hydrology and Site Survey, Layout Design and Selection of Components, Installing, Commissioning and Testing, Repair and Maintenance, MHP Project Evaluation, Policies and MHP Plants Identified in Nepal, Grid Connection, New Researches for Microhydropower and its Components.

Elective II: Bio-fuel Technology

Solid Biomass (Wood and Non-wood Solid Biomass Fuel Energy): Introduction, Solid Biomass Resources (Fuel Wood, Agricultural Residues, Animal Residues), Solid Biomass Fuel Conversion and Utilization, Environmental, Economical and Social Impact of Biomass.

Liquid Biomass (Bio-fuel Energy): Introduction, Bio-fuel Resources and Production, Bio-ethanol, Bio-diesel, Bio-hydrocarbons, Bio-fuel Conversion and Application, Environment Impact of Bio-fuels.

Gaseous Biomass Fuel (Biogas Energy): Introduction, Advantages of Biogas, Limitation of Biogas, Economics of Biogas Plant Installation in Nepal, Design Concept and Parameters of Biogas Plant, Quality Control of Biogas Plant, Biogas in relation to Environment, Ecology, Health and Sanitation

Wood and Non-wood Solid Biomass Fuel Resources, Wood and Non-wood Solid Biomass Fuel Conversion and Utilization, Design of Biomass Energy Technologies, Degradation of Lignocelluloses, Modification and Optimization Techniques, New Researches Opportunities.

Elective II: Solar Thermal Technology

Flat Plate Solar Collectors, Concentrating Collectors and Shallow Solar Collectors, Design of Solar Heating, Passive Heating, Cooling, Drying Systems, Performance of Solar Thermal Devices, Modifications required in Solar Thermal Devices, System Design of Solar Thermal Devices for Specific Purposes, New Researches for Solar Thermal Devices.

Elective II: Solar PV Technology

System Design of Solar PV Systems including Solar Home System, Institutional Solar PV System, Solar Pumping System, Solar Mini-grid System, Integration of Solar PV into National Grid, Solar-wind Hybrid System, Solar-Biomass Hybrid System, Testing of Solar PV system Components, New Researches for Solar PV and its components.

Elective II: Biogas Technology

Microbial Activities and Pathways in Anaerobic Digestion, Biogas Production in cold Climate, Design Concept and other Parameters of Domestic and Large Size Biogas Plant, Modifications and Optimization Techniques, New Researches Opportunities.

Elective II: Wind Energy Technology

Basics of Wind Power Technology, Wind Machine Fundamentals, Wind Energy Resource Analysis, Wind Energy System Design, Wind Power Systems, Solar-Wind Hybrid System, Legal Issues, Modification and Optimization Techniques, New Researches Opportunities.

Year: II Part: I**901 ME: Group Project (4 Credit)**

Group Project Works (as per BE Background), Research Proposal Preparation and Presentation, Sample Research Paper Preparation.

902 ME: Elective III (4 Credit)**Elective III: Project Planning and Management**

Basics of Project Management, Project Identification, Planning, Formulation and Appraisal, Project Organization and Implementation, Project Monitoring, Controls and Information Systems, Decision & Risk analysis, Project Evaluation and Auditing, Contract Management, Quality and Value Management.

Elective III: Operations Research/Management

Introduction to Modeling for Decision, Data Management and Analysis, Regression Analysis, Forecasting Models for Time-series, Introduction to Optimization, Linear and Multi-objective Optimization Models, Interpreting Solver Results and Sensitivity Analysis, Decision and Risk Analysis, Expected Value Decision-making, Monte Carlo simulation, System modeling and Simulations, Modeling and Simulating Dynamic Inventor Models.

903 ME: Elective IV (4 Credit)**Elective IV: New Renewable Energy Technologies**

Geothermal Energy: Application, System Design

Ocean Thermal Energy Conversion: Application, System Design

Hydrogen Energy: Fuel-cell, Storage Technique, Modification

Bio-Hydrogen: Production, Optimization Techniques

Wave Energy: Application, System Design

Tidal Energy: Application, System Design

Nuclear Energy: Application and Design of Fission Techniques, Research in Fusion,
New Research Opportunities for New Renewable Energy Technologies

Elective IV: Environmental Impacts and Climate Change

Local, Regional and Global Environmental Impacts, Quantitative Tools for Environmental Problem Solving, Air Pollution, Water Pollution, GHGs Emission, Radioactivity, Radiation Balance, Impacts and Consequences of Climate Change, Climate Change Mitigation and Adaptation, Carbon Trading, CDM, Market and Non-market Approach.

Elective IV: Energy Planning and Management

Basics of Energy Planning, Concepts of Energy Planning for Microeconomic and Macroeconomic Systems, Energy Demand Analysis and Demand Projection, Energy Supply Analysis and Supply Projection, Energy Option Evaluation and Policy Analysis.

Elective IV: Energy Auditing, Analysis and Conservation

Energy Auditing Technique, Use of Renewable Energy in Place of Fossil and/or Traditional Energy, Use of Energy Efficient Technologies/Machineries, Energy conservation in Industries, Energy Conservation in Buildings, Co-generation, Electrical Energy Conservation, Electrical Energy Demand and Load Management, Energy conservation in Lighting System.

Elective IV: System Integration

Application of Integrated Systems, Simulation of Integrated Systems, Optimization Methods, Applications of Optimization Techniques, Design of Integrated Village Power Systems.

Elective IV: Design and Manufacturing

Sketch and Working Drawing, Jigs and Fixtures, Analysis of Metal Forming Processes, Design of Product for Economical Production, Failure Theories, Safety Factors and Reliability.

Elective IV: Instrumentation and Measurement System

Basic instrumentation in Electrical Engineering and Electronics, Instrument Fundamentals, Electrical measurement, Transducers, Microprocessor based Instrumentation, Motion and Dimensional Measurements, Force Torque and Shaft Power Measurement, Heat Flux and Temperature, Flow and Pressure Measurement

Elective IV: Human Resource Management and Communication Skills

Introduction to Human Resource Management, Environmental Context: New Economic Policy, Technological, Socio-economic and Political, Legal Environment Structural Reforms, their Implication for HRM in Nepal, Introduction to Strategy and Strategic Management-the Paradigm Shifts in People Management, Emergence of Human Resource Management, Human Resource Planning: Recruitment, Selection, Training and Development, HRD Development in Nepal, Labor Performance Management and Appraisal, Compensation/Rewards System, Labor Management-Industrial Relations, Features of Industrial Relations in Nepal, Collective Bargaining, Trade Unions and Trade Unionism, Theories of Trade Unions, Trade Union Law, Trade Unionism in Nepal, Issues and Problems, Employees Associations, Managerial Unionism, Roles of Communication Skills.

Year: II Part: II**951 ME: Thesis (16 Credit)**

Proposal Defense, Mid-Term Defense, Pre-Defense and Final Defense of Research Work, Dissertation/Thesis with New Innovations, Minimum One Research Paper Based on Dissertation (Published/Accepted)