Department of Agricultural Economics

Rajiv Gandhi University

PG Syllabus
M.Sc. (Ag) in Agricultural Economics
w.e.f. 2024 onwards

Syllabus formulated in accordance with the ICAR Restructured and Revised Syllabi of Post-graduate Programmes.

Course Title with Credit load
M.Sc. (Ag) in Agricultural Economics

Major Courses: 20 credits

Course Code	Course Title	Credit Hours
AEC-501*	Micro Economic Theory And Applications	3 (3+0)
AEC-502*	Agricultural Production Economics	2 (1+1)
AEC-503*	Agricultural Marketing and Price Analysis	3 (2+1)
AEC-504*	Macro Economics And Policy	2 (2+0)
AEC-505*	Econometrics	3 (2+1)
AEC- 506	Agricultural Development and Policy Analysis	2 (2+0)
AEC-507*	Agricultural Finance and Project Management	3 (2+1)
AEC-508*	Linear Programming	2 (1+1)
AEC-509*	Research Methodology for Social Sciences	2 (1+1)
AEC-510	Indian Economy: History and Contemporary Issues	2 (2+0)
AEC-511	International Economics	2 (1+1)

*courses to be taken compulsorily

Minor Courses: 08 credits
   a. It is suggested the student may choose at least two out of three courses listed above as part of minor courses as these are related to policy advocacy and aim to build larger understanding of the subject.
   b. Further, it is suggested that the student may also opt to choose the remaining Courses from any other discipline including the disciplines of Agrl. Extensions/ ABM and are related to the research problem selected by the student.
   c. The final choice of the minor courses should be mandatorily approved by the Student Advisory committee/ HOD.

Course Code	Course Title	Credit Hours
AEC-512	Institutional Economics	1(1+0)
AEC-513	Natural Resource and Environmental Economics	2 (1+1)
AEC-514	Commodity Future Trading	2 (2+0)
AEC-515	Development Economics	2 (2+0)
AEC-516	Rural Marketing	2 (2+0)
AEC-517	Evolution of Economic Thought	1 (1+0)

   Minor courses may be taken from above list or subjects closely related to a student's major subject.

Supporting Courses: 6 credits

STAT-501	Statistical Methods For Applied/ Social Sciences	3 (2+1)
STAT-502	Mathematics For Applied Sciences/ Agricultural Economics	3 (2+1)
STAT/COMP	Computer Applications For Agri-Business & Economics	3 (2+1)

Common Courses: 05 credits
1. Technical Writing and Communications Skills
2. Intellectual Property and its management in Agriculture
3. Agricultural Research, Research Ethics and Rural Development Programmes

Further, the subcommittee attempted to oversee the design of the entire course is such a way that students may opt to take extra courses to compete with MA Economics stream and Universities may consider to issue a certificate that the degree of M.Sc.(Ag) Agricultural Economics with special mention of extra credits in core Economics.

Course Contents
M.Sc. (Ag) in Agricultural Economics

I. Course Title   : Micro Economic Theory and Applications

II. Course Code   : AEC-501

III. Credit Hours   : 3+0

IV. Why this course?

Markets form an integral part of the economy. They are governed by demand and supply mechanism with profit making its ultimate goal. Thus, it is imperative to expose the students towards how the markets function, their types and how the buyers and sellers behave. That will help them make correct decision when it comes to price setting and choice of product.

V. Aim of the course

The course envisages the concepts and principles embodying micro-economics. The economic problems, functioning of price mechanism, theory of household behaviour and consumer's demand function. Theory of firm, supply determinants, determination of price under different market structures and factor pricing (micro economic components).

VI.   **Organisation of** the course The course is organised as follows:

No	Block	Unit
1.	Introduction to micro-economics	1. Basic Concepts: A review
2.	Insight of consumer, production and cost involved	1. Consumer Choice 2. Production and Cost
3.	Overview of market	1. Market Forms 2. Factor Markets

VII. Theory

Block 1: **Introduction** to **micro-economics**

Unit 1: **Basic Concepts: A review**

Scarcity and Choice; Production possibility frontier, Positive and normative economics; concepts of opportunity cost, Demand and Supply: determinants of individual demand/supply; demand/ supply schedule and demand/ supply curve; market versus individual demand/ supply; shifts in the demand/ supply curve

Block 2- Insight of consumer, production and cost involved

Unit 1: Consumer Choice

Cardinal Utility Approach — Ordinal Utility Approach -Budget sets and Preferences under different situations — Hicks and Slutsky income and substitution effects —

Applications of Indifference curve approach — Revealed Preference Hypothesis — Consumer surplus — Derivation of Demand curve — Elasticity of demand — Demand and supply together; how prices allocate resources; controls on prices — price floor and price ceiling — applications in agriculture.

Unit 2: Production and Cost

Production functions: single variable - average and marginal product, variable proportions, stages of production. Two variables - isoquants, returns to scale and to a factor; factor prices; Technical progress; cost minimization and output maximization; Elasticity of substitution. Expansion path and the cost function Concept of economic cost; Short run and long run cost curves; increasing and decreasing cost industries; envelope curve; L-shaped cost curves; economies of scale; revenue and expenditure, elasticity and marginal revenue; Firm equilibrium and profit.

Block 3: Overview of market

Unit 1: Market Forms

Behaviour of profit maximizing firms and the production process- Perfect competition: Equilibrium of the market. Long run industry supply, applications: effects of taxes and subsidies; Monopoly: Equilibrium; supply; multiplant firm; monopoly power; deadweight loss; price discrimination; Monopolistic Competition: Product differentiation; equilibrium of the firm in the industry-with entry of new firms and with price competition. Comparison with pure competition. Duoploy: Cournot model and reaction curves; Stackelberg's model, Bertrand model; Oligopoly.

Unit 2: Factor Markets

Labour and land markets - basic concepts (derived demand, productivity of an input, marginal productivity of labour, marginal revenue product); demand for labour; input demand curves; shifts in input demand curves; competitive labour markets; Economic rent and quasi rent.

VIII. **Teaching Methods/ Activities**
- Lectures
- Case studies
  Assignments (Group/individual)
  Group Discussions on practises done by firms.
  Power point presentations by students.
  Exploring the agricultural market and identification of industries and their type.

IX. Learning outcome

After completion of the course the student will be able to:
  Get acquainted with the basic concepts of market functions.
  Build up vision towards how consumers makes choices and market reaches the equilibrium.
  Develop decision making skill for firms about product selections and scale of production to ensure maximum profit.
  Understand about different types of markets existing in the real world, their principles and whereabouts.

X. Suggested Reading

Koutsoyiannis A. *Modern Micro Economics.* Macmillan Press Ltd

Ferguson and Gould. *Micro Economic Theory*. Richard D Erwin Inc., USA
Richard A. Bilas, *Micro Economic Theory*.
Leftwich Richard H. *The Price iSystem and Resources Allocation*
Allen CL. *A Frame* Jforñ *of Price Theory*.

I.   Course Title   : Agricultural Production Economics
II. Course Code   : AEC-502
III. Credit Hours   : 1+1

IV. Why this course†

Production in agriculture is the outcome of the input factors involved. In this competitive and uncertain market, it is important that the farmers take the right decision about the combination of inputs that will result in higher income. Thus, as an economist it is a pre-requisite that the students understand the interaction between output and input. And work out the most effective production plan.

V. Aim of the course

To expose the students to develop the concept, significance and uses of production economics. To understand the relationships between factors and output. To learn how to decide the combination of inputs to be used as per the resources available. Ensure that the production process works efficiently.

VI. **Organization of the course**

The course is organised as follows-

No	Block		Unit
1.	Introduction to production economics	1.	Concepts of production economics
2.	Factors and costs	1.	Factors and theory of production
		2.	Concepts of costs
3.	Assessment	1.	Dynamics of assessment

VII. **Theory**

Block 1: Introduction to Production Economics

Unit 1: Concepts of production economics

Nature, scope and significance of agricultural production economics- Agricultural Production processes, character and dimensions-spatial, temporal - Centrality of production functions, assumptions of production functions, commonly used forms - Properties, limitations, specification, estimation and interpretation of commonly used production functions.

Block 2: Factors and costs

Unit 1: Factors and theory of production

Factors of production, classification, interdependence, and factor substitution -Determination of optimal levels of production and factor application -Optimal factor combination and least cost combination of production - Theory of product choice; selection of optimal product combination.

Unit 2: Concepts of cost

Cost functions and cost curves, components, and cost minimization -Duality theory

— cost and production functions and its applications -Derivation of firm's input demand and output supply functions -Economies and diseconomies of scale.

Block **3: Assessment**

Unit 1: **Dynamics of** economic **assessment**

Technology in agricultural production, nature and effects and measurement Measuring efficiency in agricultural production; technical, allocative and economic efficiencies - Yield gap analysis-concepts-types and measurement - Nature and sources of risk, modeling and coping strategies.

VIII. **Practical**

Different forms of production functions
- Specification, estimation and interpretation of production functions
- Returns to scale, factor shares, elasticity of production
- Physical optima-economic optima
- Least cost combination
- Optimal product choice
- Cost function estimation, interpretation
- Estimation of yield gap
- Incorporation of technology in production functions
- Measuring returns to scale-risk analysis.

IX. **Teaching Methods/ Activities**

- Lectures
- Assignments (Group/individual)
  Group Discussions on working out
  Power point presentations by students
  Exploring the agricultural market and identification of industries and their type.

X. Learning outcome

After the successful completion of the course the student will be able to- Understand how the factors and output interact with each other. - Work out whether the production system is working efficiently and point out the loop holes.- Apply the knowledge of costs and profits to work out the demand and supply functions. This will result into more efficient decision making.

XI. Suggested Reading

EO Heady. *Economics of Agricultunal Production and resources use.*
John P Doll and Frank Orazem. *Production Economics: Theory with app fication*
Heady EO & Dillon JL. 1961. *Agricultural Production functions.* Kalyani Publishers, Ludhiana. India. 667 p.
Baumol WG. 1973. *Economic theory and operations analysis.* Practice Hall of India Private Limited, New Dehli.626 p.
Gardner BL & Rausser GC. 2001. *Handbook of Agricultural Economics* Vol. I Agricultural Production. Elsevier.

  I. Course Title   : Agricultural Marketing and Price Analysis
 II. Course Code   : AEC 503
III. Credit Hours   : 2+1
IV. Why this course?

The ultimate aim of production process is to sell the produce in the market and

generate income. Markets serves as platform where this exchange takes place. Agriculture markets are different from other markets due to the nature of the commodity. Thus, it is important to develop a strong foundation of agricultural marketing, its components and issues. The student needs to know about the multi-pronged ways of marketing the produce, agencies involved. In this modern era, it is important to understand how technology is transforming this sector.

V. Aim of the course

The course is designed to acquaint the students about the basics of dynamics of agricultural marketing. The content includes supply, demand and marketing of farm production, marketing functions and channels, marketing costs, margins and efficiency, agricultural prices, New marketing formats like e-marketing, e-NAM future trading, supply chain management, market intelligence etc.

VI. **Organization of the** course

The course is organised as follows:

No	Block	Unit
1.	Introduction to agricultural marketing	1. Introduction to agricultural marketing
2.	Agricultural markets	1. Aspects of agricultural marketing
		2. Future marketing and government
3.	Advances in agricultural marketing	1. Use of information technology
		2. Dynamics of price

VII. **Theory**

Block 1: Introduction to Agricultural Marketing

Unit 1: Introduction to agricultural marketing

New Concepts in Agricultural Marketing - Characteristic of Agricultural product and Production — Problems in Agricultural Marketing from Demand and Supply and Institutions sides. Market intermediaries and their role - Need for regulation in the present context - Marketable & Marketed surplus estimation. Marketing Efficiency - Structure Conduct and Performance analysis - Vertical and Horizontal integration - Integration over space, time and form-Vertical co-ordination.

Block 2: Agricultural Markets

Unit 1: **Aspects of agricultural** marketing

Different Forms of marketing: Co-operatives Marketing — APMC Regulated Marketing - Direct marketing, Farmer Producer Companies, e-NAM and marketing under e-NAM, e-marketing Contract farming and Retailing, Organized retailing - Supply Chain Management - State trading, Warehousing and other Government agencies -Performance and Strategies -Market infrastructure needs, performance and Government role - Value Chain Finance.

Unit 2: Future **marketing** and government

Introduction to Commodities markets and future trading - Basics of commodity futures - Operation Mechanism of Commodity markets — Price discovery - Hedging and Basis - Fundamental analysis - Technical Analysis — Role of Government/SEBI in promoting commodity trading and regulatory measures.

Block 3: Advances in Agricultural Marketing

Unit 1: **Use of Information Technology**

Role of Information Technology and Market Intelligence in marketing of agricultural commodities, -electronic auctions (e-bay), e-Chaupals, Agmarknet and Domestic and Export market Intelligence Cell (DEMIC).

Unit 2: Dynamics of price

Price forecasting — time series analysis — time series models — spectral analysis. Price policy and economic development — non-price instruments.

VIII. **Practical**
- Supply and demand elasticities in relation to problems in agricultural marketing.
- Price spread and marketing efficiency analysis.
- Marketing structure analysis through concentration ratios.
- Performance analysis of Regulated market and marketing societies. Analysis on contract farming and supply chain management of different agricultural commodities, milk and poultry products.
- Supply Chain Analysis - quantitative estimation of supply chain efficiency.
- Market Intelligence — Characters, Accessibility, and Availability Price forecasting.
- Online searches for market information sources and interpretation of market intelligence reports — commodity outlook.
- Technical Analysis for important agricultural commodities.
- Fundamental Analysis for important agricultural commodities.
- Presentation of the survey results and wrap-up discussion.

m. **Teaching** Methods/ **Activities**
- Lectures.
- Case studies.
- Assignments (Group/individual).
  Group Discussions on price volatility and control measures prevailing.
  Power point presentations by students on government schemes.
  Visit to eNAM mandies, Warehouses, etc.

X. Learning outcome

After the completion of this course the student will be able to—
  Understand the whereabouts of agricultural marketing.
  The different forms of marketing existing in this sector.
  Gain expertise in market intelligence and price forecasting.

XI. Suggested Reading

Acharya SS & Agarawal NL. 2004. *Agnicultural Market ing in India.* Oxford and IBH Publishing company Pvt. Ltd. New Delhi.
Acharya SS & Agarawal NL. 1994. *Agricultural Prices-Anal ysis and Polic y.* Oxford and IBH Publishing company Pvt. Ltd. New Delhi.
Richard H Kohls and Joseph N. Uhl: *Marketing of Agricultnal products* by Collier MacMillan International.

I. Course **Title**   : **Macro Economics and Policy**

II. Course Code   : AEC-504

III. Credit Hours   : 2+0

IV. Why this course?

The economy of the nation is governed by certain rules, regulation and principles. The students has to gain knowledge of the mechanism through which the large economies are controlled and ensure that welfare prevails. They are entitled to know the transactions between different markets and policies framed to keep value of money under control.

V. Aim of the course

The course envisages the concepts and principles of macroeconomics from classical to Keynesian theories. The other component deals with the monetary system-money, credit and banking system, value of money and economic activities, national income accounting and approaches to estimate national income theory of income and employment determination and inflation.

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	Conceptualising Macro economics	1. Introduction: Measurement and Concepts
2.	Theories of macroeconomics	1. Classical Macroeconomics
		2. Income and spending: Keynesian Framework
3	Money, Consumption and Inflation	1. Money, Interest and Income
		2. Theories of Aggregate Consumption and Investment
		3. Inflation and Unemployment

VII. Theory

Block 1: Conceptualising Macro Economics

Unit 1: Introduction: Measurement and Concepts
Basic concepts and scope of Macro-economics, National Income Accounting: Methods of measurement of key macro-economic aggregates, relationship of national income and other aggregates (with numerical exercises), real and nominal income

Block **2: Theories of macroeconomies**

Unit 1: **Classical Macroeconomics**
Say's Law, Quantity Theory of Money, aggregate labour supply and demand of labour, Classical theory of determining output, wages and prices.

Unit 2. Income And Spending: Keynesian Framework
Simple Keynesian model of income determination; Keynesian Multiplier- aggregate spending, taxation, transfer payments, foreign spending, balanced budget; budget surplus (with numerical exercises).

Block 3- Money, Consumption and Inflation
Unit 1: Money, Interest and Income
Goods market equilibrium-IS curve; Demand for Money, the Liquidity Preference

Theory — Liquidity Trap; asset market equilibrium- LM curve; simultaneous equilibrium in goods and asset market- effect of fiscal and monetary policy

Unit 2: Theories of Aggregarte Consumption and Investment

Absolute Income Hypothesis, Relative Income Hypothesis, Fisher's Inter-temporal Choice Model, Life-Cycle and Permanent Income Hypotheses; Profits and Accelerator Theory.

Unit 3: Inflation and Unemployment

Inflation: Nature, Effects and control; Types of inflation — demand pull, cost push-stagflation, core inflation, hyperinflation; Phillips curve.

VIII. Teaching Methods/ Activities
- Lectures.
- Case studies.
  Assignments (Group/individual).
  Group Discussions on inflation.

IX. Learning outcome

After the completion of the course the student will be able to-Understand the concepts of national income, theories build up to understand macroeconomics. Understand better about the policies and government steps taken to control the economic transaction of the nation. Workout how the investment acts as a catalyst in national development.

X. Suggested Reading

Stonier & Hegue. *A Text Book of Economic* Theory
Samuelson PA. 1948. *Foundation of* Economic *Arial ysis.* Harvard University Press
MC Vaish Allid. 1983. *Macno-Economics Theory*
Gardner Ackley. 1961. *Macro—Econom ics Theory:* Macmillan, New York.
TF Dernburg & DM Mcdougali-ñfocro *Economics*
G. Sirkin — *Introduction to Macro-Econom ice Theony*
RL Heibroker- *Understanding Macro—Economics*
JK Mehta —*Macno Economics*
Michael R Edgemand — *Macro-Ecoiiom ics: Theory & Policy*
David' W Pearce —*The dictionary of modenn Economics*

I. Course Title : Eeonometries
II. Course Code : AEC 505
III. Credit Hours : 2+1

IV. Why this course?

Development of analytical skills is imperative to make students proficient in conducting quality research work. The knowledge of variables, their models, and problems encountered when dealing with variables will build up a compatibility with the analytical aspects.

V. Aim of the course

The course provides knowledge of the econometric methods like time series analysis, linear regression models and their application in economic analysis. The course provides an insight into the econometric problems in analyzing time series and cross section data.

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	Introduction to econometrics	1. Introduction
2.	Classical Regression	1. Classical Linear Regression
		2. Breaking down of Classical assumptions
3.	Qualitative Variables	1. Qualitative variables and simultaneous equation models

VII. Theory

Block 1: Introduction to Econometries

Unit 1: Introduction

Relationship between economic theory, mathematical economics, models and econometrics, methodology of econometrics-regression analysis.

Block 2: Classical Regression

Unit 1: **Classical Linear Regression**

Basic two variable regression — assumptions estimation and interpretation approaches to estimation — OLS and their properties — extensions to multi-variable models-multiple regression estimation and interpretation.

Unit 2: Breaking down of Classical assumptions

Violation of assumptions — identification, consequences and remedies for Multicollinearity, heteroscedasticity, autocorrelation — data problems and remedial approaches — model misspecification.

Block 3: Qualitative Variables

Unit 1: Qualitative variables and simultaneous equation models

Use of dummy variables- Introduction to simultaneous equations- identification problem

VIII. Practical

Single equation two variable model specification and estimation
Hypothesis testing transformations of functional forms and OLS application
Estimation of multiple regression model
Testing and correcting specification errors
Testing and managing Multicollinearity
Estimation of regressions with dummy variables

m. **Teaching** Methods/ **Activities**

- Lectures.
- Assignments (Group/individual).

X. Learning outcome

After the completion of the course, the student will be able to-Understand the variables and the properties of regression models. Identify the problems in variables and remove them before conducting the analysis and avoid biased results.

XI. Suggested Reading

Dorfman R. 1996. *Einear Programming and Economic Analysis.* McGraw Hill.
Greene WH. 2002. *Econometric Analysis.* Pearson Education.
Johnston J and Dinardo J. 2000. *Econometric Methods.* Mc Graw-Hill.
Koutseyianis, A. 1997. *Theory of Econometrics.* Barrier & Noble.
Maddala GS. 2002. *Ecoiiometnics.* Me Graw-Hill.
Pinndyck RS and Rubinfeld DL. 1990. *Econometric Models and Econometric Forecasts.* McGraw Hill.

I.	Course Title	: Agricultural Development and Policy Analysis
II.	Course Code	: AEC-506
III.	**Credit Hours**	**: 2+0**

IV. Why this course?

The ultimate aim of the economies is to attain a satisfactory level of development. Development ensures that there is not only increase in income but also the distribution is such that lesser inequalities exist. The students need to know what is development and its related concepts. All the policies framed are with one sole objective of increasing the welfare. Thus, once concept of development is build up, students can better understand policies and their genesis.

V. Aim of the course

Concept of economic development and policy, theories of development, performance of Indian agriculture. The process and implementation of policies over a period of time.

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	Basic concepts	1. Introduction
2.	Theoretical Concepts	1. Theories of Agricultural Development
3.	Performance and policies	1. Performance of Indian Agriculture
		2. Agricultural Policy: Process and Implementation

VII. Theory

Block 1: Introduction

Unit 1: Introduction

Role of agriculture in economic/ rural development — Evolution of thinking on agriculture and development; Agricultural development — meaning, stages and determinants — Population and food supply — need for sound agricultural policies

Block 2: Theoretical Concepts

Unit 1: Theories of Agricultural Development

Resource exploitation model- Conservation model- Location (Urban impact) model- Diffusion model- High pay-off input model-Induced Innovation Model- Agricultural R&D and Linkages

Block 3: Performance and policies

Unit 1: **Performance of Indian Agriculture**

Agrarian structure and land relations; trends in performance and productivity; agrarian structure and technology; credit, commerce and technology; capital formation; subsidies; pricing and procurement; Post Green Revolution agriculture; Production and productivity crisis in agriculture; Regional differences; Food Security, PDS system and Malnutrition.

Unit 2: Agricultural Policy: Process and Implementation

Instruments of Agricultural Policy; Process of agricultural policy formulation, implementation, Monitoring and Evaluation in India; Global experiences in participatory approach to Agricultural policy process; critical review of various elements of Indian agricultural policy-resource policies — credit policies — input and product marketing policies — price policies; WTO — Agreement on Agriculture; Planning models. Planning for utilization of resources and Indian Five Year Plans.

VIII. **Teaching Methods/ Activities**
- Lectures.
  Assignments (Group/individual).
  Group Discussions on evolution of Indian Agriculture and Development indices.
  Power point presentation by students on policies and their relevance.

m. Learning outcome

After the completion of the course the student will be able to-Understand the concept of development and its preference over growth. Visualize how the agriculture sector is performing in this aspect. Understand the motive behind the policies and their implementation.

X. Suggested Reading

Albert O. Hirschman 1958. *istrategy of Economic Development.* New Man Yale University
Simon Kuznets 1965. *Economic Growth and lstruct ures.* Oxford New Delhi.
Das Gupta AK. 1965. *Planning and Economic Gnowth.* George Allen and Unwin London
Robert E. Baldwin 1966. *Economic Development and* Growth. John Willey, New York

  I. Course Title   : Agricultural Finance and Project Management
 II. Course Code   : AEC 507
III. Credit Hours   : 2+1

IV. Why this course?

Money is the fuel of driving all the economic activities. India is a land of small and marginal farmers. The financial conditions of the farmers is not so strong that they can finance themselves. They require credit to meet the requirements of inputs. Thus, the student should know the sources, principles involved and types of credit available. The institutions involved and on what grounds the finance is given to the farmer. What are the risks involved and how to overcome them.

 V. **Aim of the course**

This course is designed with an objective to deliver knowledge of the principles, procedures, problems and policies relating to financing agricultural firms. In addition to this the students are also given knowledge about the research developments in the subject. The approach is analytic.

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
l	Introduction to Agricultural Finance	1. Basic Concepts: A review
2.	Credit and financial analysis	1. Credit and its aspects
		2. Financial analysis
3	Project and risk management	1. Project Overview
		2. Risk and its Management

VII. Theory

Block 1: Introduction to Agricultural Finance

Unit 1: Basic concepts: A Review

Role and Importance of Agricultural Finance. Financial Institutions and credit flow to rural/priority sector. Agricultural lending — Direct and Indirect Financing - Financing through Co-operatives, NABARD and Commercial Banks and RRBs. District Credit Plan and lending to agriculture/priority sector. Micro-Financing and Role of MFI's - NGO's, and SHG's.

Block 2: Credit and Financial Analysis

Unit 1: Credit and its aspects

Lending to farmers — The concept of 3 C's, 7 P's and 3 R's of credit. Estimation of Technical feasibility, Economic viability and repaying capacity of borrowers and appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions — credit widening and credit deepening.

Unit 2: Financial analysis

Financial Decisions — Investment, Financing, Liquidity and Solvency. Preparation of financial statements - Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and Assessing the performance of farm/ firm.

Block 3- Project and Risk Management

Unit 1: Project Overview

Project Approach in financing agriculture. Financial, economic and environmental appraisal of investment projects. Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal techniques — Undiscounted measures. Time value of money — Use of discounted measures - B-C ratio, NPV and IRR. Agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects. Net work Techniques — PERT and CPM.

Unit 2: Risk and its Management

Risks in financing agriculture. Risk management strategies and coping mechanism. Crop Insurance programmes — review of different crop insurance schemes - yield loss and weather based insurance and their applications.

VIII. Practical

Development of Rural Institutional Lending;

Branch expansion, demand and supply of institutional agricultural credit and Over dues and Loan waiving;

An overview, Rural Lending Programmes of Commercial Banks, Lead Bank Scheme;

Preparation of District Credit Plan, Rural Lending Programmes of Co-operative Lending Institutions;

Preparation of financial statements using farm/firm level data, Farm credit appraisal techniques and farm financial analysis through financial statements; Performance of Micro Financing Institutions;

NGO's and Self-Help Groups, Identification and formulation of investment projects;

Project appraisal techniques — Undiscounted Measures and their limitations;

Project appraisal techniques — Discounted Measures;

Network techniques — PERT and CPM for project management;

Case Study Analysis of an Agricultural project;

Financial Risk and risk management strategies — crop insurance schemes;

Financial instruments and methods — E banking, Kisan Cards and core banking.

IX. Teaching Methods/ Activities

- Lectures
- Case studies
  Assignments (Group/individual)
  Group Discussions on inflation

X. Learning outcome

After the completion of the course the student will be able to-Understand the key issues of finance in Agriculture. Learn the techniques of assessing the worth of a project.

XI. Suggested Reading

E Die Sollem H and Heady EO. (Ed.). *Capital and Credit Needs* in *Changing Agricultune,* Bauman.

Hopkins A Barry, Peter Jo and Baker CB. *Financial Management in Agnicultu re.*

Murray WG and Nelson AG. 1960. *Agricultural Finance.* Iowa State University

Chanona C. 1969. *Agricultunal Finance in India: Role of Commercial Banks.* Marketing and Economics Research Bureau, New Delhi.

Gittinger JP. 1972. *Economic anal ysis of agricultural projects,* John Hopkins Univ. Press, Baltimore.

Little IMD and JA Mirrless. 1974, *Project appraisal and planning for developing countries,* Oxford and IBH publishing Co. New Delhi.

Arnold CH. 1972. *Project Evaluation, collected papers,* Macmillan.

I.	Course Title	: Linear Programming
II.	Course Code	: AEC-508
III.	Credit Hours	1+1

IV. Theory

Unit I

Decision Making- Concepts of decision making, introduction to quantitative tools, introduction to linear programming, uses of LP in different fields, graphic solution to problems, formulation of problems.

Unit II

Simplex Method: Concept of simplex Method, solving profit maximization and cost minimizations problems. Formulation of farms and non farm problems as linear programming models and solutions.

Unit III

Extension of Linear Programming models: Variable resource and price programming, transportation problems, recursive programming, dynamic programming.

Unit IV

Game Theory- Concepts of game theory, two person constant sum, zero sum game, saddle point, solution to mixed strategies, the rectangular game as Linear Programming.

V. Practical

Graphical and algebraic formulation of linear programming models.
Solving of maximization and minimization problems by simplex method.
Formulation of the simplex matrices for typical farm situations.

I. Course Title : Research Methodology for Social Sciences
II. Course Code : AEC 509
III. Credit Hours : 1+1

IV. Why this course

Planning of research is very crucial to conduct a successful research. There is need to give an insight to the student about how to conduct a research, right from data collection to analysis and finally writing the references.

V. Aim of the course

The course deals with scientific methods of research, the initiation of an inquiry, formulation of research problems and hypotheses, the role of induction and deduction in research, collection and analysis of date and interpretation of results

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	Introduction to research methodology	1. Concepts of research methodology
2.	Building up hypothesis and sample selection	1. Hypothesis: Framing and Testing 2. Sampling
3.	Data collection and analysis	1. Data collection 2. Data Analysis

VII. Theory

Block 1: **Concepts of research** methodology

Unit 1: Concepts of research methodology

Importance and scope of research in agricultural economics. Types of research — Fundamental vs. Applied. Concept of researchable problem — research prioritization — selection of research problem. Approach to research — research process.

Block 2- Building up hypothesis and sample selection

Unit 1: Hypothesis: Framing and Testing

Hypothesis — meaning — characteristics — types of hypothesis — review of literature – setting of Course Objective and hypotheses — testing of hypothesis.

Unit 2: Sampling

Sampling theory and sampling design — sampling error - methods of sampling — probability and non-probability sampling methods - criteria to choose. Project proposals — contents and scope — different types of projects to meet different needs – trade-off between scope and cost of the study. Research design and techniques – Types of research design.

Block 3- Data Collection and Analysis

Unit 1: Data Collection

Data collection — assessment of data needs — sources of data collection — discussion of different situations. Mailed questionnaire and interview schedule — structured, unstructured, open ended and closed-ended questions. Scaling Techniques. Preparation of schedule — problems in measurement of variables in agriculture. Interviewing techniques and field problems - methods of conducting survey — Reconnaissance survey and Pre testing.

Unit 2: Data Analysis

Data coding, tabulation, cleaning. —Multivariate analysis —factor analysis' PCA' cluster analysis. Universal procedures for preparation of bibliography — writing of research articles.

VIII. **Practical**
- Exercises in problem identification.
  Project proposals — contents and scope.
  Formulation of Objective and hypotheses.
  Assessment of data needs — sources of data — methods of collection of data.
  Methods of sampling — criteria to choose — discussion on sampling under different situations.
  Scaling Techniques — measurement of scales.
- Preparation of interview schedule.
  Field testing. Method of conducting survey.
  Exercise on coding, editing, tabulation and validation of data.
  Preparing for data entry into computer.
  Hypothesis testing — Parametric and Non-Parametric Tests.
  Exercises on format for Thesis/ Report writing.
  Presentation of the results.

IX. Teaching Methods/ **Activities**
- Lectures.
- Case studies.
- Assignments (Group/individual).
- Group Discussions

X. **Learning outcome**

After the successful completion of this course, student will be able to-Understand fundamentals of research. How to carefully plan out the research work and conduct it.

XI. Suggested Reading

Baker CB. *Research Methodology in Agricultural Economics*
Cohen MR and Nagel R. *An Introduction to Logic and iscientific Method*
Devey J Logic. *The Theory of Enquiry*
Dhondhyal SP. *S!ocial lscience Research and Thesis Writirig*
Ezekiel M. *Correlation Analysis*
Heady EO. *Linear Programmirig Methods*
Willson ER. *An Introduction to !Scientific Research*
Kumar A. 2008. *Research Methodology: A Suruey.* Alts, New Delhi,

I. Course **Title**   Indian Economy: History and Contemporary Issues
                            Credit
II. Course Code   : AEC-510
III. Credit Hours   : 2+0

IV. V/hythiscourse?

India is a developing economy. The evolution of the Indian economy will enlighten the student with how an economy develops. Students will understand how the policies and measures taken shape up the economy of the country.

V. Aim of the course

To introduce the students to the economic history over a period of time. It also highlights the contemporary issues of Indian economy.

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	History of Indian Economy	1. India from Independence to Liberalization
		2. India since 1980's (Liberalization and Beyond): Overview
		3. Macro Trends Since 1990
2.	Contemporary Issues	1. Contemporary Isues

VII. Theory

Block 1- History of Indian Economy

Unit 1: India from Independence to Liberalization

An overview of the economic developments during the period 1947-1980; Objectives and strategies of planned economic development and the role of the State; Sectoral growth performance; savings and investment; Demographic trends and issues; education; health and malnutrition; Trends and policies in poverty; inequality and unemployment.

Unit 2: India Since 1980's **(Liberalization** And Beyond): Overview

Policy Changes since 1980s. The 1990 Crisis. Causes and Effects of liberalization. Regional differences: infrastructure, primary, secondary and tertiary sector.

Unit 3: Macro Trends Since 1990

Growth; Savings and Investment, Employment; productivity; diversification; Agro-based industries; competition policy; foreign investment, Regional differences.

Block 2- Contemporary Issues

Unit 1: Contemporary Issues

Monetary and Financial trends- areas of government spending in India, Capital expenditure, revenue expenditure, plan expenditure, non plan expenditure, Deficits (fiscal, primary, revenue), impact of fiscal deficit on economy, Capital receipts, revenue receipts, tax and non tax revenue, direct and indirect taxes, need to rationalize tax structure. Goods and Services Tax (GST). Union Budget, Zero base budgeting, Gender budgeting, Fiscal devolution and centre state financial relations in India, WPI, CPI implicit deflators. Foreign Trade policy.

VIII. **Teaching Methods/ Activities**
- Lectures
  Power point presentation by students on monetary and fiscal policy in past and present.
  Assignments (Group/individual).
  Group Discussions on Tax and its reforms.

IX. Learning outcome

After the completion of the course the student will be able to-Visualize how the Indian economy has evolved. Get acquainted with the basic steps involved in the working of the national economy.

X. Suggested Reading
- Dutt and Sundaram. *Indian Economy*

I. Course Title : International Economics
II. Course Code : AEC 511
III. Credit Hours : 2+1

IV. Why this course?

The era of Globalisation, liberalization and privatization has unified the whole world. There is trade across national boundaries and one economy has effect on the other. Getting familiar with national economy is not sufficient to understand the mechanism of trade and economic aspects. Thus, this course is designed to teach student about the trade as international level.

V. **Aim of the course**

The major objective of this course is to give an insight of the interactions between national economies. What are the theories governing the trade across national boundaries. The methods involved to regulate the international trade and institutions involved.

VI. **Organization of the** course

The course is organised as follows:

No	Block	Unit
1. 2.	Introduction Models, Rate and terms of trade	1. Concepts of International Economies 1. Barriers to trade 2. Models of trade 3. Rates and Terms of trade
3	Institutions	1. Trades Institutions

VII. **Theory**

Block l- Introduction

Unit 1: Concepts of International **Economics**

Scope and Significance of International Economics — The role of trade- General Equilibrium in a Closed Economy (Autarky Equilibrium) — Equilibrium in a Simple Open Economy - Possibility of World Trade - Trade gains and Trade Equilibrium.

Block 2- Models, Rate and Terms of Trade

Unit 1: **Barriers** to trade

Tariff, Producer Subsidy, Export Subsidy, Import Quota and Export Voluntary Restraints- The Case of Small Country and Large Country Case.

Unit 2: Models of trade

Ricardian Model of Trade- Specific Factors Model- Heckscher - Ohlin Model - Trade Creation and Trade Diversion — Offer Curve - Export Supply Elasticity and Import Demand Elasticity — Comparative Advantage and Absolute Advantage.

Unit 3: Rates and **Terms of** trade

Official Exchange Rate and Shadow Exchange Rate - Walra's Law and Terms of Trade — Trade Blocks.

Block 3- Institutions

Unit 1: Trades Institutions

IMF, World Bank, IDA, IFC, ADB — International Trade agreements — Uruguay Round — GATT — WTO.

VIII. **Practical**

Producer's Surplus, Consumer's Surplus, National Welfare under Autarky and Free Trade Equilibrium with small and large country assumption.
- Estimation of Trade Gains
  Estimation of competitive and comparative measures like NPC, EPC, ERP and DRC
  Estimation of Offer Curve Elasticity
  Estimation of Effect of Tariff, Export Subsidy, Producer Subsidy, Import Quota and Export Voluntary Restraints on National Welfare
  Estimation of Ricardian Model
  Estimation of Effect of Trade under Specific Factor Model
  Estimation of trade Equilibrium under Heckscher -Ohlin model

- Trade Creation and Diversion.

m. **Teaching Methods/ Activities**

- Lectures.
- Case studies.
  Assignments (Group/individual).
  Power point presentation on International Trade in current scenario.

X. Learningoutcorne

After successful completion of the course the student will be able to —Understand how trade take place between nations. Be able to work out strategies to maintain a favourable trade balance. Understand how the institutions play role in regulating the cross country trade and deal with the issues.

XI. Suggested Reading

Kindelberger and Joshi PK. 2016. *International* Economics AITBS De1hi-110051
Brouwer F. *International Trade and Food !Securit y.* LEI - Wageningen UR, The Netherlands.

I.	Course Title	: Institutional Economies
II.	Course Code	: AEC 512
III.	Credit Hours	: 1+0

IV. V/hythiscourse?

Institutions are involved in framing of economic development. The human behavior is governed by the institutions working in their environment. Thus, the student need to understand the institutions and their working.

V. Aim of the course

To develop critical and informed understanding about institutions, their role in the working of economy. Exposure of issues, policies & regulations and its application in agricultural system

VI. **Organization of the course**

The course is organised as follows—

No	Block	Unit
1	Introduction	1. Basics of Institutional Economics
2.	Approaches	1. Institutional changes & Resource allocation
		2. Group and collective Approach
3.	Law Protection and Institutions	1. Property rights
		2. Agrarian Institutions

VII. **Theory**

Block 1: Introduction

Unit 1: Basics of Institutional Economies

Old and New Institutional Economics — Institutional Economics vs Neo-classical Economics. Definition of institutions — Distinction between institutions and organizations — Institutional evolution.

Block 2: Approaches

Unit 1: Institutional changes & Resource allocation

Institutional change and economic performance - national and international economic institutions. Transaction cost economics — Transaction costs and the allocation of resources. Transaction costs and efficiency. Asymmetric information - Moral hazard and Principal-Agent problem.

Unit 2: Group and collective Approach

Free rider problem — path dependency — Interlinked transactions. Collective action and the elimination of free-rider problem - The logic of collective action and its role in reducing free rider problem — theory of Groups. Rent seeking — interest groups and policy formulation.

Block 3: Law **Protection** and **Institutions**

Unit 1: Property rights

Economic analysis of property rights- property rights regimes — private property — State Property   Common property Resources (CPRs) — public goods and club goods.

Unit 2: Agrarian Institutions

Special features of institutional arrangements in agriculture — Transaction costs in agriculture - Case Studies - Theories of agrarian institutions - tenancy institutions.

VIII.   Teaching Methods/ Activities
- Lectures.
- Case studies.
- Assignments   (Group/individual).
  Group Discussions on Property rights

IX. **Learning outcome**

After successful completion of this course the student will be able to-Understand institutions and their roles in economic development. Know about the policies and their issues in an institutions.

X. Suggested Reading

Pearce DW —*The dictionary of modern Ecomomics*

I. Course Title   : Natural Resource and Environmental Economies
II. Course Code   : AEC 513
III. Credit Hours   : 1+1

IV. Why this course?

Sustainable development is the need of the hour. The economic activities affect not only the society but also the environment. Every activity has its social cost. The students, hence will be taught about the economic aspect of environment.

V. Aimofthecourse

To understand about economics of environment and social costs incurred due to economic development. Work out methods to maintain environment quality and reduce social costs

VI. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	Introduction to natural resource and environmental economics	1. Basic Foundation
2.	Insight of the subject	1. Theories and economics of natural resources 2. Functioning of Market
3	Dealing with Issues and sustainability	1. Environmental Issues 2. Regulations 3. Sustainability aspects

VII. Theory

Block 1- Introduction to natural resource and environmental economics

Unit 1: Basic Foundation

Concepts, Classification and Problems of Natural Resource Economics — Economy Environment interaction — The Material Balance principle, Entropy law-Resources Scarcity - Limits to Growth - Measuring and mitigating natural resource scarcity — Malthusian and Recardian scarcity — scarcity indices - Resource Scarcity and Technical Change.

Block 2- Insights of the subject

Unit 1: Theories and economics of natural resources

Theory of optimal extraction renewable resources —economic models of oil extraction-efficiency - time path of prices and extraction - Hotelling's rule, Solow-Harwick's Rule. Theory of optimal extraction exhaustible resources — economic models of forestry and fishery.

Unit 2: Functioning of Market

Efficiency and markets — market failures - externalities — types - property rights — transaction costs — Coase's theorem and its critique - public goods - common property and open access resource management - Collective action.

Block 3- Dealing with the issues and sustainability

Unit 1: Environmental Issues

Environmental perspectives - biocentrism, sustainability, anthropocentrism Environmental problems and quality of environment - Sources and types of pollution -air, water, solid waste, land degradation — environmental and economic impacts - Economics of pollution control - efficient reduction in environmental pollution.

Unit 2: Regulations

Environmental regulation — economic instruments - pollution charges — Pigovian tax - tradable permits — indirect instruments — environmental legislations in India.

Unit 3: Sustainability aspects

Concept of sustainable development — Economic Perspective — Indicators of sustainability Relation between development and environment stress-Environmental Kuznet's curve Environmental Accounting — resource accounting methods —

International Environmental Issues — climate change — likely impacts — mitigation efforts and international treaties.

VIII. **Practical**

Exhaustible resource management — optimum rate of oil extraction.
Renewable resource management — optimum harvest of Forestry/fishery.
Exercise on pollution abatement-I.
Exercise on pollution abatement-II.
Concepts in valuing the environment.
Taxonomy of valuation techniques.
Productivity change method — substitute cost method — Hedonic price method — Travel cost method — Contingent valuation methods.
Discount rate in natural resource management.
Environment impact assessment
Visit to Pollution Control Board.

m. **Teaching Methods/ Activities**

• Lectures.
• Case studies.
• Assignments (Group/individual).

X. **Learning outcome**

After successful completion of this course, the student will be able to-Work out the plan for extraction / use of natural resource in most economical way. Understand the environment and its pollution. Learn how markets are affected if environment is not taken into consideration. Gain proficiency in rules and regulation governing economic aspect of environment.

XI. **Suggested Reading**

Pearce DW and Turner RK. *Economics* o/ *Natural Resource and Enuironment*
Kwak J. *Economism: Bad Economics and the Rise of Inequalit y*
Tietenberg T and Lewis L. *Eiiuiron mental and Natural Resource Ecoiiomics*
Schwarz PM. *Energy Economics*

I. **Course Title** : Commodity Future Trading Credits
II. **Course Code** : AEC 514
III. **Credit Hours** : 2+0

IV. V/hy this course?

Risk is involved in marketing. Price fluctuation is a very common phenomenon in agriculture marketing. In such situation selling of commodity in future market serves as a resort to insulate from this uncertainty. Thus, knowledge of futures market is helpful in ...

V. **Aim of the course**

To disseminate the knowledge about risk mitigating measures especially future trading. The future trading in agricultural commodities is increasing day by day therefore the role of SEBI, functioning of commodity exchanges are discussed.

VI. **Organization of the** course

The course is organised as follows:

No	Block	Unit
1.	Introduction to commodity market	1. Concepts of commodity future trading
2.	Techniques and risks in commodity market	1. Technical aspects 2. Risk and its Management
3.	Commodity exchange and market analysis	1. Commodity Exchange—A review 2. Analysis of commodity market

Theory

Block 1- Introduction to commodity market

Unit 1: Concepts of commodity future trading

History and Evolution of commodity markets — Terms and concepts: spot, forward and futures Markets — factors influencing spot and future markets. Speculatory mechanism in commodity futures.

Block 2- Techniques and Risks in Commodity Market

Unit 1: Technical aspects

Transaction and settlement — delivery mechanism - role of different agents - trading strategies -potential impact of interest rate, Foreign Exchange, FDI in Commodity Markets.

Unit 2: Risk and its Management

Risk in commodity trading, importance and need for risk management measures - managing market price risk: hedging, speculation, arbitrage, swaps - pricing and their features.

Block 3- Commodity exchange and **market analysis**

Unit 1: Commodity Exchange — A review

Important global and Indian commodity exchanges - contracts traded — special features -Regulation of Indian commodity exchanges - FMC   and its role.

Unit 2: Analysis of commodity market

Fundamental Vs Technical analysis — construction and interpretation of charts and chart patterns for analyzing the market trend — Market indicators — back testing. Introduction to technical analysis software — analyzing trading pattern of different commodity groups.

VII. Teaching Methods/ Activities
- Lectures.
- Case studies.
- Assignments (Group/individual).
- Group Discussions.
  Power point presentations by students.

VIII. Learning outcome

After successful completion of this course, the student will be able to-The basic concepts of commodity markets. The national and international commodity markets.

IX.

Kaufman PJ. *The Concise Handbook of Futures Markets:* Jhon Wiley & Sons

Purcell WD. *Agricultunal Futures and Options: Priiiciples and S!tnategies:* MacMillan Publications

Wasendorf RR & McCaffery *All About Commodities from the Inside Out.* McGraw Hill

I. Course Title   : Development Economics Credit

II. Course Code   : AEC-515

III. Credit Hours   : 2-F0

IV. /hy this course?

Development is more important than growth. The development of a nation ensures that condition of welfare prevails. The students has to understand different measures of development. How to measure them and relevant theories.

V. Aim of the course

To develop concept of growth and development. Methods and theories of measuring development. Study of different developed economies will give exposure towards measures to create economic upliftment.

VI. Learning outcome

After successful completion of this course, the student will be able to-Measure the development using different methods. Understand the theories of development and relate it to real world.

VII. Organization of the course

The course is organised as follows:

No	Block	Unit
1.	Introduction to development economics	1. Conceptions of Development
2.	Theories and comparison	1. Theories of Economic growth and development
		2. Comparative Economic Development

VIII. Theory

Block 1- Introduction to Development Economies

Unit 1: Conceptions of Development

Development Economics — Scope and Importance - Economic development and economic growth - divergence in concept and approach - Indicators and Measurement of Economic Development —GNP as a measure of economic growth — New Measures of Welfare — NEW and MEW — PQLI — HDI — Green GNP - Criteria for under development — Obstacles to economic development —Economic and Non-Economic factors of economic growth- Development issues, poverty, inequality, unemployment and environmental degradation.

Block 2- Theories and comparison

Unit 1: Theories of Economic growth and development

Classical theories- Adam smith - Ricardo- Malthus, Marx's theory of economic

development; Schumpeter's theory, Approaches to development- low income equilibrium trap - critical minimum effort- The Strategy of economic development-Balanced vs. Unbalanced growth, choice of technique, investment criteria, big push theory, Rostow's stages of Economic Growth, unlimited supply of labour; social and technological dualisms; roles of cap it aI accum ulation, human capital and technological change in economic development, Models of economic growth Harrod-Domar, Kaldor, Mahalanobis, Lewis, FeiRanis, Input-Output, multisectoral models.

Unit 2: Comparative Economic Development

Countries selected for case studies -USA, Japan, China and India; Overview of economic development is selected countries; agrarian surplus and the role of the peasantry in economic development; industrial revolution; division of labour, organisation of work and industrial production, the role of the State in developmental transition

IX. Teaching Methods/ Activities

- Lectures.
- Case studies.
- Assignments (Group/individual).
- Group Discussions on inflation

X. Suggested Reading

Blaug M. 1986. *Ecoiiomic History and the History of Economic Thought*
Chenery HB and TN Srinivasan. *Handbook of Develop ment Economics*
Baldwin RE. Economic *Development and Growth.* John Willey, New York

I.	Course Title	: Mathematics for Agricultural Economics
II.	Course Code	: STAT/AEC
III.	Credit Hours	: 3+0

IV. **Why this course?**

Knowledge of calculus is basic requirement for carrying out simple calculations.

V. **Aim of the course**

To solve various mathematical problems in economic research. Calculations are integral part of research analysis therefore it has wide application in economic studies.

VI. **Organization of the course**

The course is organised as follows:

No	Block	Unit
1.	Introduction	1. Preliminaries
2.	Variables and functions	1. Variables and functions
		2. Differentiation of functions
3.	Overview of linear algebra	1. Linear Algebra
		2. Optimization of functions
		3. Integration of functions

VII. **Theory**

Block 1- **Introduction**

Unit 1: Preliminaries

Logic and proof techniques; sets and set operations; relations; functions and their properties; number systems

Block 2- Variables and functions

Unit 1: **Variables and functions**

Specific functions is economic theory. Elementary analytical geometry-gradient and equation of straight line. Standard equations and simple properties of circle, parabola and rectangular hyperbola.

Unit 2: Differentiation of functions

Limit and continuity. Differentiation, theorems of differentiation, differentiation of logarithmic and exponential functions, function of a function, derivative of higher order, partial derivatives. Application of derivatives to determine average and marginal values in economic analysis; determination of elasticities; points of inflexion; linear homogenous production functions; derivation of average and marginal curves.

Block 3- Overview of Linear Algebra

Unit 1: Linear Algebra

Determinants, evaluation and properties of determinants, Vectors and vector spaces, Matrices, notations and operations, laws of matrix algebra; transpose and inverse of matrix; Solution of linear and quadratic equations involving one variable, simultaneous equations, application of determinants and matrices in solution of equation for economic analysis.

Unit 2: Optimization of functions

Optimization- unconstrained, maxima and minima, constrained optimization, Lagrange multiplier and their economic applications for optimization problems of cost, production, demand and supply.

Unit 3: Integration of functions

Integration as a reverse process of differentiation, methods of integration, reduction formulae, definite integral, use of integration to determine relation between average and marginal value. Capitalization over time, estimation of returns from capital goods over time. Pareto distribution.

VIII. Teaching Methods/ Activities
- Lectures.
- Case studies.
  Assignments (Group/individual).
  Power point presentations

IX. **Learning outcome**

After successful completion of this course, the student will be able to-Develop expertise in calculus operations.