

**Department of Economics,
Faculty of Social Sciences,
Banaras Hindu University, Varanasi**

**Draft Syllabus of Masters in Energy Economics (MEE) for Approval
Will be in force from Session 2017-18**

Background to the Course:

This course owes its Origin to the BRICS-NU programme to which Banaras Hindu University is an International Partner. Of few selected Core Areas of Research and Higher Study Energy is an important part and Energy Economics is one among the cores. It is our proud privilege that the Hon'ble Vice Chancellor, Prof. G.C.Tripathy happens to be the Leader of this Core Area and Group. On the initiation of the Hon'ble Vice Chancellor and the guidance of the Dean of Faculty of Social Sciences Prof.Manjeet Kumar Chaturvedi, Department of Economics decided to launch this course, Master in Energy Economics.

Course preamble:

Efficiency and sustainability of energy system are pre-requisites for Sustainable Development and the challenges to achieve this lie at the interface of technology innovation and human behavior. This course is tailored for the student desiring an understanding of the relationship between the energy sector and the wider economy. It covers additional topics in related and associated fields of Management, Commerce, Engineering, Mining and Natural Resources with emphasis on tracing the national and Global impacts and implications of energy sector decisions. This course provides an overview of the economic, technological, and political forces that shape the global energy industry, the methods governments use to regulate the industry, and the business models that emerge.

The course aims at broadening the vision of students while making any energy related decision as a technology developer, energy manager, entrepreneur, policy maker, researcher in future or simply for personal energy use in day to day activities.

Topics to be covered include, resource based energy activities, depletion policy and environmental issues, pricing security and sustainability.

The course begins by framing the industry in its microeconomic context and uses that framework to explore the role of technology and innovation, global markets and geopolitics, and the regulation of externalities including climate change. The readings and coursework will use specific examples from the power, renewables, oil & gas, and environmental sectors from the both developing and developed countries and other select geographies to illustrate these forces in context. Students can tailor their final policy memo towards their topics of interest.

Objectives

The aim of the of the Masters in Energy Economics programme is to prepare the students for managerial , advisory and academic position in the energy sector. The programme aims to provide an intellectually challenging academic programme which will strengthen the ability of students to analyse, synthesise and evaluate key theoretical concepts and practical

applications in energy with emphasis on the economic dimensions of the subject. Since the world's long term economic development depends on the existence of efficient, innovative and creative energy industries individuals who possesses sound knowledge on various aspects like economic, commercial, technical, management and environmental aspects will be of high demand and cater to the need of both at national and international level.

Student learning outcomes:

At the end of the course, the student will have a better understanding of the functioning of international energy markets, developed tools and techniques to learn more and analyze even beyond the course. The students will:

To master theoretical models relating to energy markets, energy regulation and policy, environmental issues, risk management, energy and the economy, energy sustainability be able to work out quantitative examples and use computer applications and skill to increase intuitive understanding of theoretical models

To understand the economic principles developed in the models

To understand how models can be used for forecasting, policy analysis and project evaluation

To have an understanding of terminology along with key drivers and interactions in energy markets

To be able to acquire and use information in major international energy data bases

To be familiar with important institutions, technologies, concepts, and public policy issues

To think critically and recognize energy myths and misconceptions.

The Class Room and Methods of Teaching

This is a lecture and discussion based course. The chief mode of teaching is interactive interface between the teacher and the taught. Student participation is encouraged and expected. Students will be provided with reading materials and references and are encouraged to read assigned material before the scheduled class, so that they can participate meaningfully in the class room discussion. From time to time additional readings will be added to the course as may be deemed to be relevant and necessary. Apart from regular class room teaching seminar discussions, workshops, invited talks, guest lectures and video shows. All modules will be delivered in the Department of Economics, Faculty of Social Sciences, on the campus of the Banaras Hindu University in face-to-face mode. Self-study makes up a considerable proportion of the student's learning experience. Formal and informal group work occurs in some modules. There will be industry- academia interaction with the successful actors. The students are required to complete successfully one internship between 2nd and 3rd Semester and a project work during 3rd and 4th Semester. The internship will be evaluated and credit will be awarded by the host institute.

Eligibility: Graduates with minimum 50% of marks from BA(Economics), BA (Hons) Economics, B.Com, B.Tech and MBA are eligible for admission in to this course. However, since the course is mathematics oriented and use higher mathematics candidates desirous of admission in to it are required to have Mathematics as a subject at Senior Secondary School.

Admission: Admission to the course is through the ALL INDIA ADMISSION ENTRANCE TEST (PET) conducted by the Banaras Hindu University. After qualifying the entrance test students are required to face the counseling by the University and the admission is based strictly on merit basis.

The Course Fee: This is a self finance course and students are required to pay a fee of Rs.30,000/- per semester and a total of Rs.1,20,000/- for the full term four semester course. A part from other regular fees also payable.

Course Structure:

All papers covered under the course are Core courses of 4 credits each and dissertation is 4 credits. The internship is assigned with 4 credits. So total credit score is 84 credit.

Sl.No	Course No	Course Title	Course No	Course Title
		SEMESTER I	SEMESTER II	
1	MEE-101	Microeconomics	MEE -201	Macroeconomics
2	MEE -102	Energy Economics	MEE -202	Basic and Applied Econometrics
3	MEE -103	Environmental Economics	MEE -203	Advanced Resource Economics
4	MEE -104	Mathematical Economics	MEE -204	Investment and Portfolio Managemen
5	MEE -105	Applied Statistics	MEE-205	Advanced Mining and Evaluation
		SEMESTER III	SEMESTER IV	
6	MEE-301	Operations Research	MEE -401	Economic Evaluation and Project Management
7	MEE-302	Research Methods for Energy Analysis	MEE-402	Management of Technology for Energy
8	MEE-303	International Trade in Energy resources	MEE -403	International Business Strategy and Energy Sector
9	MEE -304	Energy ,Economy and Society	MEE -404	Energy, Climate Change and Global Politics
10	MEE-305	Accounting and Finance	MEE -405	Field Work based Dissertation

System of Examination and Evaluation

Students will be assessed on the following basis:

Course Work: 30% : (Mid semester examination / field work 20%; Presentation 10%)

Final Examination: 70 %

Dissertation: 100 marks.

SEMESTER WISE DETAILED CURRICULUM

SEMESTER I:

MEE-101 Microeconomics

Unit I : Basic Economic Problems

Central Economic Problems; Problem of Allocation of Resources; Resource Scarcity and Substitutability; Problem of Economic Efficiency; Problem of the Extent of Utilization of Resources.

Unit II : Basic Economic Concepts

Concepts in Model Building: Variables — Dependent and Independent Variables, Endogenous and Exogenous Variables, Stock and Flow Variables, Functional Relationships and Parameters, Identities and Equations, Building a Micro-Static Model; Process of Building and Testing an Economic Model; Distinction and Integration between Micro and Macro

Economics; Time Lags; Economic Models; Employing Data for Empirical Estimation; Statistical Testing.

Unit III: Demand and Demand Forecasting

Demand — Meaning, Conditions, Function, Shift Factors in Demand; Demand for Energy as a Derived Demand; Demand Forecast — Features, Objectives, Importance; Criteria for a good Forecasting Method; Steps in Demand Forecasting; Methods of Demand Forecast; Demand Forecasting of an Energy Product; Network Externality in Demand.

Unit IV: Market and Market Structures

Classification — Perfect and Imperfect Competition; Factors determining the Nature of Competition; Barriers to Entry; Types of Barriers.

Pricing Strategies

Price Leadership — Types, Features, Merits and Problems; Price Policy — Objectives, Merits, Problems and Importance; Factors affecting Pricing Policy; Methods/Strategies and Kinds of Pricing; Guidelines for Price Determination; Principles of Price Policy; Price and Allocation Controls.

Unit V: Cost Analysis

Cost Concepts used in Decision Making Process; **Short-Run Cost Functions — Average Fixed Costs, Average Variable Costs, Relationship between Average Product and Marginal Product, and Average Variable Cost and Marginal Cost; Long-Run Cost Functions — Economies and Diseconomies of Scale, Economies of Scope; Application of Cost Analysis — Breakeven Output Level, Factors Influencing Break- Even Point—Changes in Price, Fixed Cost and Variable Cost Per Unit, Profit Contribution Analysis, Operating Leverage, Limitations and Significance of Break- Even Analysis.**



MEE -102 Energy Economics

Unit I: Introduction to Energy Economics

Define Energy Economics; Energy Resources and Energy Commodities; Properties of Energy Resources and Energy Commodities; Law of Thermodynamics; Energy Conversion Processes; Energy Conservation and Energy Efficiency.

Unit II: Energy Crisis

Understanding the Energy Crisis— Past to Present; The International Energy Crisis of the 1970s—Causes, Effects and Solutions to the Global Energy Crisis; Energy Crisis and Solution in India.

Unit III: Economics of Energy Supply

Classify energy on the basis of sources — renewable or non-renewable; worldwide energy supply — by country; sources of energy supply — Fossil fuels (coal, oil, natural gas), Renewable energy (Hydro, Marine, wind, solar, Geothermal, bio), Nuclear power; Trend and patterns of energy production; Social, Economic and Environmental Effects of Energy Production; Life Cycle of Energy Sources.

Unit IV: Energy Demand Analysis

Demand for Energy as a Derived Demand; Demand Substitution among Energy Commodities; The Increasing Global Demand For Energy— Causes and Impact of increase in Demand for Energy; World Energy Consumption — Economic Growth and World Energy Consumption by Source; Energy Consumption by End-use Sector (Buildings Sector, Industrial Sector, Transportation Sector), Global Variations in Energy Use; Energy Use, Social Problem and Energy Conservation;

Unit V: Trends in Energy Conservation

Trend and Patterns of Energy Consumption; Empirical Estimation of Economic Growth and Energy Consumption; Empirical Demand Projection for Energy Sources — Regression Technique.

Economic Pricing of Energy Sources

Production Cost versus Return of Investment; Empirical Determination of Breakeven (economic) Price — Determination of Optimum Level of Output and attainment of Equilibrium Level of Price of Energy Sources.

MEE -103 Environmental Economics

Objectives: This paper would enable the students to know about the theories of welfare economics, environment and economy. Issues relating to environmental problems, policies and protection and pollution control also find a special place in the syllabus.

Unit-I: Economy and Environment

Environment-economy relationship-Laws of Thermodynamics and Material Balance Model, Environmental Kuznets Curve (EKC): Concepts and Genesis. Explanations of inverted-U shaped EKC-empirical evidence- N-shaped EKC.

Unit II: Environmental Pollution as Economic Problem

Environmental Pollution as a Negative Externality (Pigou), the issue of Property Rights (Coase), Optimal Pollution

Unit III: Pollution Control: Command and Control and Alternative Market Based Instruments

Command and Control measures; Pigouvian taxes and subsidies, marketable pollution permits and mixed instruments (the charges and fees), Tradable pollution permits and international carbon tax, Coase's bargaining solution and collective action; □ Hybrid Instruments- two-part tariff, double dividend hypothesis, illicit dumping.

Unit IV: Environmental Valuation

Basic issues of environmental valuation, Revealed Preference Approach- household production function, travel cost, Hedonic price; Stated Preference Approach-contingent valuation method.

Unit V: Sustainable Development and Environmental Accounting

Concept of sustainable development-sustainable development rules and indicators-measures of sustainable development, Sustainable accounting-economics of green accounting and sustainable resource management, Green Economy

References

Books

Pearce, D.W. and Turner, R.K. (1991) : *Economics of Natural Resources and the Environment*, Hemel Hempstead, Harvester-Wheatsheaf.

Baumol, W.J. and Oates W.E.(1988) : *Theory of Environmental Policy*, 2nd Edition, Cambridge University Press.

Bhattacharyya, R.N. (2001) : *Environmental Economics : Indian Perspective*, Oxford University Press.

Hanley, N., Shrogen J.F. and White B. (1997) : *Environmental Economics in Theory and Practice*, Macmillan.

Perman R., Ma Y., McGilvary, J and Common, M (1999) : *Natural Resources and Environmental Economics*, 2nd Edition , Prentice Hall.

Freeman III, A.M.(1999) : *The Measurement of Environmental and Resource Values : Theory and Methods*, Resources for the Future, Washington D.C.

Kolstad, C.D. (2000): *Environmental Economics*, Oxford University Press.

Bromley, D.W. (1995): *Handbook of Environmental Economics*, Blackwell.

Articles

Dinda, S.(2004) : "Environmental Kuznets Curve Hypothesis- A Survey", *Ecological Economics*, 49 :431-455.

Munasinghe, M. (1999) : “Is Environmental Degradation an Inevitable Consequence of Economic Growth: Tunneling through the EKC”, *Ecological Economics*,29 :89-109.

Harrison,D. and D.L. Rubinfeld (1978) : “Hedonic Housing Price and the Demand for Clean Air”, *Journal of Environmental Economics and Management*,5: 81-102.

Banerjee, S. (2001): “Economic Valuation of Environmental Benefits/Costs” in Bhattacharyya R.N. (ed) “*Environmental Economics : Indian Perspective*” ,Oxford University Press.

Chopra, K.(2004) : “The Valuation of Biodiversity :the Case of Keoladeo National Park” in Kadekodi, G.(ed) “*Environmental Economics in Practice: Case Studies from India*”, Oxford University Press.

Markandya,A. and Murty, M.N.(2001) ; ‘Measuring Non-user Benefit from Cleaning Ganges’ in Markandya,A. and Murty, M.N “*Cleaning up the Ganges :A Cost-Benefit Analysis of the Ganga Action Plan,*” Oxford University Press.

Sanyal, K. (2001) : “International Trade and the Environment” in Bhattacharyya R.N. (ed) “*Environmental Economics : Indian Perspective*” ,Oxford University Press.

Chakraborti, P. (2001): “Global Environmental Issues and Initiatives” in Bhattacharyya R.N. (ed) “*Environmental Economics: Indian Perspective*”, Oxford University Press.

Chichilinski, G. (1994): “North-South Trade and Global Environment”, *American Economic Review*, 84(4):857-875.

MEE -104 Mathematical Economics

Unit I: Unconstrained optimization: one and more than one independent variable case, point of inflexion, concave and convex functions. Solution with help of simple, partial and total differential approach. Applications of unconstrained optimization in consumer’s/producer’s behavior and in various forms of market.

Unit II: constrained optimization: optimization and its solution with help of Lagrange multiplier (first order condition) and Bordered Hessian_(second order condition) techniques. Application of constrained optimization in consumer’s/producer’s behaviour.

Unit III Input-output analysis: the economic problem, assumptions. National income accounting matrix. Construction of input output table. Leontief’s input output models: Assumptions, Leontief’s open model, Leontief’s closed model, Leontief’s dynamic model. The Hawkin-Simon feasibility conditions.

Unit IV: Game theory: Game theory and economics, Features of competitive games. Some useful terminology. Solution for game theory. Rule (I)-pure strategy, Rule (II)-reduction in strategies by dominance property, Rule (III)-mixed strategy, Nash equilibrium.

Unit V: Differential equations: first order linear differential equations- homogeneous and non homogeneous cases and its solution. Application of first order differential equations in growth models and in the market. Introduction to optimal control theory.

Selected References:

1. Baldani, Bradfield & Tuvner (2007), An introduction to mathematical economics. Canada: Cenegage Learning.
2. Edward T. Dowling (1980), Introduction to mathematical economics. New Delhi: Tata McGraw Hill.
3. Alpha C. Chiang (1984), Fundamental methods of mathematical economics. New Delhi: McGraw Hill, International Book Company.
4. Yamane, Taro (1968), mathematics for economists: an elementary survey. New Delhi: Prentice Hall.
5. Allen, R.G.D. (1959), Mathematical Economics. St. Martin's press.
6. Intriligator, M.D. (1970), Mathematical optimization and economic theory. Prentice Hall.
7. Takayama, A. (1974), Mathematical Economics. The Dryden Press.
8. Henderson, J.M. & Quandt, R.F. (1980), Microeconomic Theory: A Mathematical approach. McGraw Hill.
9. Allen, R.G.D. (1986), Mathematical analysis for economists. New Delhi: Macmillan.

MEE -105 Applied Statistics

Unit I: An overview of statistics, Data description: scales of measurement, how to describe data graphically for categorical data (pie chart, bar chart) and graphs for quantitative variables (histogram, stem-and-leaf plot and time plot), how to describe data by summary statistics: measures of central tendency and variability

Unit II: Correlation and Regression Analysis

Meaning and types of Correlation, Simple Correlation Analysis; Pearson's Product Moment Method & Spearman's Rank Correlation Coefficient , Partial and Multiple Correlation

Analysis, Properties of Correlation Coefficient, Regression Analysis: Meaning , basic concepts of Regression, Concept of Least Squares Method and examples, Properties of Regression Coefficients /lines, Standard Error of Estimate,

Unit III: Random variables: Functions of random variables and their distributions, Sampling Distributions of Sample mean and variance, Planning of Sample Surveys - Methods of data collection, problem of sampling frame, choice of sampling design, pilot survey, processing of survey data, Non-sampling errors - Sources and treatment of non-sampling errors. Non –sampling bias and variance.

Unit IV: Probability

Meaning of probability and types of events, Laws of probability-Addition, Multiplication, Baye's Theorem and Expected Value Theorem. - Applications.

Unit V: Theory of Generalization and Hypothesis Testing

Concept of an Estimator and its Sampling Distribution, Properties of good Estimator, Concepts of Hypothesis, Formulation of Statistical Hypothesis –Null and Alternative Hypothesis , Types of errors: Type I and II Errors, Hypothesis Testing based on t , Z ,F, Chi-Square , Statistical test, critical region, test functions, randomized and non–randomized tests.

SEMESTER II

MEE -201 Macroeconomic Analysis & Policy

Unit I: National income accounting and National Income Identities, Measurement of National Income and Growth Rates in India, Circular Flow of Income in a two, three and four sector economy.

Unit II: Determination of Income, Output & Employment- Classical Approach (Introductory), Keynesian Approach and Introduction to Post-Keynesian debate (New Classical Vrs. New Keynesian), Analysis of fiscal and monetary policies in the closed and open economy IS-LM models, including the Mundell-Fleming model

Unit III: Consumption Function- Absolute Income Hypothesis and preview of post-Keynesian theories, Investment Function-MEC & MEI- Multiplier & Accelerator (Introduction & Application)

Unit IV: Supply of Money –The H-Theory and R.B.I. Classification, Understanding the components of supply of money in India and their significance for business and economy,

Methods followed by the RBI to regulate Supply of Money. Demand for Money-Concept & Determinants (theoretical as well as applied perspective), Estimating Demand for Money in India

Unit V: Macroeconomic Problem- Inflation & Unemployment- Phillips Curve, Theoretical Model of Inflation in India, Economic Fluctuations- Nature and Characteristics of Trade Cycle, Causes of occurrence of trade cycle from demand side (theoretical interpretation has to be given) and supply side (In context of Real Business Cycle Theory), Recent Crises in the world

Readings

- Blanchard, O. (2007): Macroeconomics, New Delhi, Pearson Education.
- Abel, A.S. and B.S. Bernanke (2005): Macroeconomics, New Delhi, Pearson Education.
- De Souza, E. (2008): Macroeconomics, New Delhi, Pearson Education
- Dornbusch. R., S. Fischer and R.Start, (2004): Macroeconomics, New Delhi, Tata Mc Grow Hill.
- H.Yane (1997): A Macroeconomics Reader, New York, Routledge. World Bank (2007): World development

MEE :202 Basic and Applied Econometrics for Energy Resources

Unit I: Methodology of Econometric Research: Model specification, Estimation of model, Evaluation of parameter estimates, Forecasting power of model, Desirable proportion of an econometric model.

Unit II: Linear Regression Model (OLS): Simple linear regression model, assumption of linear stochastic regression model, least square criterion and normal equation, regression without intercept, estimation of elasticities from estimated regression, goodness of fit and R^2 -functional forms.

Unit iii: Evaluation of Regression Model: Regression diagnostic I – multicollinearity, Regression diagnostic II – heteroscedasticity, Regression diagnostic III –autocorrelation.

Unit IV: Time Series Econometrics: Stochastic process, Unit root stochastic process, TS & DS stochastic process, Integrated stochastic process, Spurious regression, Test of stationarity: Graphical analysis, The unit root test – DF & AFD. Forecasting – Box – Jenkins (BJ) Methodology.

Unit V: Panel Data Econometrics: Evolution and Significance of Panel Data, Issue of unobserved variable, Heterogeneity and Selectivity Bias, Feasibility of Panel Formation,

Variation in slope and intercept coefficients, Fixed effect (FE) and Random Effect (RE): panel unit roots.

MEE -203 :Natural Resource Economics

Unit I: Introduction to Resource Economics: Meaning and importance of natural resource economics, classification of natural resource, Taxonomy of Natural Resources, Mc Kelvy's Resource Diagram, Resource Curse Hypothesis. Dimensions of Resource Scarcity, Physical and Economic Measures

Unit II: Capital Theoretic Approach to Economics of Natural Resources, Dynamic resource allocation problem, Maximum Principle, Discounting

Unit III: Economics of Exhaustible Resources:

Basic concepts – Hotelling rule, The concept of backstop, A simple model of optimal depletion, Optimal extraction of an exhaustible resource, Dynamic framework with optimal control-competitive and monopolistic models, Towards a backstop-exploration and technical progress, environmental cost and resource extraction

Unit IV: Economics of Inexhaustible Resources

Resource Economic Models in Fishery and Forestry

Unit V: Basics of Mineral and Energy Resources

Competitive extraction, Monopoly extraction, Socially optimal extraction, Extraction with capacity constraint, Extraction with exploration, Extraction with taxes

Reading List:

Conrad, J.M. and C.W. Clark. 1987. *Natural Resource Economics: Notes and Problems*. Cambridge University Press, Cambridge.

Conrad, J. M : Resource Economics, Cambridge Univ. Press

Dasgupta, P.S. and G.M. Heal. 1979. *Economic Theory and Exhaustible Resources*. Cambridge University Press, Cambridge.

Hartwick, J.M. and N.D. Olewiler. 1998. *The Economics of Natural Resource Use* (2nd Edition). Addison Wesley, Reading, MA.

Macmillan.

N. Hanley, J. Shogren and B. White : Environmental Economics in Theory and Practice, Pearce, D and RK Turner: Economic of Natural Resources and the Environmen, Prentice.

R.N. Bhattacharyya (Ed.) : Environmental Economics, OUP

MEE : 204 Investment and Portfolio Management

Unit I: Investment-A Conceptual Framework; Investment attributes; Investment process; Investment Avenues; Investment Vs Speculation; Investment decision approaches; Financial Markets; Portfolio Management Process; Common mistakes in Investment management.

Unit II: Investment Environment & Securities Market: Market Participants; Features and Composition of Money market, Capital market and Debt market; Risk and Return; Measurement of Risk & Return.

Unit III: Valuation of Bonds & Preference Shares; Valuation of Equity Shares; Fundamental Analysis: Economy Analysis, Industry Analysis and Company Analysis; Technical Analysis: Tools of Technical Analysis.

Unit IV: Modern Portfolio Theory: Markowitz Model; Capital Asset Pricing Model; Sharpe Single Index Model; Arbitrage Pricing Theory; Efficient Market Hypothesis; Behavioral Finance and its implications in Investment decisions.

Unit V: Portfolio Selection; Formulation of Portfolio Strategy; Optimal Portfolio; Portfolio Revision- Strategies & Constraints; Portfolio Evaluation-Treynor measure, Sharpe measure and Jensen Measure.

Suggested Readings:

Barua, S.K., Raghunathan, V. and Varma, J.R., Portfolio Management, Tata McGraw-Hill.

Bodie, et. al, Investments, Irwin McGraw-Hill.

Chandra, P., Investment Analysis and Portfolio Management, Tata McGraw-Hill.

Damodaran, A., Investment Valuation, John Wiley and Sons.

Elton, Edwin J. and Gruber, M.J., Modern Portfolio Theory and Investment Analysis, John Wiley and Sons.

Fischer, D.E. and Jordan, R.J., Security Analysis and Portfolio Management, Pearson India.

ECM-205 : Advanced Mining and Evaluation

Unit I: Mineral formation: Geological time scale, Formation of deposits (Igneous, sedimentary and metamorphous deposits), Identification of minerals

Unit II: Mineral Resources for Energy: Fossil fuels, classification of fossil energy resources: Coal, Petroleum (properties & grading), Non-fossil energy resources: Uranium, Geographical location: World scenario and Indian scenario & Statistics of important mineral resources (coal, petroleum, uranium)

Unit III: Mineral Economics: Special features of mineral and mining industry, Conservation of minerals, National mineral policy.

Unit IV: Estimation of Mineral Reserves: Methods of sampling during exploration and mining, Concepts of Cut-off grade, and stripping ratio, Classification of resources: Estimation of reserves, Introduction to geostatistical ore reserve estimation.

Unit V: Economic Evaluation: Break-even analysis, Economic appraisal of capital investments by NPV and IRR methods, Comparison of investment alternatives, Feasibility studies, Critical variables, price forecasting and sensitivity analysis, Global mineral marketing

SEMESTER III

MEE-301 Operations Research

Operations Research

Operational defines of PERT/CPM Technique, Phases of OR, Models of Modelling in OR, OR techniques, Uses and limitations of OR.

Linear Programming: Problem formulation, Graphical Solution, Simple Method, Duality Concept

Project Management- Comparison of PERT/CPM, Assumptions of PERT/CPM, Algorithm, Network Analysis, Fundamentals of Network model, Three estimate approach of PERT, Resource Leveling and Time cost Trade-off Analysis.

Inventory Control Model: Deterministic Inventory Control Model

Simulation Techniques: Operational Definitions, The nature of simulation: Systems, Models and Simulation, Motivation, Limitation and Pitfalls: Monte Carlo Simulation Technique.

Decision Theory: Basic Structure and Components of Decision, Decision Criteria, Decision Tree.

Game Theory: Theory of two person, Zero sum game, Mixed strategies, Theory of Two person, non-zero sum game, Solution method of game

Queuing Theory: Basic Charectristics, Queuing models:M/M/1 system, M/M/C system, M/Ek/1 System

Sequencing Models: Classification, Assumptions, Sequencing Problem, n jobs through two machines 7 three machines

Replacement, Maintenance and Reliability Problems: Failure rates, Reliability function, Hazard Rate, MTBF

Information Theory –Entropy- A measure of uncertainty

Readings:

Vohra, N.D.; Quantitative Techniques in Management; Tata McGraw Hill Publishing Company Ltd., New Delhi.

Wanger, H.M., Principles of Operation Research with Applications to Managerial Decision, Prentice Hall of India, New Delhi.

Levin, R. I. and Kirkpatrick, C.A., Quantitative Approaches to Management, McGraw-Hill.

Hardy, A. Taha, Operations Research – An Introduction, Macmillan Publishing Co., New York.

Harper, W.M., Operations Research, ELBS, London.

Hilier, F.S. & Lieberman, G.J., Introduction to Operations Research, Holden Day Inc. San Francisco.

Hartley, R.V., Operation Research: A Managerial Emphasis, Good Year Publishing Company, California.

MEE-302 Research Methods for Energy Analysis

Section-I Research Methodology :

Research- Meaning & Types (Descriptive, Analytical etc.), Introduction to Philosophy of Research- The Research Onion,

Formulation of a Research Problem & Writing of a Research Synopsis: Research Design- Quantitative, Qualitative & Mixed and their various kinds, Hypothesis – Formulation (including Sources) & Types of hypothesis, Value neutrality of hypothesis,

Data Collection and Sampling - Types of sampling, determination of the size of sample, Sampling Procedure, Choice of Sampling Technique. Tools of Primary data collection- Questionnaire & Interview and their data entry and interpretation,

Hypothesis Testing- Type I & Type II Errors, concept of Confidence, Limits and critical region, Test of significance for large and small samples –tests for mean and difference between means, F tests. test of significance including Z, chi-square, t and F tests, analysis of variance – one and two way classifications analysis & discussion. Use of Statistical tools and their limitations, Explanation of Result

Section-II Research Methodology in Energy Economics :

Important national and international data bases for energy related studies, Methodology for estimating and forecasting energy demand-simple and sophisticated approaches (End use method, Input-Output Approach, etc.), Methodology for computing energy efficiency,

Computers and its Application: SPSS and Packages

Reading List-

- Kothari R.C. Research Methodology ,Methods and Techniques,New Age International Publishers,Ind revised edition ,reprint 2008.
- Cooper D.and Schindler P. Business Research Methods ,Tata McGraw Hill.
- Don E. Ehridge Research Methodology in Applied Economics: Organizing ,Planning and Conducting Economics Research ,John Wiley and sons, April 2004
- John W. Best and James V. Kahn, Research in Education.
- Goode and Heart, Research Method
- Jerry W. Willis, Foundations of Qualitative research: Interpretative and Critical Approaches. Sage.
- R. Bogdan and S. Biklon; Qualitative Research for Education: An Introduction to Theory and Methods, Allyn and Becon
- A. Chalmers; What is this thing Called Science: an Assessment of the Nature and Status of Science and its Method, Hackett.
- J. Creswell; Qualitative Inquiry and research Design: Choosing among Five Traditions, Sage.
- Flick Uwe; An Introduction to Qualitative Research, Sage.
- Anselm Strauss and Juliet Corbin; Basics of Qualitative Research: Grounded Theory- Procedures and techniques, Sage.
- Charles Teddlie and Abbas Tashakkori; Foundation of Mixed Methods Research, Integrating Quantitative and Qualitative Approaches in Social and Behavioural Sciences, Sage.

MEE-303 International Trade in Energy resources

International Trade in Energy

Energy commodities are extensively traded between countries and the opportunity to buy or sell energy commodities using foreign markets has a profound effect on domestic energy markets. This course explores the concept of comparative advantage, including a discussion of the welfare effects of international trade and the determinants of the amount of trade between countries. It will also discuss the many ways that governments can alter international trade through various policy mechanisms. The course will end with a discussion of the very important role of international capital flows in financing energy projects, determinants of those flows and how they are affected by government policies.

Unit: I

Global Scenario of Energy: Energy consumption in various sectors and its changing patterns. The future energy security and market behavior, Global demand and supply outlook, Energy needs and demand of developing countries.

Unit: II

Models of the Oil Market: Competitive Models: Property Rights Model (Nationalization), Supply Shocks Model, Target Revenue Model.

Non-Competitive Models: OPEC Cartel, Oligopoly Model.

Unit: III

Challenges for International Trade in Energy: Unequal distribution of energy resources, Issues related to restrictive practices of energy exporting countries; Energy dual pricing policies, Period of high oil prices, 1973-85, Increasing Global Competition, Import Dependence.

Unit: IV

Trade in oil, gas and electricity; Challenges in Trade in oil, gas and electricity: Infrastructure and construction of transportation pipe lines, Transmission grid.

Unit: V

Energy Charter Treaty (ECT): International Energy Agency; Role of international capital flows in financing energy projects.

Reading List:

Andre Mornier, "Setting the Rules of Energy Trade" In Fundamentals of the Global Oil and Gas Industry. London: Petroleum Economists (2008)

Yulia Selivanova, "The WTO and Energy. WTO Rules and Agreements of Relevance to the Energy Sector, Trade and Sustainable Energy Series, ICTSD Programme on Trade and Environment, International Centre for Trade and Sustainable Development (August, 2007)

Yulia Selivanova, "World Trade Organization Rules and Energy Pricing: Russia's Case, 38 Journal of World Trade 4 (2004)

Yulia Selivanova, "Energy Dual Pricing in WTO Law, Analysis and Prospects in the Context of Russia's Accession to the WTO." Cameron May(2008),

Statement of the Energy Charter Secretariat at the Council for Trade in Services, WTO, 11, February, 2010.

The Energy and Resources Institute (TERI) Energy Data Year Books

International Energy Agency, World Energy Outlook, Executive Summary.

Adelman, M. A. (1982) "OPEC as a Cartel." in J. M. Griffin and D.J. Teece, OPEC Behavior and World Oil Prices, London: George Allen & Unwin

Adelman, M. A. (1986) "Scarcity and World Oil Prices." Review of Economics and Statistics.

Alhajji, A. and Huettner, D. (2000b) "OPEC and World Crude Oil Markets From 1973 to 1994: Cartel, Oligopoly, or Competitive?" *Energy Journal*, 21(3).

Alhajji, A. and Huettner, D. (2000c) "The Target Revenue Model and the International Oil Market: Empirical Evidence from 1971 to 1994." *Energy Journal*, 21(2):

Alsmiller R. G. and Horwedel J. E. (1985) "A Model of the World Oil Market with an OPEC Cartel." *Energy*, 10 (10):

Baldwin N. and Prosser R. (1988) "World Oil Market Simulation." in Sterner T., *International Energy Economics*. Chapman & Hall.

Michael Kennedy, "An Economic Model of the World Oil Market *The Bell Journal of Economics and Management Science*, Vol. 5, No. 2 (Autumn, 1974), Published by: RAND Corporation,

MEE -304 Energy, Economy and Society

Unit I: Energy and Economy

Definition, meaning and forms of energy; understanding energy-economy linkages

Unit II: Political Economy and Public Policy Issues

Geo-political issues concerning energy supply; energy security; energy efficiency and energy conservation; demand-side management; urban transportation policies

Unit III: Energy Policy & Planning : Energy (and power) policies in the country, tariffs and subsidies, energy utility interface, private sector participation in power generation, energy and development , National energy plan , role of modelling in energy policy analysis, energy investment planning and Energy pricing.

Unit IV: Energy Audit: Energy Audit Concepts, Elements, measurements , mass and energy balances, evaluation of energy conserving opportunities. Presentation of reports, case studies, discounted cash flow, present value concept, annual investments and rate of return.

Unit V: Energy and Energy Management in the context of Environment : Fossil fuels and combustion, combustion calculation, emissions to air, energy accounting, pollution accounting, energy uses and options for improvement.

References :

1. Paul W. O'Callaghan, *Integrated Environmental Management Hand Book*, John Wiley & Sons, Chichester, 1996.
2. Paul W. O'Callaghan, *Energy Management : A comprehensive guide to reducing costs by efficient energy use*, McGraw Hill Book Company, London, 1993.

3. Harol W. Henry, Fredric W. Symonds etc., Energy Management : Theory and practice, Marcel

Dekker, Inc., New York, 1980.

4. Hiren Sarkar and Gopal K. Kadekodi, Energy pricing in India : perspectives, issues and options, 1988.

MEE-305 Financial Accounting and Business Finance

Unit I: Introduction, Basic principles of Accounting, Journal Ledger, bank Reconciliation Statement, Trial Balance, Final Account Of proprietary.

Unit II: Company Accounts I: Accounting for issue of shares, forfeiture of shares, Issue and redemption of Debentures,

Unit III: Company Accounts II Special features of Company's Financial Statement, preparation of Financial Statements of Companies as per the Provisions of Companies Act.

Unit IV : Business Finance : Meaning and scope of Business Finance, Functions of Business Finance, Objectives of Financial Management- Profit Maximisation Vs Wealth Maximisation, Time Value of Money. Financial Terminology.

Unit IV Financial Planning :Concept of Financial Planning, objectives, importance and limitations of Financial Plan, Short term, Medium term Long term Planning, Sources of Short term Medium term and Long term finance, Leverages.

Reading

- Shim.J & J.Giegel, (2004): Financial management, Schaum outline Series, India, Tata McGraw Hill Co.
- Brealey, R and S.C. Luyers, (2000): Principles of Corporate Finance; New York McGraw Hill.
- Grimblatt, M and S. Tionan, (2002): Financial Markets and Corporate Strategy), New Delhi, McGraw Hill.
- Rustagi.R.P, (2006): Financial management , theory concepts and applications, India, Galgotia Publishing Company
- Khan, M.Y, (Latest ed): Financial Management ,New Delhi, Tata McGraw Hill
- Horne Van, (Latest ed): Financial management and policy, India, Prentice Hall
- Gupta, R.L. and Gupta.(Latest Edition)- V.K Principal and Practice of Accountancy

SEMESTER IV

MEE -401 Economic Evaluations and Project Management

COURSE OBJECTIVE: The course covers key components of project management including project integration, project scope management, project time and cost management. Arrow Diagramming and Network Analysis. Crashing of a Project.

COURSE DESCRIPTION: In this course, important aspects of energy project management will be taught through the theory, methods and quantitative tools used to effectively plan, organize and control energy projects.

To achieve this, we will use a basic project management framework in which the project life-cycle is broken into organizing, planning, monitoring, controlling and learning from old and current energy projects.

Within the framework, the students will learn the methodologies and tools necessary for each aspect of the process as well as the theories upon which these are built.

Management of the project will be divided into five sections:

Unit I: Project Organization

Project organization involves selecting an appropriate project organization-structure and establishing the Organizational Breakdown Structure (OBS) for the project. Through an analysis of the project information-transfer needs (i.e., who needs information from whom), project teams and a reporting structure may be determined. Specifically, several product development processes and the Design Structure Matrix are studied.

Unit II: Project Planning

Project planning involves establishing the Work Breakdown Structure and mapping this structure to the established OBS. Furthermore, a project budget and Cost Breakdown Structure are developed and mapped to the OBS and WBS. The planning phase also includes establishing an appropriate timeline for the project in the context of resource constraints. Finally, the project manager must acknowledge that very few (if any) of the estimates and predictions at hand will prove to be accurate in the future; she needs to account for risk factors and their possible consequences on the schedule, budget, quality and environment while planning a project.

Specific methodologies for planning include:

1. The Critical Path Method (CPM)
2. The Precedence Diagramming Method (PDM)
3. The program Evaluation and Review Technique (PERT)

Unit: III Project Monitoring

Project Monitoring refers to the configuration and metrics used to monitor the progress of a project throughout its life. Particular questions of interest to the project manager are:

1. Is the project progressing according to the schedule?
2. Will the project be completed within the allocated budget?
3. Will the product perform as expected?
4. If there are any deviations in schedule, budget or quality, how efficiently and how fast are they captured, reported and acted upon?

Unit IV: Project Control

Based on the information gathered through the Project Monitoring system, corrective action may be required to keep a project on track. The Project Control section of the course describes techniques to help realign projects that have gone awry. Corrective action may be needed in many areas such as project scope, product performance, project schedule, and project budget. Project Control also requires a clear trace as to when and how changes are made to baselines as well as a clear understanding and documentation of project configurations.

Unit V: Project Learning

Project Learning is recognized by organizations as one of the most important factors for success in current and future projects. Through life-cycle and post-mortem analysis, the project manager may identify areas to be emphasized or more closely managed in future projects. Such areas are:

1. Resource allocation.
2. Risk and uncertainty.
3. Budget constraints.
4. Project feasibility, and
5. Project time and cost management.
6. Crashing of a project.

MEE 402 Management of Technology for Energy

Unit I: Technology Choice: Linkage; National Technology Policies; Technology, Competition and Industrial Structure; formulating the technology strategy,

Unit II: Technology Development and Acquisition process; Managing Technologies,

Unit III: Technology in Indian Industries, Strategic R&D management and Technological Consortia; Licensing and joint Ventures,

Unit IV: Managing Technology Spillovers; Justification of new technology; management accounting and technology; Integration of New with Old technology, Assimilation of Technology;

Unit V: Intellectual Property Rights and their Implications for Industry Policy and Technology Management.

MEE -403 International Business Strategy and Energy Sector

Unit I International Business Environment- Global Trade; Foreign Direct Investment; National and Regional Competitiveness; Regional Economic Integration; Global Growth generators (Emerging economies) ; Implications of Economic Inequality; Differences in National Political Economies.

Unit II Environmental Analysis-Understanding Environmental analysis & its components; Organizational appraisal; Industry analysis; Competitors Analysis; SWOT Analysis; Ethics in International Business; Intellectual property rights.

Unit III Strategy and Structure of International Business-Understanding Global strategy; Global Value creation; Turnaround; Divestment & Liquidation strategies; Growth Strategies- Merger; Take-over & Joint strategies; Integration & Diversifications.

Unit IV Functional Strategies- Designing global products & services; Global marketing; Global R7D; Global Human Resource Management; Financial plans & Policies; Accounting in International Business.

Unit V Strategy Implementation and Evaluation- Strategic implementation- Relationship between strategic Formulation and Implementation; Strategic Implementation; Strategic Evaluation & Control- Types of Strategic Control; techniques of Strategic Evaluation; Operational Control.

Suggested Readings:

- Michael E. Porter; Competitive Strategy: Techniques for Analyzing Industries & Competitors.
- Carl Nelson; Import/Export: How to Take Your Business across Borders.
- Tarun Khanna & Krishna G. Palepu; Winning in Emerging Markets: Road Map for Strategy and Execution.
- Pankaj Ghemawat; Redefining Global Strategy: Crossing Borders in a World where Differences Still Matter.
- Bob De Wit & Ron Meyer; Strategy: An International Perspective.
- Cavusgil; International Business.
- Alain Verbeke; International Business Strategy.
- S Raghunath & Elizabeth L. Ross; International Business Strategy: Perspectives on Implementation in Emerging markets.

MEE -404 Energy, Climate Change and Global Politics

Unit I : Introduction: the energy-carbon-climate problem, Climate change science: early discoveries, energy balance model, Science of Energy and Climate change, the global energy infrastructure and GHG emissions

Unit II: Energy Use, Climate Change: Sources and Uses of energy emissions and climate change

Unit III: Politics and Economics of International Energy, Climate change politics: International Agreements: the United Nations Framework Convention on Climate Change and Kyoto Protocol, Policy Mechanisms to address climate change Beyond Kyoto, COP 21 and aftermath

Unit IV: Energy and Climate change from national perspectives

Unit V: Impact of a Changed Energy Future, Climate and Energy Planning

MEE -405 Field Work based Dissertation

