GEN-4301 **Islamic Studies** **Credit Hours: 2(2-0)**

Objectives	۱۔طلباء کو علوم القرآن سے متعارف کروانا ۲۔طلبا کو بنیادی علوم حدیث سےمتعارف کروانا ۔ ۳۔سیرت نبی ﷺ کا تعارفی مطالعہ کروانا۔

Week	Topic	Activity
Week 1	• قران پاک کا تعارف،فضائل ، اعجاز	
	• قرآن پاک کا نزول قرآن ، جمع و تدوین	
Week 2	• علوم قرآن: علم تفسیر ، ماخذ تفیسر	
	• علم اسباب نزول، علم ناسخ و منسوخ	
Week 3	• سورہ حجرات آیت (01 تا ۰۹)	
	• سورہ حجرات آیت (10 تا 18)	
Week 4	• سنت و حدیث کا تعارف: معنی و مفہوم، اقسام	**Assignment# 01**
	• تاریخ تدوین حدیث	
Week 5	• سنت کی آئینی حیثیت	
	• منتخب متون احادیث کا مطالعہ: حدیث نمبر ۰۵-1	
Week 6	• منتخب متون احادیث کا مطالعہ: حدیث نمبر 10-۵	**Quiz # 01**
	• منتخب متون احادیث کا مطالعہ: حدیث نمبر ۱۵-۱۰	
Week 7	• **Mid Term**	
Week 8	• منتخب متون احادیث کا مطالعہ: حدیث نمبر ۲۰-۱۵	
	• پیدائش سے بعثت تک نبی کریمﷺ کی زندگی کے اہم واقعات	
Week 09	• نبی پاکﷺ کی مکی زندگی کے اہم واقعات	**Assignment# 02**
	• نبی پاکﷺ کی مدنی زندگی کے اہم واقعات	
Week 10	• خلافت راشدہ(حضرت ابو بکر صدیق رضی اللہ عنہ و حضرت عمر رضی اللہ عنہ کے دور کی اہم خصوصیات	
	• خلافت راشدہ(حضرت عثمان رضی اللہ عنہ و حضرت علی رضی اللہ عنہ کے دور کی اہم خصوصیات	
Week 11	• عقائد :ایمانیات ثلاثہ (ایمان باللہ ، ایمان بالرسالت اور ایمان بالاخرت)(الف)	**Quiz # 02**
	عقائد :ایمانیات ثلاثہ (ایمان باللہ ، ایمان بالرسالت اور ایمان بالاخرت)(ب)	
Week 12	• فقہ کا تعارف : پس منظر	
	فقہی مسالک کا تعارف	
Week 13	• نماز: اہمیت ، طریقہ نماز ، مسائل نماز (الف)	
	• نماز: اہمیت ، طریقہ نماز ، مسائل نماز (ب)	
Week 14	• روزہ : اہمیت ، مسائل روزہ	
	• زکوۃ : اہمیت ، مسائل زکوۃ	
Week 15	• حج اور عمرہ : اہمیت ، طریقہ کار ، مسائل (الف)	
	• حج اور عمرہ : اہمیت ، طریقہ کار ، مسائل(ب)	
Week16	• جہاد: اہمیت ، مقاصد جہاد ، اداب جہاد (الف)	
	• جہاد: اہمیت ، مقاصد جہاد ، اداب جہاد (ب)	
Week17	**Terminal Examination**	

منتخب متن حدیث :

.1	الایمان بضع وسبعون شعبۃ---	.2	ان اللہ لاینظرالی اجسادکم ---
.3	من صلی علی واحدۃ	.4	من عادی لی ولیا---
.5	بحسب امری من الشر---	.6	ایاکم و الظن---
.7	اللہ فی عون العبد---	.8	من کایؤمن باللہ فلیصل رحمہ
.9	من کان یؤمن باللہ و الیوم الآخر فیکرم جارہ	.10	من حسن اسلام المرء---
.11	الکلمۃ الطیبۃ صدقۃ	.12	لا یجتمع غبار-----
.13	اکثروا ذکر ھازم اللذات---	.14	آیۃ المنافق ثلاث
.15	جزوا الشوارب----	.16	ما تواضع احد للہ
.17	الحیاء شعبۃ من الایمان	.18	الرجل علی دین خلیلہ---
.19	تردون علی غرا---	.20	لیس شئی اکرم علی اللہ من الدعاء

Reference Material:

1. Hameed ullah Muhammad, "Emergence of Islam" , IRI, Islamabad
2. Hameed ullah Muhammad, "Muslim Conduct of State"
3. Hameed ullah Muhammad, „Introduction to Islam
4. Mulana Muhammad Yousaf Islahi,"
5. Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
6. Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
7. Mir Waliullah, "Muslim Jurisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
8. H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
9. Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)
10. The five pillars of Islam: A journey Through the Divine Acts of worship, Muhammad Mustafa al Azami
11. The five pillars of Islam: A framework of Islamic values and character building, Musharaf Hussain
12. Towards understanding Islam, Abu al'la Moudodi

13اسلامی نظریہ حیات، خورشید احمد

14اسلامیات لازمی، ڈاکٹر محمد عرفان، ڈاکٹر حبیب الرحمان، مکتبہ البیت ، اسلام آباد

GEN-4302 Entrepreneurship Credit Hours: 2(2-0)

Objective:

By the end of this course, students shall have:

1. Knowledge of fundamental entrepreneurial concepts, skills and process.
2. Understanding on different personal, social and financial aspects associated with entrepreneurial activities.
3. Basic understanding of regulatory requirements to set up an enterprise in Pakistan, with special emphasis on export businesses;
4. Ability to apply knowledge, skills and competencies acquired in the course to develop a feasible business plan.

Course Contents:

1. **Introduction to Entrepreneurship:**
   - Definition and concept of entrepreneurship.
   - Why to become an entrepreneur?
   - Entrepreneurial process.
   - Role of entrepreneurship in economic development.

2. **Entrepreneurial Skills:**
   - Characteristics and qualities of successful entrepreneurs (including stories of successes and failures).
   - Areas of essential entrepreneurial skill and ability such as creative and critical thinking, innovation and risk taking abilities etc.
3. **Opportunity Recognition** and **Idea Generation:**
   - Opportunity identification, evaluation and exploitation;
   - Innovative idea generation techniques for entrepreneurial ventures.
4. **Marketing and Sales**
   - Target market identification and segmentation;
   - Four P's of Marketing.
   - Developing a marketing strategy.
   - Branding.
5. **Financial Literacy:**
   - Basic concepts of income, savings and investments.
   - Basic concepts of assets, liabilities and equity.
   - Basic concepts of revenue and expenses.
   - Overview of cash-flows.
   - Overview of banl‹ing products including Islamic modes of financing.
   - Sources of funding for startups (angel financing, debt financing, equity financing etc.).
6. **Team Building for Startups:**
   - Characteristics and features of effective teams.
   - Team building and effective leadership for startups

7. **Regulatory Requirements to Establish Enterprises in Pakistan:**
   - Types of enterprises (e.g., sole proprietorship; partnership; private limited companies etc.).
   - Intellectual property rights and protection.
   - Regulatory requirements to register an enterprise in Pakistan, with special emphasis on export firms.
   - Taxation and financial reporting obligation.

Suggested Reading

1. "Entrepreneurship: Successfully Launching New Ventures" by Bruce R. Barringer and R. Duane Ireland.
2. "Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko.
3. "New Venture Creation: Entrepreneurship for the 21st Century" by Jeffry A. Timmons, Stephen Spinelli Jr., and Rob Adams.
4. "Entrepreneurship: A Real-World Approach" by Rhonda Abrams.
5. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries.
6. Effectual Entrepreneurship" by Stuart Read, Saras Sarasvathy, Nick Dew, Robert Wiltbank, and Anne-Valerie Ohlsson

GEN-4303 Quantitative Reasoning-II CreditHours:3(3-0)

Course Objectives:

Summarizing, interpreting, and presenting quantitative data in mathematical forms, such as graphs, charts, tables, or mathematical text. Construct or compute representations of data using mathematical forms or equations as models and use statistical methods to assess their accuracy.

Course Contents:

Logic, Logical and Critical Reasoning: Introduction and importance of logic; Inductive, deductive and abductive approaches of reasoning; Propositions, arguments (valid; invalid), logical connectives, truth tables and propositional equivalences; Logical fallacies; Venn Diagrams; Predicates and quantifiers; Quantitative reasoning exercises using logical reasoning concepts and techniques.

Mathematical Modeling and Analyses: Introduction to deterministic models; Use of linear functions for modeling in real-world situations; Modeling with the system of linear equations and their solutions; Elementary introduction to derivatives in mathematical modeling; Linear and exponential growth and decay models; Quantitative reasoning exercises using mathematical modeling.

Statistical Modeling and Analyses: Introduction to probabilistic models; Bivariate analysis, scatter plots; Simple linear regression model and correlation analysis; Basics of estimation and confidence interval; Testing of hypothesis (z-test; t-test); Statistical inference in decision making; Quantitative reasoning exercises using statistical modeling.

Recommended Books:

1. Using and Understanding Mathematics: A Quantitative Reasoning Approach by Bennett, J. O., Briggs, W. L., & Badalamenti, A.
2. Discrete Mathematics and its Applications byy Kenneth H. Rosen.
3. Discrete Mathematics with Applications by Susanna S. Epp.
4. Applied Mathematics for Business, Economics and Social Sciences by Frank S. Budnick.
5. Elementary Statistics: A Step-by-Step Approach by Allan Bluman.
6. Introductory Statistics by Prem S. Mann.

7. Applied Statistical Modeling by Salvatore Babones.
8. Barrons SAT by Sharvon Weiner Green, M.A and Ira K. Wolf

Botany

BOT-4304 Plant systematics, Anatomy & Development Credit Hours: 3(3-0)

Objectives

To understand Various systems of classification, identification and nomenclature of higher plants.

Course Contents:

A. Plant systematics

1. Introduction to Plant Systematics: aims, objectives and importance.
2. Classification: brief history of various systems of classification (artificial, natural and phylogenetic and current).
3. Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to International Code of Botanical Nomenclature (ICBN). Principles of ICBN.
4. Morphology: a detailed account of various morphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.
5. Diagnostic characters, economic importance of following families: Ranunculaceae, Brassicaceae (Cruciferae), Fabaceae (Leguminosae), Rosaceae, Euphorbiaceae, Cucurbitaceae, Solanaceae, Lamiaceae (Labiatae), Apiaceae (Umbelliferae), Asteraceae (Compositae), Liliaceae and Poaceae (Gramineae)

B. Anatomy

Concept, structure and function of various tissues like: Parenchyma, Collenchyma, Sclerenchyma, Epidermis (including stomata and trichomes), Xylem, Phloem, Meristem: types, stem and root apices, Vascular cambium, Structure and development of root, stem and leaf. Primary and secondary growth of dicot stem, periderm, Characteristics of wood: diffuse porous and ring –porous, sap and heart wood, soft and hard wood, annual rings.

C. Development / Embryology

Early development of plant body: Capsella bursa-pastoris, Structure and development of Anther Microsporogenesis Microgametophyte, Structure of Ovule Megasporogenesis Megagametophyte, Endosperm formation, Parthenocarpy, Polyembryony

Practicals

Anatomy

1. Study of stomata, epidermis,
2. Tissues of primary body of plant
3. Study of xylem 3-dimensional plane of wood.
4. T.S of angiosperm stem and leaf.

Taxonomy

1. Identification of families given in syllabus with the help of keys.
2. Technical description of common flowering plants belonging to families mentioned in theory syllabus.
3. Field trips shall be undertaken to study and collect local plants.
4. Students shall submit 40 fully identified herbarium specimens.

Recommended Books:

1. Mauseth, J.D. 1998. An Introduction to Plant Biology: Multimedia Enhanced. Jones and Bartlett
Pub. UK
2. Moore, R.C., W.D. Clarke and Vodopich, D.S. 1998. Botany. McGraw Hill Company, U.S.A.
3. Raven, P.H., Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants. W.H. Freeman and Company Worth Publishers.
4. Stuessy, T.F. 1990. Plant Taxonomy. Columbia University Press, USA.
5. Lawrence, G.H.M. 1951 Taxonomy of Vascular Plants. MacMillan & Co. New York.
6. Panday, B.P. 2004. A textbook of Botany (Angiosperms). S. Chand and Co. New Delhi.
7. Raymond E, S. E. Eichhorn. 2005. Esau's Plant Anatomy. Meristems cells and tissues of the plant body, 3 rd ed. John Wiley & Sons. Inc.
8. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
9. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.
10. Maheshwari, P.1971. Embryology of Angiosperms, McGraw Hill. New York.
11. Eames A.J. and L.H Mac Daniels. 2002. An Introduction to Plant Anatomy. Tata-Mac Graw-Hill
Publishing Company, Limited New Delhi.
12. Pullaiah, T. 2007. Taxonomy of Angiosperms. 3 rd Edition Regency Publications, New Delhi.
13. Naik, V.N. 2005 Taxonomy of Angiosperms. 20 th Reprint. Tata-Mac Graw-Hill Publishing Company, Limited New Delhi.

Chemistry

CHM-4306 Physical Chemistry Credit Hours: 4(3-1)

Course Contents:

1. Physical States of Matter

a. **Gases:**

General characteristics of gases, Gay Lussac's law, ideal gas equation, kinetic molecular theory of gases, molecular velocities (average velocity, mean square velocity, root mean square velocity, most probable velocity), ideal and real gases, deviation of gas from ideality, derivation of kinetic gas equation, molecular collisions, collision diameter, critical phenomenon of gases, liquefaction of gases, mean free path, Vander Waal's equation for real gases.

b. **Liquid:**

General characteristics of liquids, physical properties like surface tension, viscosity, parachor value, rheochor value and their applications, refractive index, specific and molar refraction and their applications, optical activity, specific rotation, dipole moment and molecular structure.

c. **Solids:**

General characteristics of solids, types of solids, isotropy and anisotropy, habit of a crystal, crystal lattice and unit cell, crystal systems, Bragg's equation and X-ray crystallography of sodium chloride crystal and Bravis lattices.

2. Quantum theory and structure of atom:

Bohr's atomic model, defects of Bohr's atomic model, classical and quantum mechanics, failure of classical mechanics, the concept of quantization, dual nature of matter, de-Broglie's equation, Heisenberg's uncertainty principle, limitation of Heisenberg's uncertainty principle, wave function and derivation of time independent Schrodinger wave equation, concept of atomic orbitals, quantum numbers, electronic distribution.

3. Chemical Thermodynamics: Introduction, thermodynamic terms like system, surrounding, boundary of system, states and state function, internal energy, extensive and intensive properties, first law of thermodynamics, enthalpy of a system, relationship between free energy change and enthalpy change, heat capacity of gases at constant volume and at constant pressure, , heat capacities relationship, 2nd law of thermodynamics, 2nd law of thermodynamics, concept of entropy, entropy change in phase transition, concept of Gibb's and Helmholtz's free energy, change in free energy and equilibrium constant.

4. Chemical Kinetics

Introduction, concept of rate of chemical reaction, rate law, velocity constant, elementary and complex reaction, order and molecularity of reaction, zero, first and second order reactions, derivation of kinetic equation for first order and 2nd order reaction when initial concentration of both reactants is same, various methods for determining rate of chemical reaction, Arrhenius equation, Lindemann' s theory for unimolecular reaction, introduction to transition state theory, transition state theory for bimolecular reaction.

5. Electrochemistry

Introduction, conductors and insulators, electrolytic and electronic conduction, specific conductance, measurement of specific conductance, cell constant and its determination, molar & equivalent conductance and their determination, Ostwald's dilution law (dependence of degree of dissociation constant on dilution), electrochemical cells, types of cells, Faraday's laws of electrolysis and their significance.

6. Surface Chemistry

Absorption and adsorption, types of adsorption, characteristics and factors which affect adsorption, applications of adsorption, physical adsorption and chemisorptions, catalysis, types of catalysis, enzyme catalysis, characteristics of catalysis, Freundlich adsorption isotherm and Langmuir adsorption isotherm and their applications.

7. **Solutions**

Introduction, types of solution, concentration units (%age, normal, molar, molal, ppm, ppb, et.), Raoult's law, ideal and non-ideal solutions, concept of zeotropic and azeotropic mixture, molecular interactions in solution, colligative properties (lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure and their determination).

Recommended Books:

1. Haq Nawaz Bhatti, A Textbook of Physical Chemistry, Caravan Book House, Lahore.
2. Bhatti H.N. and K. Hussain, "Principles of Physical Chemistry", Carvan Book House, Lahore.
3. Chaudhary G.R, "A Text Book of Physical Chemistry", Abdi Umair Printing Press, Imtiaz Book Depot, Lahore.

Reference Books

1- Akhtar M.N. & Ghulam Nabi, "A Text Book of Physical Chemistry".

2- Maron S.H. & B. Jerome, "Fundamentals of Physical Chemistry", macruthan Publishing Co. Inc. New York.

3- Atkins P.W., "Principles of Physical Chemistry" Pitman Publishing Company (1990).

4- Moore W.J. "Physical Chemistry", 5th Ed. Longmans publishers.

5- Jones M., "Elements of Physical Chemistry", Addisson-Sesky publishing Company.

6- Adamson A.W., "Understanding Physical Chemistry" 3rd Ed. Benjamin Cummings Publishing Company Inc.

7- Heald C. & A.C.K. Smith, Applied Physical Chemistry Macmillan press Ltd.

8- Hirst, D.M. "mathematics for Chemists" MacMillan Press Ltd.

9- Alberty R. "Physcial Chemistry" 17th ed., John Wiley and Sons (1987).

10- Atkins, P.W. "Physical Chemistry" 6th ed., W.H. Freeman and Co. New York (1998).

11- Laidler k.J. "The World of Physical Chemistry" 1st ed., Oxford University Press (1993).

12- Laidler K.J., John H.M. and Bryan C.S. “Physical Chemistry” 4th ed., Houghton Mifflin Publishing Company Inc. (2003).

13- Barrow G.W. “Physical Chemistry” 5th ed., McGraw Hill (1992)

Physical Chemistry Practical’s

1. Determination of surface tension and parachor value by stalagmometer.
2. Determination of percent composition of liquid solutions from surface tension measurements.
3. Determination of viscosity and Rhechor value of Liquids from viscosity measurements.
4. Determination of percent composition of liquid solutions viscometrically.
5. Determination of refractive index and specific refractivity by refractometer.
6. Determination of percent composition of liquid solutions by refractive index measurements.
7. Determination of heat of neutralization of an acid with a base.
8. Determination of heat of solution of salts by calorimetric method.
9. Determination of angle of rotation of an optically active substance.
10. Determination of percent composition of an optically active substance in solution.
11. Determination of equilibrium constant of KI + I2 ----------> KI.
12. Conductometric titration of strong acid and strong base.

Recommended Book:

1. Muhammad Abid Khawaja, Practical Chemistry Note Book, Physical Chemistry, Ilmi Kitab Khana, Urdu Bazar, Lahore.

Reference Books:

1- Levitt B.P., “Findlay’s Practical physical Chemistry”, 9th Ed., Longman Group Limited.

2- Das R.C. and B. Behera, “Experimental Physical Chemistry”, Tata McGraw Hill Publishing Company Limited.

3- Crocleford H.D., H.W. Biard, F.W. Getzen & JW. Nowell, “Laboratory Manual of physical Chemistry”, 2nd Ed., John Wiley & Sons London.

4- Helpern Arthur M., “Experimental Physical Chemistry. A Laboratory Textbook” 2nd ed. Prentice Hall (1997).

5- Bassette J., Denney C., Jeffery G. H. and Mendham J. “Vogel’s Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis”. English Language

Book Society. 4th ed. (1978).

6- Daniel, F., Experimental Physical Chemistry" McGraw Hill (1962). 7- Shoemaker, D., "Experimental Physical Chemistry" McGraw Hill (1989)

Computer

CS-4306 Introduction to Software Engineering Credit Hours: 3(3-0)

Course Objectives: After completing this course students should be able to:

1. Develop and write a software project proposal
2. Develop and write a Software Requirements Specification
3. Design a software system in OOP paradigm

Course Outline: Software Definitions, Nature of Software, Overview of Software Engineering, Characteristics of a Software, Software Types, Professional software development, Software engineering practice, Software process structure, Software Process Models (Waterfall, Prototype, Spiral, RAD), Project Management, Agile software Development, Agile process models, Requirement Engineering Process, Functional, Non-Functional and Interface Requirements, System Analysis Modeling, Flow Charts, Data Flow Diagrams, Software Design Mythologies, Architectural Design, Procedural or Functional Design, Architectural design, Design and implementation, UML diagrams, Design patterns, Software testing and quality assurance, Software evolution, configuration management, Software Process improvement. Software Testing Techniques, Black Box Testing, White Box Testing, Acceptance Testing, Different Testing Strategies.

Recommended Books:

1. Software Engineering 8E by Sommerville Addison Wesley, (2006)
2. Software Engineering: A Practitioner's Approach 7thEdition, Roger Pressman, McGraw-Hill, (2009)
3. Applying UML and Patterns. Introduction to OOAD & Iterative Development by Craig Larman

Tools

Microsoft Visio

Week	Topics	
Week 1	• Course Introduction • Overview and Basics	
	• Software and its importance • What is engineering	

	• Definitions of Software Engineering • Well-Engineered Software • The Balancing Act	
Week 2	• Software Development • Construction • Management • Software Engineering Framework	
	• Software Development Loop • Software Engineering Phases	
	• Requirement Engineering • Software Requirements Definitions • Role of Requirements	
Week 3	• Requirement Statement and Requirement Specification Documents • Requirement Specification Characteristics	

	• Relationship of Several components of Software Requirements
	• Software Requirement Specification (SRS)
	  o Introduction
	  o Purpose
	  o Scope
	  o System environment	

	• Software Requirement Specification (SRS)
	  o Product function Specifications
	  o Contraints
	  o Requirement specification
	▪ Functional and non functional requirements	

Week 4	• Preparation Guidelines of Software Requirement Specification Document • SRS Example web/ mobile application	Assignment

	• Use Cases and Customer-Developer Relationship • Use Case Model Components • Creating a Use Case Model • Relationship among Use Cases	
	• Creating a Use Case Model • Review and discussion on SRS and Usecase Diagram	
Week 5	• Elaborated Use Cases • Usecase description (fully dressed format)	

	• Activity Diagrams • Activity diagram notations	
	• Elaborated Use Cases • Activity Diagrams • Review and discussion on practice project case study Activity Diagrams	

Week 6	• Software Process Models
	  ○ Water Fall
	  ○ Iterative
		Quiz

	• Evolutionary Development • Prototyping Model	
	• Spiral development Process Model • Activities of Four Quadrants	
Week 7	Midterm	
Week 8	• Unified Process Model and conformance to Waterfall model development Phases	
	• Unified Process Model • Comparing Software process models • Software development processes: from the • waterfall to the Unified Process	

	• Software Architecture and Design • Show how graphical models and UML are used to represent software systems • Connect software architectural elements to detailed design elements	
Week 9	• Software Design • Introduction • Software Design Strategies	Assignment
	• Function Oriented versus Object Oriented Design • Object Oriented Design Components	
	• Software Classification • The object model • Relationships between Objects	
Week 10	• Relationships between Objects • Relationship types and notations	
	• Object Oriented Analysis • Interaction Diagrams • Introduction and types	
	• Difference between Sequence Diagrams and Collaboration Diagra • POS system Sequence Diagrams and Collaboration Diagrams	
Week 11	• Interaction Diagram Types • Interaction Diagram Notation	Quiz
	• Illustrating Classes and Instances • Collaboration Diagrams • Drawing Collaboration Diagrams • Examples	
	• Sequence Diagrams	
Week 12	• Drawing collaboration and Sequence Diagrams • Examples	
	• POS System and Basic Sequence Diagrams • Preparing sequence diagrams	

	for selected case study	
	• Review Sequence Diagrams • More notations	
Week 13	• Drawing Sequence Diagrams Case Studies • Sequence Diagram Case Study Task	
	• Sequence Diagram Case Study Task Evaluation and feedback	
	• Class Diagram • Design Class Diagram • UML Attributes: Attribute Text and Association Lines	
Week 14	• Class Diagram • Generalization, Abstract Classes, Abstract Operations	
	• Object Oriented Design • Relationship Between Interaction and Class Diagrams?	
	• Sequence Diagram and Class Diagram • Class Diagram Notations • Draw Class Diagram	
Week 15	• Reinforcement of Sequence Diagrams and Class Diagram	
	• Comparing domain model and class diagram • OOP and class diagrams • Understanding POS system class diagram	
	• Introduction to Software Implementation • Explain fundamental concepts in writing a software program	
Week 16	• Software Testing Techniques • Black Box Testing, White Box Testing	
	• Testing • Test cases	
	• Test cases	
Week 17	**Terminal Exam**	

Economics

ECO-4306 Intermediate Microeconomics Credit Hours: 3(3-0)

Course Objectives:

The objective of the course is to extend the knowledge of the basic microeconomic principles that will provide the foundation for future studies in economics.

Course Contents:

A. Introduction

1. Analyzing Economic Problems
2. Constructing Economic Models
3. Optimization Principle

B. Consumer Theory

1. Budget Constraint and its Application
2. Utility and Preferences
3. Indifference Curve Analysis
4. Optimal Choice of Consumer
5. Application of Consumer Theory in choosing Taxes
6. Income Effect
7. Substitution Effect
8. Price Effect as a combination of Income and Substitution Effect
9. Decomposition of Price Effect into income & substitution effects (all approaches)
10. Marshallian and Hicksian Demand Curves (normal, inferior and Giffen goods)

C. Theory of Demand and Supply

1. Income Consumption Curve and Engel Curves
2. The Price Consumption Curve and the Demand Curve
3. Derivation of Demand Curve
4. Demand Function
5. Supply Function
6. Supply and Demand Equilibria
7. Comparative Statics
8. The Inverse Demand Function

D. Producer Theory

1. Producer’s Objective
2. Technology Constraints
3. Short Run and Long Run Production Function and Cost
4. Diminishing Marginal Product
5. Diminishing Technical Rate of Substitution
6. Returns to Scale and Cost Function

7. Isoquant and Isocost Analysis
8. Cost Minimization in Short and Long run
9. Short-Run and Long run Profit Maximization

E. Markets Analysis

1. Perfectly Competitive Markets: Analysis and Application
2. Short Period Analysis (equilibrium cases, supply curve of firm)
3. Long Period Analysis (equilibrium of firm, supply curve of industry)
4. Monopoly Markets: Analysis and Application
5. Short Period Analysis (equilibrium cases, why no supply curve of firm)
6. Long Period Analysis (equilibrium of firm, sub-optimum, optimum and super-optimum cases)
7. Price Discrimination (concept, need, possibility, forms and degrees of price discrimination)
8. Monopolistic Competition: Analysis and Application
9. Short Period Analysis (equilibrium cases)
10. Long Period Analysis (equilibrium of firm)
11. Oligopoly: Analysis and Application
12. Cournot Model
13. Bertrand Model
14. Stackelberg Model
15. Sweezy's Kinked Demand Model

Recommended Books:

1. Hal R. Varian, Intermediate Microeconomics, 9th Edition, 2014, W.W. Norton &
2. Company, ISBN-13: 9780393123968
3. Walter Nicholson and Christopher M. Snyder, Intermediate Microeconomics and
4. Its Application, 11th Edition, Thomson South-Western, ISBN- 13: 9781133189022
5. Robert S. Pindyck and Daniel L. Rubinfeld, Microeconomics, Prentice Hall, Fifth Edition, ISBN: 0130165832

English

ENG-4304 History of English Literature-I Credit Hours: 3(3-0)

Course Objectives

1. To study the history and practice of English as a scholarly discipline.

2. To study the history and development of each genre through excerpts of literary texts.

3. To do close reading of texts and analyze them with different critical frameworks.

Contents

1. Introduction to Literature

2. Old English/Anglo Saxon Age

3. Middle English/Anglo Norman Period

4. The Age of Chaucer, 14 th Century

5. The Renaissance Period

6. Elizabethan Age

7. 17 th Century Literature (The Puritan Movement , Metaphysical & Cavalier Movements)

8. Restoration Period

9. Classical Age

10. Romantic Age

11. Victorian Age

12. 20th Century or The Modern Age

13. 21st Century or The New Millennium Literature

Reference Books

1. Alexander, Michael. A History of English Literature
2. Louis Cazamian, A History of English Literature, London: J.M.Dent
3. Cuddon, J.A. The Penguin Dictionary of Literary Terms & Literary Theory
4. David Daiches, A Critical History of English Literature, Vol.14 London
5. Fletcher, Robert Huntington. A History of English Literature. 2005.

Geography

GEO-4304 Human Geography Credit Hours: 3(2-1)

Objectives: This course attempts to impart knowledge about the relationship between man and environment including natural resources and related human activities.

Course outline:

Introduction

Definition, scope and branches

Basic approaches o Environmental determinism

1. Possibilism
2. Probabilism
3. Cognitive behaviourism
4. Coupled nature-human systems

Population and its characteristics

1. Population distribution
2. Population structure and composition
3. Population dynamics (fertility, mortality, migration etc.)

Economic activities

1. Classification of Economic Activities
2. Agriculture, mining, forestry, animal husbandry and poultry
3. Industries: cottage, light and heavy o Trade, transport and services
4. Tourism

Settlements

1. Theories of human settlement
2. Types of settlements
3. Rural settlements
4. dispersed, nucleated and Ribbon settlements
5. Urban Settlements

Urban hierarchy and functions Urbanization

1. Process of urbanization
2. Urban structure, morphology and theories

Environmental issues, causes and remedies

Field visits:

To explore economic activities in the context of natural environment of relevant area/region. To study rural and urban settlements, industrial areas and national parks.

Recommended Books:

1. Ahmed, Q. S. (2001) Fundamentals of Human Geography, Royal Book Company, Karachi.
2. Becker, A. & Secker. (2002) Human Geography: Culture, Society, and Space, John Wiley and Sons, New Jersey.
3. Benko, G. & Shorhmay. (2004) Human Geography: A history for the 21st century, Hodder Arnold, London.
4. Blij, H. J. D. (2002) Human Geography: Culture, Society, and Space, John Wiley and Sons, New Jersey.
5. Cloke, P. & Crang, P. (2005) Introducing Human Geographies, 2nd edition, Hodder Arnold, London.
6. Fouberg, E. H. (2012) Human Geography People, Place and Culture, John Wiley & Sons, Inc., Hoboken.
7. Getis, A. & Getis, J. (2005) Human Geography: Landscape of Human Activities, McGraw-Hill, Higher Education,
8. Boston. Harper, H. L. (2003) Environment and Society: Human Perspectives on Environmental Issues. Prentice Hall, New York.

9. Knox, P. L. & Marston, S. A. (2012) Places and Regions in Global Context: Human Geography, Prentice Hall, New York.
10. Lewis, C. P., Mitchell F. & Dyer, C. (2001) Village, Hamlet and Field: Changing Medieval Settlements in Central England, Windgather Press, London.
11. Neuwirth, R. (2006) Shadow Cities: A Billion Squatters, A New Urban World, Routledge, London.
12. Rubenstein, J. M. (2012) Contemporary Human Geography, PHI Learning Private Limited, New Delhi.

History

HIS-4306 History of Ummyas And Abbasids Credit Hours: 3(3-0)

Objectives

1. Understand the transformation from Khilafat-e-Rashida to autocratic / monarchical system of government.
2. Comprehend the administrative setup and expansionist policies pursued by the Umayyads & Abbasides.
3. Appreciate the religious-political trends and cultural and intellectual developments of the period.

Course Contents:

Section A: Umayyad's (661-750 AD):

1. Amir Muawiyah (661-680 AD) Foundation of Umayyad Rule. Transition in the system of
2. Caliphate, character and achievements.
3. Yazid bin Muawiya (680-683 AD) Character of Yazid. Conflict with Hazrat Imam Hussain, Tragedy of Karbala: its effects and significance in the History of Islam.
4. Marwan bin Hakam (683-685 AD) Accession of Marwan, Battle of Marj-e-Rahat,
5. Consolidation of his rule, character and policies.
6. Abdul Malik bin Marwan (685-705 AD) Abdul Malik as the real founder of Umayyad
7. Dynasty. His administrative policies and reforms, Vocalization of Quran.
8. Waleed bin Abdul Malik (705-715 AD) His accession and expansion of Umayyad Empire in Asia, Africa and Europe, Administrative policies.
9. Sulaiman bin Abdul Malik (715-717 AD) His policy towards renowned Muslim
10. Generals,Siege of Constantinople.
11. Umar bin Abdul Aziz (717-720 AD) Revival of the policies of 'Pious Caliphate',
12. Administrative, Economic and Religious reforms, character and achievements.
13. Yazid-II (720-724 AD) His Life and rule.
14. Hisham (724-749 AD) Important events, and issues, the Alvi and Abbasid Movement Downfall of Umayyad's Causes of the fall of Umayyad's

Section B: The Abbasids (750-1258 AD)

1. Establishment of Abbasid Caliphate, Fall of the Umayyads and establishment of Abbasid
   Caliphate
2. Abu-al-Abbas Abdullah al-Saffah (749-754 AD) the Khilafat of Abu-al Abbas Abdullah Al-Saffah. As founder of Abbaside Dynasty.
3. Abu Jafar Al-Mansur (754-775 AD) Revolt of Abdullah ibn Ali. Consolidation of Abbasid caliphate, Foundation of Baghdad. Political Turmoil in Khurasan. African Rebellion. Roman inroads. Administration of Abu Jafar Al-Mansur, reforms and character.
4. Al-Mahdi (775-785 AD) Appearance of Muqanna in Khorasan. Byzantinian inroads. The
   Zindiqiya Movement.

5. Al-Hadi (785-786 AD).

6. Haroon al-Rasheed (786-809 AD) HST accession, the Barmakids, their rise and fall. Affairs in Africa, Nomination of Ameen and Mamoon as successors to the Caliphate, War
   with the Byzantinians, Role of Queen Zubaydah, Haroon's character and achievements.

7. Mamoon al- Rasheed (813-833 AD) War of succession between Ameen and Mamoon. Disorder in Baghdad. War with the Byzantines. Religious Policy. Intellectual Activities. Role of the Turks.
8. Al. Muatasim and Almutwakal Rise of Turks, paramount Influence of Muatazilites,

9. Later Abbasids (847-1258 AD) Political development. Social structure under the Abbasids.
   Intellectual and cultural achievements under the Abbasids. Contribution to Sciences and philosophy.

Recommended Readings:

1. Ibn-i Athir, Tarikh Al-Kamil, Vol. V, part-l, tr. Abul Khair Maududi, Hyderabad (Deccan) 1938.

2. Mir Khwan, Rawzat-us Safa, Lucknow, Nawal Kishore Press, 1938.

3. Moinuddin, Shah, Tarikh-e-lslam, Vols. lll-IV, Azamgarh, Latest Edition.

4. Muir, William, the Caliphate, Its Rise, Decline and fall, Beirut, 1961.

5. Nicholson, R. A., Literary History of the Arabs, Cambridge, 1953.

6. Numani, Shibli, Al-Mamun, Lahore, Latest Edition.

7. Siddiqui, A. H., Caliphate and Kingship in Medieval Persia, Karachi 1962 (Urdu trans. Khilafat wa Saltanat, Karachi 1962.

8. Siddiqui, Mazharuddin, Development of Islamic State and Society, Lahore, 1956.

9. Shustery A. M. A., Outline of Islamic Culture, Latest Edition.

10. Tabari, Tarikh-ul Umam Wal-Muluk, Egypt, 1939 (Urdu Trans.) Vol. III, Parts I, II, III & IV
by Muhammad Ibrahim, Hyderabad (Deccan), 1932, 1953, 1940.

11. The Cambridge History of Islam Eds. P. M. Holt, Ann K. S. Lambton and Bernard Lewis, Cambridge: Cambridge University Press, 1970.

12. Umar, Abu Nasr Al-Haroon, tr. Sh. Muhammad Ahmed Panipati, Lahore, 1955.

Islamic Studies

ISL-4304 Study of Seerah of Holy Prophet Sal-Allah-u-alah-wasalam Credit Hrs. 3(3-0)

Course Objectives:

۱۔طلباء کو مطالعہ سیرۃ طیبہ کی ضرورت و اہمیت سے آگاہ کرنا

۲۔ تعمیر شخصیت میں مطالعہ سیرۃ طیبہ کے کردار کو واضح کرنا

۳۔بعثت نبوی کے موقع پر اقوام عالم کی عمومی صورت حال سے آگاہ کرنا

Course Contents:

Week.No.	Title	Description	
1	سیرۃ النبی صلی اللہ علیہ وسلم: تعارف و اہمیت	۱۔ سیرۃ کا لغوی اور اصطلاحی مفہوم ۲۔ سیرۃ النبی کی ضرورت و اہمیت ۳۔ تعمیر شخصیت اور معاشرتی استحکام میں مطالعہ سیرت کی اہمیت	
2	بعثت نبوی کے وقت دنیا کے حالات(۱)	۱۔ بعثت نبوی کے وقت اہم تہذیبیں ۲۔ عرب، مصر، حبشہ، بازنطینی، ساسانی ۳۔ بعثت نبوی کے وقت اہم تہذیبوں کی مذہبی ومعاشی حالت ۴۔ بعثت نبوی کی تہذیبوں کی سماجی اور سیاسی حالت	
3	بعثت نبوی کے موقع پر دنیا کے حالات(۲)	۱۔ہندوستان ، چین اور مغرب کی مذہبی و سماجی حالت ۲۔ ہندوستان ، چین اور مغرب کی معاشی حالت ۳۔ ہندوستان ، چین اور مغرب کی سیاسی صورت حال	

4	حضور صلی اللہ علیہ وسلم کے ابتدائی حالاتِ زندگی	۱۔ حضور صلی اللہ علیہ وسلم کا خاندانی حسب و نسب ۲۔ پیدائش اور ابتدائی تربیت ۳۔ لڑکپن اور جوانی کے حالات زندگی	**Assignment**
5	حضور صلی اللہ علیہ وسلم کی بطور آخری رسول بعثت	۱۔آخری رسول کے طور پر حضور صلی اللہ علیہ وسلم کے انتخاب کے اسباب	
6	مکی دور میں حضور صلی اللہ علیہ وسلم کی دعوت اسلام	۱۔ دعوت اسلام کا آغاز اور طریق کار ۲۔ دعوت اسلام کے اثرات اور ابتدائی مسلمان	**Quiz**
7			
8	مکی دور میں حضور صلی اللہ علیہ وسلم کی عزیمت و استقامت	۱۔قریش مکہ کی مخالفت کے اسباب ۲۔ ایذا رسانیوں اور ترھیبات کے اسالیب ۳۔ حضور صلی اللہ علیہ وسلم کی عزیمت ، استقلال اور صبر اور طائف کی طرف سفر	
9	ہجرت مدینہ : اسباب و اثرات	۱۔ ہجرت مدینہ کے اسباب اور پس منظر ۲ہجرت مدینہ کے لیے حضور صلی اللہ علیہ وسلم کا سفر اور اس سے متعلقہ واقعات ۳۔ ہجرت کے اثرات	
10	حضور صلی اللہ علیہ وسلم کے مدینہ میں ابتدائی اقدامات	۱۔مؤاخاۃ ۲۔ میثاق مدینہ ۳۔ مہاجرین کی بحالی اور اسلامی ریاست کا قیام	**Assignment**
11	غزوات نبوی (۱)	۱۔ غزوۂ بدر ،اسباب، واقعات اور نتائج ۲۔ غزوۂ احد، اسباب ، واقعات اور نتائج ۳۔ غزوۂ خندق ، اسباب ، واقعات اور نتائج	
12	غزوات نبوی (۲)	۱۔ صلح حدیبیہ ۲۔ غزوۂ خیبر ۳۔ فتح مکہ	**Quiz**

	۱۔ غزوات نبوی کے سیاسی اور دفاعی اثرات ۲۔ غزوات نبوی کے معاشی اثرات ۳۔ غزوات نبوی کے سماجی اور دعوتی اثرات	غزوات نبوی کے اثرات	13
	۱۔ یہود سے تعلقات ۲۔ مشرکین اور منافقین سے تعلقات ۳۔قبائل عرب سے تعلقات	رسول اللہ صلی اللہ علیہ وسلم کے داخلی سیاسی اقدامات	14
	۱۔ غیر ملکی سربراہوں سے حضور صلی اللہ علیہ وسلم کی مراسلات ۲۔ غیر ملکیوں کے ساتھ وفودکا تبادلہ ۳۔ فتح مکہ۔دعوت اسلامی کا فروغ ۴۔حضورصلی اللہ علیہ وسلم کی خارجی سیاست کے اثرات	رسول اللہ صلی اللہ علیہ وسلم کے خارجی تعلقات	15
	۱۔ عہد نبوی کا معاشرتی و معاشی نظام ۲۔ عہد نبوی کا مذہبی نظام ۳۔ عہد نبوی کا نظام حکومت	عہد نبوی۔ تہذیبی مطالعہ	16

Recommended Books

نمبر شمار	نام مؤلف	نام کتاب
1	ابن ہشام	السیرۃ النبویۃ
2	مولاناشبلی نعمانی ، سید سلمان ندوی	سیرۃ النبی صلی اللہ علیہ وسلم
3	قاضی محمد سلیمان سلمان منصور پوری	ر حمۃ اللعالمین
4	مولانا سیدابو الحسن علی ندوی	نبی رحمت صلی اللہ علیہ وسلم
5	ڈاکٹر یسین مظہر صدیقی	عہد نبوی کا نظام حکومت
6	ڈاکٹر خالد علوی	انسان ِکاملؐ

Reference Books

نمبر شمار	نام مؤلف	نام کتاب
1	ڈاکٹر اکرم الضیاء العمری	السیرۃ النبویۃ الصحیحۃ
2	مولاناعبدالرؤف دانا پوری	اصح السیر
3	مولانا صفی الرحمن مبارکپوری	الرحیق المختوم
4	پیر محمد کرم شاہ الازہری	ضیاء النبی صلی اللہ علیہ وسلم
5	سید ابوالاعلیٰ مودودی	سیرت سرور عالم صلی اللہ علیہ وسلم

Math

MATH-4305 Numerical Analysis-I Credit Hrs. 3(3-0)

Course Objectives:

This course introduces students to fundamental numerical methods for solving mathematical problems and approximating solutions to mathematical equations and functions.

Course Contents:

Introduction to Numerical Analysis: Overview of numerical methods and their significance, Sources of error in numerical computations, Root Finding and Nonlinear Equations: Bisection method, False position method, Newton-Raphson method, Secant method, Fixed point iteration method, Convergence and stopping criteria, Interpolation and Polynomial Approximation: Lagrange interpolation, Newton divided-difference interpolation, Hermit interpolation, Polynomial interpolation error, Numerical Differentiation, and Integration: Forward, backward, and central difference approximations, Numerical integration: trapezoidal rule, Simpson's rule, Error analysis for differentiation and integration, Systems of Linear Equations: Gaussian elimination methods, Gauss Jordan method, matrix inversion, LU decomposition, Iterative methods: Jacobi, Gauss-Seidel, SOR.

Recommended books:

1. Numerical Analysis" by Richard L. Burden and J. Douglas Faires
2. An Introduction to Numerical Analysis" by Endre Süli and David F. Mayers
3. Introduction to Numerical Analysis" by J. Stoer and R. Bulirsch
4. Numerical Methods for Scientists and Engineers" by R.W. Hamming

For the combinations of **i) Computer, Math & Stat ii) Math, Stat & Physics**

MAT-4305 Introduction to Linear Algebra Credit Hours: 3(3-0)

Objective:

Basic understanding of matrices, vector space, and linear transformations.

Course Contents:

Vectors and Linear Combinations, Lengths and Dot Products, Matrices, Vectors and Linear Equations, The Idea of Elimination, Elimination Using Matrices, Rules for Matrix Operations, Inverse Matrices, Elimination, Transposes and Permutations, Spaces of Vectors, The Null space, The Rank and the Row Reduced Form, The Complete Solution to Ax = b, Independence, Basis and Dimension, Dimensions of the Subspaces, Orthogonality of the Subspaces, Projections, Orthogonal Bases and Gram-Schmidt, The Properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes, Introduction to Eigenvalues, Diagonalizing a Matrix, Symmetric Matrices, Positive Definite Matrices, Similar Matrices, Singular Value Decomposition, The Idea of a Linear Transformation, The Matrix of a Linear Transformation.

Recommended Books:

1. Introduction to Linear Algebra" by Gilbert Strang, 5th Edition
2. Linear Algebra for Everyone" by Gilbert Strang, September 2020
3. Linear Algebra and Learning from Data" by Gilbert Strang, 2019

MATH-4306 **Calculus-III** **Credit Hrs. 3(3-0)**

Course Objectives:

This course extends the study of infinite series, conic sections, and calculus to multivariable functions, including partial differentiation, multiple integration, and vector calculus.

Course Contents:

Sequences, Monotone Sequences, Infinite Series, Convergence Tests, The Comparison, Ratio, and Root Tests, Alternating Series, Absolute and Conditional Convergence, Maclaurin and Taylor Polynomials, Maclaurin and Taylor Series; Power Series, Convergence of Taylor Series, Differentiating and Integrating Power Series, Modeling with Taylor Series, Parametric Equations, Tangent Lines and Arc Length for Parametric Curves, Polar Coordinates, Tangent Lines, Arc Length, and Area for Polar Curves, Conic Sections, Rotation of Axes, Second-Degree Equations, Conic Sections in Polar Coordinates, Rectangular Coordinates in 3-Space, Spheres, Cylindrical Surfaces, Parametric Equations of Lines, Planes in 3-Space, Quadric Surfaces, Functions of Two or More Variables, Limits and Continuity, Partial Derivatives, Differentiability, Differentials, and Local Linearity, The Chain Rule, Directional Derivatives and Gradients, Tangent Planes and Normal Vectors, Maxima and Minima of Functions of Two Variables, Lagrange Multipliers, Cylindrical and Spherical Coordinates, Double Integrals, Double Integrals over Nonrectangular Regions, Double Integrals in Polar Coordinates, Surface Area, Parametric Surfaces, Triple Integrals, Change of Variables in Multiple Integrals, Jacobians.

Recommended Books:

1. Multivariable Calculus; by James Stewart
2. Calculus Volume 3" by Edwin Herman and Gilbert Strang
3. Calculus: Early Transcendental" by Howard Anton, Irl Bivens and Stephen Davis

Physical Education & Sports

PES-4305 **Track & Field** **Credit Hours: 3(3-0)**

Objectives: The main purpose of this course is to enhance the knowledge of the students regarding Track & Field. This course will also be helpful in developing the skill of the students regarding the marking, and laying out of standard track and other circles. The students will be able to conduct the track and field competitions at various levels as well as to perform the duties of Technical officials.

Course Contents

A. History of Ancient Olympic Games With Special Reference To Track & Field

1. Brief History
2. Terms and condition for participation
3. Programme of activities
4. The Olympic Flame
5. The Decline of the Games

B. History of Modern Olympic Games With Special Reference To Track & Field

1. The History behind the Modern Olympic Games
2. List of the countries organize Olympic games
3. Special features/detail of all time athletes
4. The Olympic Oath
5. The Olympic Hem
6. IOC (international Olympic committee)

C. Laying out 200m & 400m track stragers

D. Conduct of Track and Field Events

1. Preparation of Track and Field competition program (Board, University, Province, National)
2. Formation of committees for Track and Field competition

E. Officials and Their Duties In Track and Field Competition

F. Rules and Techniques of Track Events

G. Rules and Techniques of Field Events

H. Rules of Cross Country

I. Rules of Walk-Race

J. Decathlon, And Pentathlon (Combined Events)

Recommended Books:

1. Dr. A. Waheed Mughal, Olympics Games & Athletics, Islamabad, 2012
2. Ch: Hashmat Ali, Olympics and Athletics, Lahore.
3. M. Shafiq History of the Olympic Games with special reference to Athletics, Faisalabad
4 Dr. Abdul Whaeed Mughal, Athletics Skill and Officiating, Islamabad, 2012.
5. John Heaton, Better Athletics field, Kay Ward Ltd. London, 1986.
6. Amateur Athletics Association, Hand Book, 2009.
7. How to organize an Athletics Meet. Amateur Athletics Association Hand Book.
8. IAAF (2005). IAAF Hand Book: International Amateur Athletics Federation.

Physics

PHY-4304 Waves, Oscillations, and Thermodynamics Credit Hours: 3(3-0)

Course Objectives:

1. To understand the basics of waves, the mechanism of wave production, propagation and interaction with other waves.

2. Use of the basic concept of waves in their application in daily life.

Course Contents:

A. Harmonic Oscillations:

Simple harmonic motion (SHM), Obtaining and solving the basic equations of motion x (t), v (t), a (t), Longitudinal and transverse Oscillations, and Energy considerations in SHM. Application of SHM, Torsional oscillator, Physical pendulum, simple pendulum, SHM,, and uniform circular motion, Combinations of harmonic motions, Lissajous patterns, Damped harmonic motion, Equation of damped harmonic motion, Quality factor, discussion of its solution, Forced oscillations and resonances, Equation of forced oscillation, Discussion of its solution, Natural frequency, Resonance, Examples of resonance.

B. Waves in Physical Media:

Mechanical waves, Travelling waves, Phase velocity of traveling waves, Sinusoidal waves, Group speed and dispersion, Waves speed, Mechanical analysis, Wave equation, Discussion of solution, Power, and intensity in wave motion, Derivation & discussion, Principle of superposition (basic ideas), Interference of waves, Standing waves. Phase changes on reflection, Beats Phenomenon, Analytical treatment, Electromagnetic Spectrum, Doppler Effect Reflection and Refraction of light waves, Total internal reflection, Plane and Spherical Mirrors, Double slit Interference, Michelson and Fabry-Perot Interferometers.

C. Thermodynamics:

Review of previous concepts. The first law of thermodynamics and its applications to adiabatic, isothermal, cyclic, and free expansion, Reversible and irreversible processes,

the Second Law of thermodynamics, Carnot theorem, Carnot engines. Heat engine, Refrigerators, Calculation of efficiency of heat engines. Thermodynamic temperature scale: Absolute zero: Entropy, Entropy in a reversible process, Entropy in an irreversible process. Entropy & second law. Entropy & probability.

Recommended Books:

1. Halliday, D. Resnick, Krane, Physics, Vol. I & II, John Wiley, 5 th ed. 1999.
2. N.K. Bajaj, The Physics of Waves & Oscillations, Tata McGraw-Hill Publishing company Limited, 1986.
3. H. J. Pain, The Physics of Vibrations and Waves, 5 th Edition 1999.
4. J. A. Edminister Schaum's Outline Series; Theory and Problems of Electromagnetism, McGraw-Hill Book Co., 1986.
5. J. F. Lee and F. W. Sears, Thermodynamics, Addison-Wesley 1954.
6. A. J. Pointon, Introduction to Statistical Physics, Longman 1967.
7. M. W. Zemansky, Heat and Thermodynamics, 3rd Edition, McGraw Hill, 1951.
8. Reif, Statistical Physics, Berkley Physics series, McGraw Hill 1965.
9. M. M. Abbott, Schaum Outline of Thermodynamics, McGraw-Hill Professional Book Group, 1995.

PHY-4307 Physics Lab-III Credit Hours. 1(0-1)

Course Objectives:

To know the electrical circuit elements and their experimental measurement to give an understanding of electrical circuits and the use of CRO.

List of Experiments:

1. 1 Calibration of an Ammeter and a Voltmeter by potentiometer
2. Comparison of capacities by ballistic galvanometer.
3. Measurement of self/mutual inductance.
4. To convert a Western-type galvanometer into an ammeter reading up to 1 ampere (0-1amp range)
5. To convert a moving coil (Western type) galvanometer into a voltmeter reading up to 3

volts (0-3Volt range)

6. Setup of a RLC series circuit. Draw its frequency response curve and find the values of resonance frequency bandwidth and quality factor.
7. Setup of a RLC parallel circuit. Draw its frequency response curve and find the values of resonance frequency bandwidth and quality factor.
8. To determine thermal Emf and plot temperature diagram.
9. Calibration of the thermocouple by the potentiometer.
10. To study the network theorems (Superposition, Thevinin, Norton).

Recommended Books:

1. G L Squires, Practical Physics, 3 rd Edition, Cambridge University Press
2. Nolan and Bigliani, Experiments in Physics, Surjeet Pub Ind.

Political Science

POL-4305 Political System of Developed Countries (UK, USA) 3(3-0)

Course Objectives: To enable the students to understand the nature and functions of developed political systems of the world;

to help the students to make comparative study and analysis of both the political systems

Course Contents:

Political System of UK

1. Historical background of political System of UK
2. Evaluation of British Constitutional/legal foundations of the system, Traditions and role, important traditions.
3. Characteristics of British Constitution
4. Political process and political recruitment;
5. Political parties, characteristics and role,
6. British Queen/King, role and Powers, Prime Minister, role and powers
7. British Cabinet role and powers, Speakers power and role
8. Functioning of the organs of the government: legislature, executive and judiciary
9. Political culture
10. Pressure groups
11. Political environmental factors influencing the politics such as geographic,
12. Socio-economic, international scenario, media etc.

Political System of United States

1. Historical background of political System of US

2. Constitutional/legal foundations of the system;
3. Political process and political recruitment;
4. American Federation
5. President of US and Powers
6. Political culture
7. Political parties, elections and pressure groups.
8. Functioning of the organs of the government: legislature, executive and judiciary
9. Political environmental factors influencing the politics such as geographic,
10. Socio-economic, international scenario, media etc.

Recommended Books:

1. F. N Forman and N. D. J. Baldwin. British Politics. London: MacMillan, 1991.

2. G. Q. Wilson. American Government: Institutions and Politics. 3rd edition, Heath & Co.,

3. Harold, J. Laski. Parliamentary Government in England. London, Allen & Unwin, 1960.

4. J. M. Colomer. Political Institutions in Europe, London, 1996.

5. M. Carter Gwendolen and John H. Hertz. Major Foreign Powers. New York: Harcourt, Brace & World, Inc., 1967.

6. P. G. Cocker. Contemporary British Politics and Government. Kent, Tudor Business Publishing Ltd., 1993.

7. Pomper McWilliams Baker. American Government. McMillan Publishing Co. London, 1993.

Psychology

PSY-4305 Personality Theories-I Credit Hours: 3(3-0)

Objectives: Is to explores the structure, dynamics, development, and assessment of personality and provides insights into the factors that contribute to individual differences.

Course Contents:

A. Psychology of personality

1. Introduction to the Discipline
2. Meaning of personality
3. Meaning of theory
4. Components of personality theory

B. The Psychoanalytic Legacy; Sigmund Freud

1. Biographical sketch

2. Basic concepts
3. Personality structure

i. Three interacting systems.

ii. Personality development

iii. Five sequential stages.

iv. Personality dynamics

v. instincts / anxiety / catharsis and anti-catharsis

vi. Defense mechanisms

4. Application of psychoanalytic theory; Dream analysis paraphrases

5. Psychotherapy

6. Critical evaluation

C. Personality's ancestral foundations: Carl Jung:

1. Biographical sketch
2. Basic concepts: Conscious and unconscious; Archetypes, Personality typology Personality development
3. Further applications: Dream analysis; Psychopathology; Psychotherapy
4. Critical evaluation

D. Overcoming inferiority and striving for superiority: Alfred Adler

1. Biographical sketch
2. Basic concepts:
   i. Developing social feelings: society; work and love
   ii. Style of life; future goals vs. past events; overcoming inferiority Striving for superiority and superiority complex; Family influences on personality development

3. Further applications: Dream analysis; Psychopathology Psychotherapy

4. Critical evaluation

E. Neo Freudians

a. Karen Horney

i. Basic anxiety

ii. Coping by way of 10 neurotic needs moving towards, or against, or away from people

iii. Development of an idealized vs. a real image of self

iv. Claims, should and Defense mechanisms.

b. Harry Stack Sullivan

i. Empathy

ii. Anxiety and security

iii. 3 modes of experience

iv. 6 stages of Development

c. Henry A. Murray

i. Definition of need

ii. variety of needs

iii. Strength of needs and interactions Environmental press

iv. Thema

F. Erik Erikson

i. Psycho-social stages of personality development

ii. Identity crises

G. Erich Fromm

i. Existential needs

ii. Individual and social characters

H. Evolutionary Psychology

Recommended Books:

1. Buss, D. M. (2004). Evolutionary psychology: The science of mind (2nd ed.) Boston: Allyn & Bacon.

2. Ewen, R. B. (1998). An introduction of theories of personality. (5th ed.). New Jersey:

Lawrence Erlbaun Associate Publishers.

3. Feist, J. (1985). Theories of personality. Sydney: Holt Rinehart & Winston, Inc.
Pervin,

L. A., Cervone, D., & John, O. P. (2005). Personality theory and research

Sociology

SOC-4306 Classical Sociological Theory Credit Hours: 3(3-0)

Objective: The course provides a review of classical sociological theorists. It focuses on the content and utility of classical theories in terms of understanding social world. While the course provides a general history of sociological theory, the focus remains on examining how classical theories have provided the basis for a better understanding of the character and dynamics of societies around the world.

Course Contents:

A. Background

1. Social Forces
2. Intellectual Forces
3. French Revolution
4. Enlightenment

B. Development of Sociological Theory

1. Theory and Knowledge
2. Process of Theorizing
3. Types of Sociological Theories
4. Inductive and Deductive
5. Process of theorizing
6. Fact, Propositions, and Laws
7. Sociological Theory between 1600 -1800 AD

C. August Comte

1. Positivism
2. The law of Human Progress
3. Hierarchy of the Science
4. Social Static & Dynamic

D. Emile Durkheim

1. Rules of Sociological methods
2. Division of Labour
3. Social Solidarity
4. Theory of Religion
5. Theory of Suicide

E. W. G. Sumner

1. Folkways and Mores
2. Ingroup and outgrou
3. Basic motives

F. Karl Marx

1. Communist Manifesto
2. Socialism
3. Stages of Social Evolution

G. Herbert Spencer

1. The law of Social Evolution
2. Concept of Society
3. Laissez-faire

H. Max Weber

1. Sociology of Religion
2. Bureaucracy
3. Protestant Ethic and the Sprit of Capitalism

Recommended Books:

1. Blalock, Hubert M. (1969). Theory Construction from Verbal to Mathematical Formulation. N.J: Prentice Hall Inc
2. Bronner, Stephen Erick (2004). Critical Theory and Society: A Reader. London: Routledge and Kegan Paul. 3. Cooley, C.H. (1962). Social Organization. New York: Scrichnes Books. 4. Coser. L A. (1971). Master of Sociological Thought: Ideas In Historical Social

Statistics

STA- 4304 Basic Statistical Inference Credit Hours: 3(3-0)

Objectives:

1. To understand the inferences about population parameters using parametric tests
2. To acquire basic knowledge about non-parametric tests.

Course Contents:

Point and interval estimate properties of good point estimator; Testing of hypothesis for population mean, difference between population means and population proportion and difference between two population proportions, difference between means for paired data; Single population variance, ratio of two variances; Testing the significance of regression and correlation coefficient.

Recommended Books:

1) Ross, S. (2017). A first course in Probability. 9th edition. Pearson Education Limited.

2) Chaudhry, S. M. and Kamal, S. (2008), "Introduction to Statistical Theory" Parts I & II, 8th ed, Ilmi Kitab Khana, Lahore, Pakistan.

Zoology

ZOO-4306 Principle of Animal Life-II Credit Hours: 3(2-1)

Objectives:

The course will impart knowledge and understanding of:

1. Cell division and its significance in cell cycle.
2. Concepts and mechanisms of inheritance pattern, chromosome and gene linkage and molecular basics of genetics.

Course Contents

1. Cell Division:

a) Cell cycles:
b) Mitosis and meiosis;
c)control of the cell cycle.

2. Inheritance Patterns:

a) Mendelian genetics;
b) inheritance patterns;
c) gene, structure, chemical composition and types.

3. Chromosomes and Gene Linkage:

a) Eukaryotic chromosomes; linkage and crossing over;
b) chromosomal aberrations.

4. Molecular Genetics:

a) Cellular Control: DNA: the genetic material;
b) DNA replication in prokaryotes and eukaryotes;
c) control of gene expression in eukaryotes;
d) gene mutation;
e) recombinant DNA and applications of genetic technologies.

5. Animal Behaviour:

a) Behaviour and its types, proximate and ultimate causes;
b) anthropomorphism;
c) development of behavior; learning; factors controlling animal behavior;
d) communication;
e) behavioral ecology;
f) social behavior.

6. Evolution:

a) A Historical Perspective:

b) Theories of evolution: Lamarckism and natural selection, neo larmarckism, Darwinism, and neo Darwinian.

7. Evolution and Gene Frequencies:

a) Hardy-Weinberg principle;
b) evolutionary mechanisms: population size, genetic drift, gene flow,
c) de Vries mutation theory and rates of evolution,
d) polymorphism; species and speciation;
e) molecular evolution;
f) mosaic evolution.

Recommended Books

1. Hickman, C.P., Roberts, L.S., Keen L.S., Larson, A., I'Anson, H. and Eisenhour, D.J., Integrated Principles of Zoology, 14th Edition (International), 2004. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 10th Edition (International), 2016. Singapore: McGraw Hill.
3. Pechenik, J.A. Biology Of Invertebrates, 7th Edition (International),2015. Singapore: McGraw Hill.
4. Kent, G.C. and Miller, S. Comparative Anatomy Of Vertebrates. 2000.New York: McGraw Hill.
5. Campbell, N.A. Biology, 6 th Edition. Menlo Park, California: 2002.Benjamin/Cumming Publishing Company, Inc.

Practicals

1. Study of mitosis in onion root tip.
2. Study of meiosis in grasshopper testis (students should prepare theslide).
3. Problem based study of Mendelian ratio in animals.
4. Multiple alleles study in blood groups.
5. Survey study of a genetic factor in population and its frequency.
6. Study of karyotypes of Drosophila, mosquito.
7. Study of cytochemical detection of DNA in protozoa and avian bloodcell.
8. Study to demonstrate nervous or endocrine basis of behavior (conditioned reflex or aggression or parental behavior).
9. Study to demonstrate social behaviour (documentary film be shown,honey bee, monkey group in a zoo).

Note for1-2: Prepared microscopic and/or projection slides and/or CDROM computer projections must be used).

Recommended Books

1. Miller, S.A. General Zoology Laboratory Manual. 7th Edition (International), 2013. New York: McGraw Hill.

2. Hickman, C.P. and Kats, H.L. Laboratory Studies In Integrated Principles Of Zoology. 2000. Singapore: McGraw Hill.

AD Commerce

COM-4304 Cost Accounting Credit Hours: 3(3-0)

Objectives:

1. To identify and understand different types of costs and its uses.
2. To identify, use and interpret the results of costing techniques appropriate to different activities and decisions;
3. To understand the role of responsibility accounting and performance measurement;

Course Contents:

WEEKS	TOPICS
WEEK 1	**CONCEPT OF MANAGEMENT & CONTROLLER FUNCTIONS**
	• The concept "management & organizing" • The organization chart • Nature of cost accounting
	• The controllers participation in planning & control • Scope of cost accounting
	• The cost departments • Relationship of the cost department to other departments
WEEK 2	• Difference between cost accounting and financial accounting • Sources of cost accounting data • Information system
	COST ACCOUNTING CONCEPTS AND OBJECTIVES:
	• Concept of cost, Costing, Cost Accounting, Cost Accountancy
	• Objectives of cost accounting
	• Essentials of a good costing systems
	• Cost center & profit center
WEEK 3	• Costing systems
	• Difference between financial & cost accounting
	COST CLASSIFICATION:

	• According to element • According to nature • According to time
	• According to function • According to time period in which they apply
WEEK 4	• Cost classification for decision making o Marginal cost o Differential cost o Opportunity cost o Relevant cost
	o Replacement cost o Abnormal cost o Shutdown cost o Controllable cost o Capacity cost o Urgent cost o Sunk cost
	• According to behavior o Fixed cost o Variable cot o Semi variable cost
WEEK 5	**FINANCIAL STATEMENTS: THE BASES FOR PLANNING AND CONTROL** • The reporting function • Financial statements in annual reports • Preparing the income statement
	Practice Problems & Exercises
	• Preparing the cost of goods sold statement
WEEK 6	Practice Problems & Exercises
	• Evaluating annual results to orient outsiders
	Practice Problems & Exercises
WEEK 7	**Midterm**
WEEK 8	• Evaluating annual results to orient insiders
	Practice Problems & Exercises
	Flow of costs
WEEK 9	**JOB ORDER COSTING** • Job order costing: definition • Characteristics Job order costing • Job cost sheet
	• Accounting under job costing
	• Practice Problems & Exercises

WEEK 10	**PROCESS COSTING** • Process costing: definition • Characteristics of process costing • Difference between Job order costing and Process costing
	• Procedures of process costing • Costing by departments
	• Product flow • Procedures for material, labor & FOH costs
WEEK 11	• The cost of production report
	Practice Problems & Exercises
	Practice Problems & Exercises
WEEK 12	**PLANNING AND CONTROL OF FACTORY OVERHEAD.** • Factory overhead- predetermined • Factory overhead- actual • Factory overhead- applied
	• Variance analysis
	Practice Problems & Exercises
WEEK 13	• Indirect factory overhead rates • Indirect factory overhead rates • Changing factory overhead rates
	Practice Problems & Exercises
	PLANNING AND CONTROL OF MATERIALS. • Procedures for material procurement & use • Material costing methods
WEEK 14	• Practice Problems & Exercises
	• Cost of Materials in Inventory at the End of a Period • Costing procedures for scrape, spoiled goods and defective works
	• Practice Problems & Exercises
WEEK 15	**Quantitative Models for Materials Planning and Control** • Planning material requirement • Material control
	• Inventory Carrying and Ordering Costs for Economic Order Quantity Calculations
	Practice Problems & Exercises
WEEK 16	**PLANNING AND CONTROL OF LABOR.** • Basis for labor cost control

	• Productivity & efficiency measurement & labor costs
	• Labor costing procedure
	Practice Problems & Exercises
WEEK 17	**Accounting for Labor-Related Costs** • Overtime Earnings • Bonus Payments • Vacation Pay • Guaranteed Annual Wage Plans
	Apprenticeship and Training Programs Human Resource Accounting Pension Plans Additional Legislation Affecting Labor-Related Costs, Labor-Related Deductions
	Project / Presentation

CS- 4305 Introduction to Data Science Credit Hours: 3(3-0)

Objectives:

1. Understand the key concepts and principles of data science.

2. Analyze and preprocess data to prepare it for analysis.

Course Contents:

Module 1: Introduction to Data Science

- What is Data Science?

- The Data Science Workflow

- Tools and Technologies in Data Science

- Ethical Considerations in Data Science

Module 2: Data Collection and Preprocessing

- Data Acquisition

- Data Cleaning and Data Wrangling

- Handling Missing Data

- Data Transformation and Feature Engineering

Module 3: Data Visualization

- Introduction to Data Visualization

- Types of Charts and Graphs
- Data Visualization Tools (e.g., Matplotlib, Seaborn)
- Effective Data Communication through Visualization

Module 4: Statistical Analysis

- Descriptive Statistics
- Probability Distributions
- Hypothesis Testing
- Correlation and Regression Analysis

Module 5: Machine Learning Basics

- Introduction to Machine Learning
- Supervised, Unsupervised, and Semi-Supervised Learning
- Model Evaluation and Validation
- Overfitting and Underfitting

Module 6: Introduction to Python for Data Science

- Python Basics
- Libraries for Data Science (NumPy, pandas)
- Data Manipulation in Python
- Data Visualization in Python

Module 7: Data Analysis with Python

- Exploratory Data Analysis (EDA)
- Case Studies: Data Analysis Projects

Module 8: Introduction to Machine Learning with Python

- Scikit-Learn: A Machine Learning Library
- Classification and Regression Algorithms
- Model Selection and Hyperparameter Tuning

Module 9: Real-World Applications

- Data Science in Various Industries (e.g., healthcare, finance, marketing)
- Guest Lectures or Case Studies from Data Scientists

Module 10: Final Project

- Students work on a data science project to apply the skills and concepts learned throughout the course.

Recommended Books:

1. "Python for Data Analysis" by Wes McKinney

2. "Introduction to Machine Learning with Python" by Andreas C. Müller & Sarah Guido

3. "Data Science for Business" by Foster Provost and Tom Fawcett

4. "Data Science for Dummies" by Lillian Pierson

5. "The Art of Data Science" by Roger D. Peng, Elizabeth Matsui, and Jeff Leek

COM-4306 **Business Finance** **Credit Hours:** 3(**3-0**)

Objectives:

1. To understand the time value of money and their application in our life
2. To analyze and interpret the basic valuation of long term securities
3. To calculate present and future value of money and evaluate the capital projects basic techniques
4. To prepare the cash budget, sale budget. And purchase budget for company

Course Contents

Week	TOPICS TO BE COVERED	
1	Introduction of Business (Link with previous subject ITB).Forms of business organizations & their characteristics. sole proprietorship. partnership	
2	Joint Stock Companies, Limited liability concept, Legal status and process of their formation till IPO.Difference between Pvt limited and Public Limited company. Advantages and limitations of each business. Hierarchy of a Company	
3	Goal of the firm, difference between profit maximization and shareholders wealth maximization, agency problems Goals of a Financial Manager, Finance and accounting. What is financial management?	
4	Difference between investing, financing and asset management decisions. Formation of companies/financial statements of companies Solution to end Questions (Van Horne Page 14)	Assignment

5	Financial Markets, Money market vs capital markets; primary markets vs secondary Market. Flow of Funds between different markets and role of Financial Intermediations	
6	Concept of Time Value of Money, Discussion of Time Line its importance, Difference between Present Value and Compound Value concept. Solution of Question for Simple and Compound Interest Amortizing a Loan	Quiz
7	Midterm	
8	Concept of Annuity, Different types of Annuities, Distinguish between an "ordinary annuity" and an "annuity due".How to calculate the required rate of return in an Annuity.Effective interest verses compound interest. Questions and problems	
9	Valuation of Long Term Securities, Basic Concepts of Valuations, Different Types of Bonds on the Basis of Valuations ,Valuation of Bonds (Solution of Relevant Questions Van Horne Chapter 4)	Assignment
10	Midterm Paper display ,Flow of Funds, Sources and Uses of Funds, Discussion of Fund Flow Statement and its uses in business environment	
11	Adjustments in Fund Flow Statement (Solution to relevant Questions from Van Horne Chapter 7)Discussion on Cash Budget and its importance	Quiz
12	Preparation of Sale and Purchase Budget Preparation of Forecasted Balance sheet and Income Statement with the Adjustment of Cash	
13	Capital budgeting, Different capital budgeting techniques. Discounted verses non-discounted techniques. Payback period method	
14	Internal Rate of Return Method, Problem of Multiple IRR Net present value method, Profitability index, Adjustment of Deprecation and Taxes in saving to calculate the Free Cash Flow for Capital Budgeting	
15	END TERM EXAMS	

Textbook:

a. Financial Management 13th Edition by Van C. Horne
b. Financial management by Brigham and Housten 13th edition

- You will be using first textbook as course book; so you must bring first book in every class
- You do not need to bring second one. We will have homework/assignments from second book.

Reference Material:

- One Case Study will be solved from each topic provided you in advance.

COM-4307 Operations Management Credit Hours: 3(3-0)

Objectives:

The goal of the course is to help students become effective managers in today's competitive, global environment. The course will examine operations as a competitive weapon, demand forecasting, supply-chain management, aggregate planning, inventory systems, just in-time systems and material requirements planning.

Course Contents:

Week No.	Topic	Assignments	Quiz
Week 01	Introduction to Operations Management.		
	Process view & Supply chain view		
	Operations Strategy.		
Week 02	Competitive priorities and capabilities.		
	Decision-Making in Operations Management.		
	How are processes chosen for firms strategically?		
Week 03	Process structure in services &manufacturing: Strategic fit		
	Process tools		
	Strategies for change: Process improvement.		
Week 04	Mass customization practices	**Assignment 0**	
	How to find what size is the right size?		
	Long-term capacity		
Week 05	Systematic approach to long-term capacity.		
	Strategic capacity planning		
	Capacity planning challenges in a service business.		
Week 06	What limits the system from reaching its goal and how to remove it?		**Quiz 01**

	Bottleneck management		
	Theory of constraints.		
Week 07	Line balancing.		
	Bottleneck identification and management in Pakistani Government sector.		
	Bottleneck identification and management in Pakistani Private sector.		
Week 09	How to understand and measure quality?	**Assignment 02**	
	Cost of Quality; TQM and Six Sigma.		
	SPC and Process capability.		
Week 10	Lean Systems.		
	Inventory Management basics.		
	ABC analysis; EOQ model and variants.		
Week 11	Continuous review system; Periodic Review System.		**Quiz 02**
	How to know how many to produce?		
	Operations Planning and Scheduling.		
Week 12	Levels in operations planning, Strategy.		
	Resource Planning.		
	Material requirement planning		
Week 13	How to network for creating and delivering value for customers?		
	Supply chains- manufacturing & Services; Designing Supply Chains		
	Measuring SC performance.		
Week 14	Supply chain strategies.		
	Operations Scheduling.		
	Forecasting.		
Week 15	Management of Quality.		
	Facilities Planing and Management.		
	Implementation of facilities planing system.		
Week 16	Project & Presentation		
	Project & Presentation		
	Project & Presentation		

Recommended Textbook (Latest Available Edition)

- Operations Management, International Edition, Eighth Edition, by William J. Stevenson, Publisher: McGraw-Hill
- Jay Heizer & Barry Render, Operations Management, Latest Edition, Prentice Hall.

ReferenceMaterial:

- Operations Management by William J. Stevenson.
- Operations Management for MBAs by Jack R. Meredith and Scott M. Shafer.
- Operations Management (10th Edition) (Pearson Custom Business Resources) by Jay Heizer and Barry Render.