

<b>SEMESTER-III</b>			
<b>COMMON CORE - TRANSFORMS WITH MATLAB</b>			
<b>Code: 17PCCC31</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits : 3</b>

### **Objectives**

- Comprehend the concepts of Z and Fourier Transforms
- To enable students develop their calculation skills using MATLAB.

### **UNIT I**

Fourier Transforms: Introduction - Fourier Integral theorem - Fourier Transforms - Alternative form of Fourier complex integral formula - Relationship between Fourier Transforms and Laplace Transforms.

**(Text Book 1 - Chapter 2 : Sections 2.1 , 2.2 , 2.3 , 2.4 , 2.5)**

### **UNIT II**

Properties of Fourier Transforms - Finite Fourier Transforms .

**(Text Book 1 - Chapter 2 : Sections 2.6 , 2.7)**

### **UNIT III**

Z - Transforms : Introduction - Properties of Z- Transforms - Z-Transforms of some basic functions - Inverse Z- Transforms - Use of Z-Transforms to solve finite differential equations.

**(Text Book 1 -Chapter 5 : Section 5.1 , 5.2 , 5.3 , 5.4 , 5.5 )**

**(Exercise Problems are not included)**

### **UNIT IV: MATLAB**

Introduction : MATLAB Environment - Types of files - Search - Constants , Variables and Expressions - Vectors and Matrices - Polynomials - Input / Output statements-MATLAB graphics.

**(Text Book 2 - Chapter 1, 2, 3, 4, 5,6)**

### **UNIT V**

Control Structures - Writing Programmes and functions - Ordinary Differential Equations and Symbolic Mathematics - MATLAB Applications : Z-Transforms and Fourier Transforms.

**(Text Book 2 - Chapter 7, 8, 9, 15 ( Sections : 15.1, 15.6, 15.7 ,15.8)**

### **TEXT BOOKS:**

1. T.Veerarajan : Transforms and Partial Differential Equations ( Updated Edition) .
2. RajkumarBansal , Ashok Kumar Goel , Manoj Kumar Sharma : MATLAB and its Applications in Engineering, Pearsons Publications.

SEMESTER – III			
Core Elective - II		Phytochemistry and Photochemistry	
Code : 17PCHE31	Hrs / Week : 5	Hrs / Sem : 75	Credits : 5

### Unit I Biomolecules

Synthesis and reactions of oxazole, imidazole, coumarins, benzopyrazole and anthocyanins - synthesis of flavones - Pyranose and furanose forms of aldohexose and ketohexose - Methods used for the determination of ring size - Structural elucidation of maltose, sucrose and lactose - Starch and cellulose - Nucleic acids, nucleotides, polynucleotides and nucleosides.

### Unit II Alkaloids and Terpenoids

Alkaloids – Introduction - General methods of extraction – Classification - Degradation studies - HEM, Emde and Von-Braun - Structural elucidation of papaverine, morphine and quinine, cocaine.

Terpenoids – Introduction - General methods to elucidate the structure of terpenes - Structural determination of camphor, zingiberine,  $\alpha$ -pinene and squalene.

### Unit III Steroids

Classification – Structural elucidation of cholesterol and ergosterol – Structural elucidation of androsterone, testosterone, progesterone and Oestrone.

Conversion of Cholesterol into androsterone, progesterone, testosterone, 5 $\alpha$ - and 5 $\beta$ -Cholanic acid - Conversion of Oestrone to Oestriol.

### Unit IV Photochemistry and Green Chemistry

Photochemistry - Basic principles - Jablonski diagram - Photosensitization - Photochemical reactions - Photoreduction – Photooxidation - Photochemical rearrangement - Norrish type I and II reactions - Paterno-Buchi reaction, Barton reaction and di- $\pi$  methane rearrangement.

Green Chemistry - Twelve principles, atom economy- addition and rearrangement reaction, substitution reaction, elimination reaction - Green solvents - Supercritical CO<sub>2</sub>, H<sub>2</sub>O, Ionic liquids.

## Unit V Pericyclic reactions

Atomic and molecular orbitals – Woodward-Hoffmann rules - FMO and MO correlation diagram approaches - Electrocyclic reactions - con and dis rotatory motions for  $4n$  and  $4n+2$  system (butadiene and 1,3,5-hexatriene) - Stereochemical course of electrocyclic reaction in terms of conservation of orbital symmetry - Cycloaddition - suprafacial and antarafacial additions, [2+2] and [4+2] reactions (ethylene and butadiene) – Sigmatropic rearrangements - [i,j] shift of C-H and C-C bonds (1,3 1,5 and 3,3 system).

## References

1. Finar I L, Organic Chemistry Volume I and II, Sixth Edition, ELBS with Longmann, Singapore (1997).
2. Gurdeep Chatwal, Organic Chemistry of Natural Products, Vol II, Himalaya Publishing House, Bombay, (2003).
3. Nasipuri D, Stereochemistry of Carbon Compounds, Second Edition, New-Age International Publishers, New Delhi (1996).
4. Ahluwalia, V. K and Rajender S. Varma, Green Solvents for Organic synthesis, Narosa Publishing House Pvt. Ltd. (2009).
5. Paul T Anastas, Text Book on Green Chemistry, OUP, (2006).

SEMESTER –IV			
Core XV COMPUTERISED ACCOUNTING PACKAGES – TALLY 9.0 ERP			
Code: 17PCOC44	Hrs/Week: 6	Hrs/Sem: 90	Credits : 4

### **Objective:**

To provide knowledge on the use and application of computers in accounting.

### **UNIT I - Introduction to Tally:**

New features of Tally 9.0 - Tally screen components – Creating/Setting up of company in Tally – Company features – Creating accounting ledgers – Creating inventory ledgers – Create Stock Items, Stock Groups, Stock Categories, Godowns and units of measure –

### **UNIT II Cost Centers and vouchers and Final accounts:**

Create cost categories - Cost centers – invoice- inventory reports and exception reports. Types of vouchers – POS – reversing journals & Voucher classes – Types of accounting and inventory vouchers – Stock journal – Trial balance primary groups – final accounts. .

### **UNIT II -Value Added Tax:**

Meaning of VAT - General technologies used in VAT – VAT rates – Computation of VAT - VAT classification - Ledger setup for VAT- voucher entry- Input credit adjustments for capital goods – features of composite dealers – VAT composition computation report – VAT composition returns.

### **UNIT III – TDS & ST:**

Features of TDS – Flowchart of TDS – Account classification for TDS – TDS detection entries for advance payment and balance payment – TDS computation report  
– TDS pending statement. Features of Service tax – Creation of ledger & input credit adjustments of Service Tax – Service tax reports. Features of TCS – TCS on Contracts, license and leases – Revised forms for E-TCS returns – TCS reports.

### **UNIT V - Pay Roll:**

Features of Tally – Pay roll info – Create pay heads, gratuity pay heads , employee group, employees salary details - units attendance – production types- pay sheet report- pay slip- pay roll statement report – pay roll register – attendance sheet report  
– gratuity report – pay roll with PF and ESI –.

### **References:**

1. LP Editional Board , Guide to Tally Law point, Kolkatta
2. A.K. Nadhani and K.K. Nadhani, Implementing Tally, BPB publications
3. P. Mohan, Information Technology for Business, Himalaya Publishing House, Delhi.



<b>SEMESTER-III</b>			
<b>ELECTIVE I - CLOUD COMPUTING</b>			
<b>Code: 17PCSE31</b>	<b>Hrs/week:5</b>	<b>Hrs/sem:75</b>	<b>Credits: 5</b>

**Objectives:**

- Comprehend the core concepts of the cloud computing.
- Apply the fundamental concepts in data centers to understand the tradeoffs in power, efficiency and cost.
- Analyze various cloud programming models and apply them to solve problems on the cloud.

**UNIT I: UNDERSTANDING CLOUD COMPUTING**

Cloud computing - cloud types- the cloud cube model- deployment models-service models-characteristics of cloud computing-assessing the role of open standards.

**UNIT II: CLOUD ARCHITECTURE**

The cloud computing stack – composability – infrastructure – platforms – virtual appliances – communication protocols – Connecting to the cloud: The Jolicloud net book OS – Chromium OS the browser as an operating system.

**UNIT III: DEVELOPING CLOUD SERVICES**

Infrastructure as a service (IaaS) – IaaS workloads- Platform as a service (PaaS) – Software as a service (SaaS)– Identity as a service (IDaaS) – Compliance as a service(CaaS).

**UNIT IV: VIRTUALIZATION AND CLOUD APPLICATIONS**

Virtualization technologies – load balancing and virtualization – advanced load balancing – the Google cloud – Google Analytics – Google translate- Google Toolkit –Google APIs-windows azure service – windows Azure App fabric.

**UNIT V: CLOUD STORAGE**

Cloud storage – unmanaged cloud storage – managed cloud storage – creating cloud storage systems – working with Amazon storage systems: Amazon Elastic compute cloud(EC2)- Amazon simple storage system(S3) – Amazon Elastic block store(EBS)- cloud front.

**TEXT BOOK:**

1. Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd, 2012. New Delhi. Chapters:1,3,4,5(pgs:94-99),8(pgs:162-173),10(pgs:201-216),15(pgs:316-321),9(pgs:185-199)

**BOOK(S) FOR REFERENCE:**

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, Second Edition, August 2008.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pvt. Limited, July 2008.

## CORE IX - MONETARY ECONOMICS

Code:17PECC31

Hrs/Week: 6

Hrs/Semester: 90

Credits: 5

**Objective**

To enable the students to have realistic understanding and practical solution of the economic problem the study of monetary economics is relevant

**20 Hrs****UNIT-I DEMAND FOR MONEY**

Introduction- Nominal versus Real cash Balances- Neo classical theory- Keynes theory - Determinants of the Demand for money- The Transaction Demand for money- Approaches of BAUMOL and ~~BN~~ <sup>Tobin</sup> - Friedman and modern Quantity theory - Empirical Evidence.

**15 Hrs****UNIT-II SUPPLY OF MONEY**

High powered money and Money multiplier- Determinants of the Money multiplier - Factors affecting High powered money - RBI approach to money supply - Approaches to the measures of money supply - Factors affecting the velocity of circulation of money.

**UNIT-III THEORIES OF INFLATION****20 Hrs**

Definition - Keynes' view- Forms of inflation - Inflationary gap - Demand pull inflation - Cost push inflation and Economic Development - Effects of inflation - Philips curve - LIPSEYS Analysis - policies to control inflation

**UNIT-IV FINANCIAL MARKETS****20 Hrs**

Role and structure of money market and capital market - Structure of a financial market - Instruments of the money market - Call money market - Treasury Bill market - Commercial Bill market - Stock market - Gilt edged market - recent measures taken by RBI.

**UNIT-V MONETARY POLICY****15 Hrs**

The IMF prescription and monetary policy - Objectives of monetary policy - Regulation and control of money supply - RBI and monetary policy - An Evaluation of Reserve Bank and monetary policy.

**Text Book:** Gupta S.B - 'Monetary Economics Institutions, theory and policy' S. CHAND &co, 2009.

**Reference Books:**

1. Mishra S.S- "Money, Inflation and Economic Growth" Oxford and IBH Publishing company, New Delhi, 1981
2. T.N. HAJELA, Banking and public finance, 2009
3. Patinkin D - "Money, Interest and Prices" Harper and Row, New York, 1965
4. Hicks J.R- "The Crisis in Keynesian Economics" Oxford University Press New Delhi

SEMESTER- IV			
CORE -XVI- PORTFOLIO MANAGEMENT			
<b>Code: 17PECC44</b>	<b>Hours / Week :6</b>	<b>Hrs / Semester: 90</b>	<b>Credits :4</b>

**Objective:**

To enable the students to use finance theory in investment and management appropriately and to provide a basic for the measurement and analysis of the risk of financial investments

**UNIT -I FINANCIAL MARKETS AND INSTRUMENTS 15Hrs**

Portfolio Management – Meaning and importance - Money and bond markets, equity markets, derivative markets, managed funds, exchange traded funds, exchange trading and over The Counter (OTC) trading, clearing, settlement, margin trading, short sales and contingent orders, regulation of financial markets

**UNIT -II INVESTMENT STRATEGIES 20Hrs**

Active fund management and investment strategies: historical mutual fund performance, market efficiency and behavioral finance, return based trading strategies, hedge funds

**UNIT- III DIVERSIFICATION 15Hrs**

Expected portfolio return and variance, risk premium, risky/risk free capital allocation, minimum-variance portfolio frontier, market portfolio, expected return relationships, Treynor-Black model, and factor models

**UNIT -IV RISK AND PERFORMANCE 20Hrs**

Portfolio Immunization: Term structure of interest rates, duration, immunization of equity portfolios. Risk and performance management: types of risk, regression methods for measuring risk, value-at-risk, risk adjusted performance measures, m squared measure, performance measurement with changing portfolios

**UNIT V: RISK MANAGEMENT 20Hrs**

Risk management and VaR based portfolio insurance: Put option protection, Put call parity, volatility hedging, Basak-Shapiro model

**Reference Books:**

1. Saunders, A., 2000, *Financial Institutions Management: A Modern Perspective*, ED.3, McGraw Hill, New York
2. Bodie, Z., A. Kane and A.J. Marcus, 2005, *Investments*.Ed.6, McGraw-Hill Irwin,London
3. Elton, E.J., M.J. Gruber, S.J. Brown and W.N. Goetzmann, 2003, *Modern PortfolioTheory and Investment Analysis*, Ed.6, Chichester: John Wiley & Sons, New York.
4. Brown, S.J. and W.N. Goetzmann, 2001, *Hedge Funds with Style*. NationalBureau of Economic Research.
5. Duffie, D. and K.J. Singleton, 2003, *Credit Risk: Pricing, Measurement andManagement*, Princeton University Press,

SEMESTER IV			
Core XII - War and Literature			
Code: 17PLCC41	Hrs/Week:6	Hrs/Sem: 90	Credits: 6

### Objectives

- To offer an inter-disciplinary knowledge to students
- To enable students to have both historical and literary perception of war
- To analyse writings against its historical background

### Unit I

American War of Independence – No Taxation without Representation  
Philip Freneau - The American Soldier (Poem)  
Patrick Henry - Give me Liberty or Give me Death (Prose)

### Unit II

French Revolution – Liberty, Equality & Fraternity  
Saint Therese of Liseux – Canticle to obtain the Canonization of the  
Venerable Joan of Arc (Poem)  
Maximilien Robespierre – Speech on French Revolution (Prose)

### Unit III

Indian National Army  
Rabindranath Tagore – Freedom (Poem)  
Subash Chandra Bose - Give me blood, and I shall give you freedom (Prose)

### Unit IV

First World War – Causes & Results  
Wilfred Owen - Anthem for Doomed Youth (Poem)  
Mary Borden – The Two Gunners (Short Story)

### Unit V

Post II World War & Peace  
James Kirkup – No more Hiroshimas (Poem)  
Iain Crichton Smith – The Telegram (Short Story)

**Text Book** – Compiled by the Research Department of English.

### References

1. Khurana, K.L., *Modern Europe*, Lakshmi Narain, Agarwal Publications, Agra, 1979.
2. Bhattacharee, Arun, *A History of Europe*, Sterling Publication, New Delhi, 1975.
3. Fisher, A.A.C., *History of Europe*, Eyre, Spottiwoode, London, 1989.
4. Gate, South, *A Text Book of Modern European History*, J.M. Dent and Sons, London, 1970.
5. Grant, A.J. and Temperley, Harold, *Europe in the 19<sup>th</sup> and 20<sup>th</sup> Centuries*, Longman Publications, London, 1971.

Semester III			
Elective III–Calculus of Variations and Integral Equations			
Code: 17PMAE31	Hrs/Week: 6	Hrs/Sem: 90	Credits : 3

**Objectives:**

- To solve differential equations using variational methods.
- To introduce Fredholm & Volterra Integral equations and to study the methods of solving the above equations.

**Unit I:**

The Calculus of Variations - Functionals - Euler's equations - Geodesics - Variational problems involving several unknown functions.

**(Chapter 9: Sections 1 - 11)**

**Unit II:**

Functionals dependent on higher order derivatives - Variational problems involving several independent variables - Constraints and Lagrange multipliers.

**(Chapter 9: Sections 12 - 14)**

**Unit III:**

Isoperimetric problems - The general variation of a functional - Variational problems with moving boundaries - Hamilton's principle, Sturm - Liouville's problems and variational methods - Rayleigh's principle - Ritz method.

**(Chapter 9: Sections 15 - 21)**

**Unit IV:**

Integral Equations - Introduction - Relation between differential and integral equations - Relationship between Linear differential equations and Volterra integral equations.

**(Chapter 10: Sections 1 - 3)**

**Unit V:**

The Green's function and its use in reducing boundary value problems to integral equations - Fredholm equations with separable kernels - Fredholm equations with symmetric kernels: Hilbert Schmidt theory - Iterative methods for the solution of integral equations of the second kind - The Neumann series - orthogonal kernels.

**(Chapter 10: Sections 5 - 11)**

**Text Book:**

Dr.M.K.Venkataraman, Higher Mathematics for Engineering and Sciences, The National Publishing Company, 2001.

**Book for Reference:**

Francis B. Hildebrand, Methods of Applied Mathematics, second edition, Prentice-Hall of India private limited, 1968.

<b>Semester IV</b>			
<b>Elective IV– Projective Geometry</b>			
<b>Code: 17PMAE41</b>	<b>Hrs/Week :6</b>	<b>Hrs/Sem: 90</b>	<b>Credits : 4</b>

## Objectives

- To acquire the essential ideas and methods of differential Geometry.
- To learn about the classical theory of curves, surfaces and vector methods.

## UNIT-I

Projective Geometry as an extension of high school geometry: Two approaches to projective geometry-An initial question-Projective invariants-Vanishing points – Vanishing lines-Some projective noninvariants – Betweenness-Division of a segment in a ratio-Desargues’ Theorem-Perspectivity;projectivity-Harmonic tetrads;fourth harmonic-Further theorems on harmonic tetrads. **(Chapter 1 : Sections 1-12)**

## UNIT-II

Projective Geometry as an extension of high school geometry: The cross-ratio-Fundamental Theorem of Projective Geometry-Further remarks on the cross- ratio-Construction of the projective plane- Previous results in the constructed plane-Analytic construction of the projective plane.**(Chapter 1 : Sections 13-18)**

## UNIT-III

The axiomatic foundation: Unproved propositions and undefined terms-Requirements on the axioms and undefined terms-Undefined terms and axioms for a projective plane-Initial development of the system;the Principle of Duality-Consistency of the axioms-Other models-Independenceof the axioms-Isomorphism-Further axioms-Consequences of Desargues’ Theorem-Free planes. **(Chapter 2 : Sections 1-11)**

## UNIT-IV

Establishing coordinates in a plane : Definitions of a field-Consistency of the field axioms-The analytic model –Geometric description of the operations plus and times- Setting up coordinates in the projective plane-The non commutative case. **(Chapter 3 : Sections 1-6)**

SEMESTER IV			
Core XII(Common)		Organisational Behaviour	
Code: 17PMCC41	Hrs/Week: 6	Hrs/Sem: 90	Credits: 4

**Objective:**

To enable the students to understand the various dimensions of organizational behaviour.

**Unit-I Introduction to Organisational Behaviour and Personality:**

Organizational Behaviour: Definition- Nature and Scope –Objectives –Evolution- Models of Organisational Behaviour – Autocratic – Custodial- Supportive - Collegial. Personality: Definition-Determinants of Personality-Types of Personality- Theories of Personality-Sigmund Freud's four stages of Personality - Ericson's eight life stages.

**Unit-II Perception, Attitude and Learning:**

Perception: Definition- PerceptionProcess- Factors affecting Perception.

Attitude: Concepts- Formation of Attitude- Types of Attitude - Measurement of Attitude.Learning: Meaning - Definition- Determinants of Learning- Learning Theories- Classical Conditioning- Operant Learning- Cognitive Theory- Social Learning Theory.

**Unit-III Motivation and Leadership:**

Motivation: Meaning – Concepts- Theories of Motivation-Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory -McGregor's Theory Xand Theory Y.

Leadership: Definition – Functions- Leadership Styles- Leadership Theories-Trait Theory- Behavioral Theory - Managerial Grid Theory.

**Unit-IV Group Behaviour and Team Building:**

Group Behaviour: Definition- Characteristics of a Group-Types of Groups- Group Formation and Development- Group Role- Inter-Group Behaviour-Inter-Group Conflict-Group Decision Making. Team Building: Meaning- Types of Team- Team Building Process.

**Unit-V Organisational change, Development and Effectiveness:**

Organisational Change and Development: Reasonsfor Organistional Change- Types of Change -PlannedChange - Resistance to Change and Managing Change.

Organisational Development (OD): Meaning – Objectives- Models of OD and OD Interventions Organisational Effectiveness: Definition - Approaches to Organisational Effectiveness –Factors Influencing Organisational Effectiveness.

**Text Books:**

1. S.S. Khanka – Organisational Behaviour S.Chand &Co Ramnagar New Delhi

**References:**

1. K. Aswathappa Organisational Behaviour Himalaya Publishing House , Mumbai
2. Fred Luthans Organisational Behaviour McGraw Hill International Edition
3. Stephen. P. Robbins, Essentials of Organisational Behaviour, Prentice Hall of India, New Delhi



SEMESTER - IV			
CORE X		NANO SCIENCE AND TECHNOLOGY	
Code :17PPCC41	Hrs/Week: 6	Hrs/Semester:90	Credits: 4

### Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	Recall a thorough knowledge of the basic concepts of nanoscience and nanotechnology	PSO1	R
CO 2	Explain the preparation, characterization and properties of nanomaterials	PSO4	U
CO 3	Analyze the types and properties of carbon nanotubes	PSO4	An
CO 4	Assimilate existing and new concepts, methodology and researches and apply them in their academic research environment	PSO5	E
CO 5	Aware of challenges, risks and promises of magneto electronics and nano technological development	PSO6	C
CO 6	Discuss the preparation of Quantum Nano structures	PSO1,4	U

### Unit I-Introduction

History of Nanotechnology- Nano structures- importance of nano materials- Synthesis of nanomaterials- physical methods(Laser Ablation, Evaporation,Sputtering and solvated metal Dispersion)- Chemical methods- Thermolysis, Sonochemical approach, reduction of metal ions by hydrogen and Methanol- Biosynthesis (Elementary idea only)

### Unit II-Preparation and characterisation

Structural Characterisation (X- ray diffraction, Scanning Tunneling Microscopy, Atomic force microscopy) - Properties of nanomaterials(Optical,Electrical and magnetic properties) – Synthesis of semiconductor nanomaterials ( Precipitation methods, Thermal decomposition of complex precursors) -Synthesis of Ceramic nanomaterials - Physical methods ( Gas condensation & Laser methods)- Chemical method(Sol-gel synthesis)

### Unit III- Carbon nanotube

Carbon nanotube - Carbon allotropes (Diamond ,Graphite, Carbon nanotubes) - Types of Carbon nanotubes – Graphene sheet to single walled nanotube - Synthesis of carbon nanotubes( Electric arc -Discharge method, Laser method, Fluidised bed CVD method, Solar production of Carbon nanotubes) - Purification and properties of Carbon nanotubes – Fullerenes - Purification and properties of Fullerenes.

#### **Unit IV-Quantum well, Quantum wire and Quantum dots**

Introduction - preparation of Quantum nanostructures - Fermi gas and Density of states – Calculation of the density of states in 1,2 and 3 dimension- Infrared detector -Quantum wire(Production ,Structure, Use), Quantum dot-Fabrication Techniques - Application of Quantum dots – Quantum dot information storage, Infrared photodetectors, Lasers.

#### **Unit V-Magneto electronics and Applications of Nanotechnology**

Magneto electronics: Nano crystalline soft magnetic materials-Permanent magnetic materials-Theoretical background-Super para magnetism-Coulomb blockade-Single electron transistor-Spintronics-Giant magneto resistance-Quantum Hall Effect-fractional Quantum Hall Effect Applications of Nanotechnology:Chemistry and Environment - Energy applications of Nanotechnology -Information and Communication- Heavy industry - Consumer goods - Nano medicine - medical applications of molecular nanotechnology ( Nanorobots, Cell repair machines, nanonephrology)

#### **Book for Study:**

1.Nano Physics, Dr.Sr.GeraldinJayam

Unit	Book no.	Page No
III	1	2.1-2.7,2.14-2.20,2.26-2.29
IV	1	4.1-4.10,4.15-4.30
V	1	5.1-5.5,5.10-5.30

#### **Book for Reference**

1. Shanmugam.S, Nanotechnology, MJP Publishers, Chennai(2011)
2. Parthasarathy. B.K, Nanostructure and Nanomaterials, Isha Books, Delhi(2007)
3. Fahrner.W.R (Ed), Nanotechnology and Nanoelectronics- materials, Devices, measurement techniques, Springer(2004)
4. Charles.P. Poole Jr Frank J. Owens;John Wiley & Sons inc.Publication(2003)
5. Massimiliano Di ventra, Stephane Evoy, James R. Heflin Jr(Editors) , Introduction to Nanoscale science and Technology Springer(2009)
6. Guozhong Cao, Nanostructures and Nanomaterials – Synthesis, Properties and Applications, Imperial College Press, London(2004).

SEMESTER - III			
CORE - VII		QUANTUM MECHANICS-I	
Code :17PPHC31	Hrs/Week: 6	Hrs/Semester: 90	Credits: 5

### Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	Develop a knowledge and understand the meaning of uncertainty principles, energy eigen function and boundary conditions	PSO1	C
CO 2	Able to numerically solve the linear harmonic oscillator and describe fundamentals	PSO2	A
CO 3	Compile the knowledge of role of angular momentum and the Pauli spin matrices using ladder operators	PSO1	C
CO 4	Relate the matrix formalism to the use of basic states and solve simple problems in that formalism	PSO2	U
CO 5	Make use of the perturbation theory and variation methods in applications of ground state of He atom	PSO2	A
CO 6	Have a deep understanding of the mathematical foundations of quantum mechanics	PSO1	U

### Unit I: Formalism of Quantum Mechanics

Inadequacy of classical Physics - Uncertainty Principle – Interpretation of wave function – Statistical Interpretation – Normalisation of  $\Psi$  – Probability current density – Expectation value – Ehrenfest's theorem – Energy eigen functions – separation of wave equations – Boundary and continuity condition – Energy eigen values in one dimension – discrete energy level – continuous energy eigen functions – discrete and continuous eigen values in 3D – 1D square well potential.

### Unit II: Eigen functions and eigen values

Normalisation – Orthonormality – Momentum eigen functions – The Dirac function.

Discrete Eigen Values: Bound state - Linear Harmonic Oscillator – Spherical symmetric potential in 3D - Hydrogen atom.

### Unit III: Angular Momentum

Angular momentum operator – Eigen values and eigen functions of  $L^2$  – commutation relations – Angular momentum and rotations – Ladder operators – the constants  $C_+$  and  $C_-$  - Angular

momentum corresponding to  $j = \frac{1}{2}$  and the Pauli spin matrices, wave function and equations – combination of two angular momenta – C.G coefficient.

#### **Unit IV: Matrix formulation**

Transformation theory – Unitary matrix – Transformation of Hamiltonian with W, U, V – Hilbert space – Dirac bra and ket notation - Schrodinger's picture – Hisenberg's picture – Interaction picture – Matrix theory of harmonic oscillator.

#### **Unit V: Approximation methods**

Perturbation theory in non-degenerate cases – Applications to ground state of He atom, Harmonic oscillator – Stark effect in Hydrogen – Variation method – Application to ground state of He atom - WKB Approximation.

#### **Books for Study:**

1. L.I.Schiff, Quantum Mechanics , IIIEdition,McGraw Hill,1968
2. Ajoy Ghatak, S.Lokanathan, Quantum Mechanics Theory and Applications, 5<sup>th</sup> Edition, Macmillan India Ltd, NewDelhi.
3. Quantum Mechanics ,Chatwal Anand, Fourth Edition,1993,Himalaya Publishing house,Bombay,

Unit	Book no.	Sections / Page No
I	1	2-3, 7-8,24-32, 34-44
II	1	47-50, 53-55, 66-83, 88-98
III	2	212 – 221, 309 – 318
	3	653 - 659
IV	1	155-159, 163-166, 168-173, 180 - 185
V	3	405-410, 505 – 508
	2	380 - 384

#### **Books for Reference:**

1. Richard L.Liboff , Introductory Quantum mechanics, Fourth edition, Pearson Education 2003.
2. SathyaPrakash, Advanced Quantum Mechanics, Reprint 2013,Keda Nagth and Ram Nath Publications, Meerut.
3. P.M.Mathews and K.Vengatesan, A text book of Quantum Mechanics, 38 reprint 2007, Tata Mc Graw Hill Publishing Company Ltd, NewDelhi.
4. S.N.Biswas, Quantum Mechanics, 2011 Reprint, Books and Allied P Ltd, Kolkata.
5. Ajoy Ghatak, S.Lokanathan, Quantum Mechanics Theory and Applications, 5<sup>th</sup> Edition, Macmillan India Ltd, NewDelhi.
6. Vimal Kumar Jain, Introduction to Quantum Mechanics, 2010 Edition, Narosa publishing P Ltd, NewDelhi.

SEMESTER - III			
CORE VIII THERMODYNAMICS AND STATISTICAL MECHANICS			
Code : 17PPHC32	Hrs/Week: 6	Hrs/Semester: 90	Credits:5

#### Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	Acquire working knowledge of the zeroth, first, second and third law of thermodynamics	PSO1	C
CO 2	Apply statistics in different systems containing atoms and molecules	PSO2	A
CO 3	Construct the partition function for calculations about the microcanonical, canonical, grand canonical ensemble	PSO2	An
CO 4	<ul style="list-style-type: none"> <li>Recover the loss of thermodynamics and equipartition theorem from the statistical description using microstates</li> <li>Uses Fermi Dirac and Bose Einstein statistics according to the spin of the particles</li> </ul>	PSO6	E
CO 5	Acquire knowledge about phase transitions and fluctuations in ensembles	PSO1	C
CO 6	Analyse energy changes in chemical reaction using the first law of thermodynamics	PSO1	An

#### Unit I: Thermodynamics

Zeroth, First, Second and Third law of thermodynamics – Entropy – Maxwell's thermodynamic relations – Thermodynamic potentials – Chemical potential.

#### Unit II: Basis of Statistical Mechanics

Phase space – Ensemble – Liouville theorem – Conservation of extension in phase – Equation of motion – Equal a priori probability – Statistical Equilibrium – Microcanonical Ensemble – Quantisation of Phase space – Classical limit – Symmetry of wave functions – Effect of symmetry of counting – Various distributions using microcanonical ensemble.

#### Unit III: Ensemble

Gibbs paradox – Sackur-Tetrode equation – Entropy of a system in contact with a heat reservoir- Ideal gas in canonical ensemble – Grand canonical ensemble – Ideal gas in grand canonical ensemble – Comparison of various ensembles – Quantum distributions using other ensembles.

#### Unit IV: Statistical Thermodynamics

Macrostates and microstates – Bose-Einstein distribution function – Fermi-Dirac distribution function – Maxwell-Boltzmann distribution function – Partition function – Thermodynamic properties of a system - Bose-Einstein condensation – Einstein and Debye theories of the specific heat capacity of a solid – Blackbody radiation.

#### Unit V: Ising model and Fluctuations

Phase transitions of the second kind – Ising model – Bragg-Williams approximations – Fowler-Guggenheim approximation – One dimensional Ising model.

Fluctuations in ensembles – concentration fluctuations in quantum statistics - One dimensional random walk – Brownian motion.

**Book for Study:**

1. Heat and thermodynamics, V N Dass, First Edition, 2005, Dominant Publishers , Delhi.
2. Statistical Thermodynamics, M.C Gupta, Reprint 2009, New age international P Ltd, New Delhi.
3. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Sears Salinger, Third edition, Narosa publishing house pvt Ltd, New Delhi.
4. Statistical Mechanics, B.K Agarwal, Melvin Eisner, Reprint 2002, New age international P Ltd, New Delhi.

Unit	Book no.	Sections / Page No
I	1	1-2, 14-19, 70-71, 76-77, 154-160, 173-187
	2	5.5
	3	7.7
II	4	1.2, 1.3, 1.5-1.10, 2.2, 2.4-2.7
III	4	3.5, 3.6, 4.2, 4.3, 4.6 - 4.9
IV	3	11.3, 11.9, 11.10, 11.13, 11.14, 11.5, 13.1, 13.2, 13.3
	4	6.2
V	4	11.1 -11.4, 11.6, 10.3-10.6

**Books for reference:**

1. Kerson Huang, Statistical Mechanics, John Wiley & Sons, Inc., New York, Second edition, 1987.
2. A.K. Dasgupta, Fundamentals of Statistical Mechanics, New Central Book Agency (P) Ltd., Calcutta, 2000.
3. Sears and Zymanski, Statistical Mechanics, McGraw Hill Book Company, New York, 1961.
4. Frederick Reif., Fundamentals of Statistical and thermal Physics, McGraw Hill International Editions, Singapore, 1985.

SEMESTER - IV			
CORE XI		QUANTUM MECHANICS –II	
Code :17PPHC41	Hrs/Week: 6	Hrs/Semester:90	Credits: 4

### Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	Understand time dependent perturbation theory in quantum mechanics	PSO1	U
CO 2	Interpret the wave functions and apply operators to its to obtain information about the particle's physical properties	PSO2	U
CO 3	Develop a knowledge and understand the scattering matrix and partial analysis	PSO1	A
CO 4	Relate the Einstein Coefficient using semi classical treatment	PSO6	R
CO 5	Interpret the form and construction of relativistic wave equations	PSO6	U
CO 6	Discuss the construction of Symmetric and anti-symmetric wave functions	PSO1	U

### Unit I: Time Evaluation Process

Time dependent perturbation theory – first & second order – Application: Elastic scattering ( first order) – Harmonic perturbation - Transition probability – The selection rules – Application: Elastic scattering ( First order) - Adiabatic & Sudden approximations – Disturbance of an oscillator.

### Unit II: Identical Particles and Spin

Symmetric and antisymmetric wavefunctions – construction – The exclusion principle – spin matrices and eigen functions – Collision of identity particles – Expectation value and projection operator – Density operator – Equation of motion - Density matrix.

### Unit III: Scattering Theory

Definition and interpretation of scattering cross section – Quantum theory of scattering – Green's function – The Born approximation and its validity – Scattering by Yukawa potential – Ramsauer –Townsend effect – Scattering by a perfect rigid sphere - Scattering by a square well potential – Resonance scattering – Coulomb potential.

### Unit IV:Semiclassical Treatment

Absorption and induced emission – Transition probability – Electric dipole transition – Einstein coefficient – Relation between Einstein coefficients – Selection rules for a single particle – Photoelectric effect.

### Unit V: Relativistic Wave Equations

The Klein-Gordon equation – The Dirac equation – Dirac matrices – Free particle solutions - The electron in an electromagnetic field – spin angular momentum – spin orbit energy – The hydrogen atom – Classification of energy levels – Negative energy states.

#### Books for study:

1. L.I. Schiff, Quantum Mechanics, III Edition, McGraw Hill, 1968
2. Ajoy Ghatak, S. Lokanathan, Quantum Mechanics Theory and Applications, 5<sup>th</sup> Edition, Macmillan India Ltd, New Delhi.
3. Quantum Mechanics, Chatwal Anand, Fourth Edition, 1993, Himalaya Publishing house, Bombay,
4. P.M. Mathews and K. Vengatesan, A text book of Quantum Mechanics, 38 reprint 2007, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.

Unit	Book no.	Sections / Page No
I	4	335 – 345, 351 – 354
	2	594 – 598
	1	289 – 291, 292 -295
II	1	362 – 366, 368, 372 – 374, 378 – 383
	4	381 - 383
III	2	552 – 560, 574 - 578
	1	324 – 326, 123 - 129
IV	1	398 , 401 – 406, 416 – 417, 420 - 422
	2	227 - 228
V	1	466 - 488

#### Books for Reference:

1. Richard L. Liboff, Introductory Quantum mechanics, Fourth edition, Pearson Education 2003
2. Sathya Prakash, Advanced Quantum Mechanics, Reprint 2013, Kedar Nath and Ram Nath Publications, Meerut.
3. P.M. Mathews and K. Vengatesan, A text book of Quantum Mechanics, 38 reprint 2007, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
4. S.N. Biswas, Quantum Mechanics, 2011 Reprint, Books and Allied P Ltd, Kolkata.
5. Ajoy Ghatak, S. Lokanathan, Quantum Mechanics Theory and Applications, 5<sup>th</sup> Edition, Macmillan India Ltd, New Delhi.
6. Vimal Kumar Jain, Introduction to Quantum Mechanics, 2010 Edition, Narosa publishing P Ltd, New Delhi.



SEMESTER - IV			
CORE XII ATOMIC AND MOLECULAR SPECTROSCOPY			
Code :17PPHC42	Hrs/Week: 6	Hrs/Semester: 90	Credits: 4

### Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	Explain the structure of atoms and the origin of the observed spectra	PSO1	U
CO 2	Interpret rotational spectra, get information about molecular dimension and atomic masses	PSO4	U
CO 3	Explain pure rotational Raman spectra and understand the techniques in instrumentation	PSO3	U
CO 4	Apply knowledge of Mossbauer spectroscopy in solid state physics and nanotechnology	PSO4	A
CO 5	Assess how nuclear spins are affected by magnetic field and able to explain what happens when radio frequency radiation is observed	PSO1	E
CO 6	Discuss the techniques of ESR spectroscopy	PSO1	U

### Unit I: Atomic Spectra

Introduction-Different Spectral lines of hydrogen-Origin of Atomic Spectra: Rutherford's explanation-Bohr's theory of Hydrogen Spectrum-Critical potential (excitation & ionization potentials)-vector atom model.

**Electronic Spectroscopy:** Structure of atoms-electronic angular momentum-The angular momentum of many –electron atoms-The Zeeman effect

### Unit II: Microwave Spectroscopy

**Microwave Spectroscopy:** The rotation of molecules – Rotational spectra – Diatomic molecules – Polyatomic molecules –Techniques and instrumentation –Chemical analysis. Applications(Microwave oven)

### Unit III: Infra-Red Spectroscopy and Raman Spectroscopy

**Infra Red Spectroscopy:** The vibrating diatomic molecule – The Diatomic vibrating rotator- The interactions of rotations and vibrations- The vibrations of polyatomic molecules- Techniques and instrumentations.

**Raman spectroscopy:** Pure rotational Raman Spectra- vibrational Raman spectra- Techniques and instrumentation.

### Unit IV: Electronic Spectroscopy of Molecules and Mossbauer Spectroscopy

Vibrational coarse structure: progressions – intensity of vibrational electronic spectra: The Frank – Condon principle – Dissociation energy and Dissociation products – rotational fine structure of electronic- vibration transition.

**Mossbauer Spectroscopy: Principles of Mossbauer-Applications of Mossbauer Spectroscopy****Unit V: Resonance Spectroscopy**

NMR – Chemical shift – The coupling constant – Nuclear quadrupole effects – Techniques and instrumentation.

ESR – The hyperfine structure – Double resonance – Fine structure - Techniques of ESR spectroscopy.

**Books for study:**

1. M.K.Dutta, Atomic and Molecular Spectroscopy, 1<sup>st</sup> Edition 2010, IVY Publishing House, Delhi.
2. C.N.Banwell, Fundamentals of Molecular spectroscopy, 4<sup>th</sup> Edition, Tata McGraw hill Publishing Company, NewDelhi.

Unit	Book No.	Sections
I	1	1-4
	2	5.1,5.2,5.4,5.6
II	2	2.1-2.7
III	2	3.1,3.2,3.4,3.5,3.8,4.2,4.3,4.6
IV	2	6.1.2-6.1.5,9.1,9.2
V	2	7.2, 7.2.1 - 7.2.2,7.3.4,7.4,7.5.1,7.5.3-7.5.6

**Books for Reference:**

1. G.M.Barrow, Introduction to Molecular Spectroscopy, 17<sup>th</sup> print, MGH Publishing Company.
2. Gary M.Lampman, Donald L.Pavaia, George S.Keiz, James R.Vyvyvan, Spectroscopy, 4<sup>th</sup> Edition, Cengage Learning India P Ltd, Delhi.
3. G.Arulhas, Molecular structure & Spectroscopy, Second edition,Prentice hall Private Ltd.
4. Suresh Chandra, Molecular Spectroscopy, Narosa Publishing House Ltd, Newdelhi.

SEMESTER – III			
Core VIII: Biotechnology			
Code : 17PZOC32	Hrs / week : 6	Hrs / sem : 90	Credits : 5

### Objectives

- To study the potential benefits of biotechnology
- To familiarize with basic concepts of nanotechnology
- To understand the application of biotechnology in industries

### Unit I Cloning and Screening

Definition – scope – vectors - properties of good vector-cloning and expression vectors - *E.coli* vector- screening of recombinants - pBR 322 - bacteriophage – Lambdaphage - M13 – cosmid – plasmid- shuttle and yeast. - Integration of DNA insert with the vector-Introduction of vector into suitable host.

### Unit II Animal Cell and Organ Culture

Cell culture - culture media - initiation of cell culture - evolution of continuous cell lines – large scale culture of cell lines- stem cell culture – organ culture - somatic cell fusion- hybridoma technology – *in-vitro* fertilization- embryo transfer - transgenic animals- fish, sheep and mice.

### Unit III Microbial Biotechnology and Human Welfare

Microbial biotechnology- Isolation and improvement of microbial strains – micro organism used in alcohol production –alcoholic beverages-wine, beer, whisky- uses of alcohols. Cloned genes and production of chemicals-human peptide hormones - insulin–vaccine for hepatitis B – rabies – polio - small pox – malaria - foot and mouth disease viruses - disease prevention - gene therapy - DNA finger printing.

### Unit IV Enzyme and Industrial Biotechnology

Methods of enzyme production – immobilization of enzymes - enzyme engineering - application of enzymes. Single cell protein- mushroom culture – techniques-advantages and nutritive value. Bio gas production – anaerobic digestion-solubilization-acidogenesis-methanogenesis- mechanism of methane production

## **Unit V            Nanotechnology**

Nanomaterials, synthesis of nanoparticles: RF plasma, chemical methods, thermolysis, nanobiosensor, nanofluids, nanocrystals in biological detection - synthesis of nanodrugs - nanomedicine.

### **Books for Reference**

1. Dubey.R.C. 2006. A Text Book of Biotechnology, 4<sup>th</sup> edition S.Chand & Company Ltd, New Delhi.
2. Singh.B.D.2005. Biotechnology. Revised edition. KalyaniPublishers, New Delhi.
3. Kumaresan V. 2009 Biotechnology. Saras Publication
4. Rema.L.P. 2007.Applied Biotechnology. MJP Publishers, Chennai.
5. Satyanarayana U. 2006. Biotechnology, Books and Allied (P) Ltd. Kolkatta
6. Robert Preidt, LauraCostlow and Peter. 2007. Introductory Nanotecnology. Dominant Publishers and Distributors, Delhi
7. Suhas Bhattacharya, 2013. Introduction to Nanotechnology. Wisdom Press. Delhi

### **PRACTICALS**

#### **Hrs/week : 2**

1. Isolation of DNA from goat liver.
2. Isolation of RNA from yeast
3. PCR amplification.
4. Western blotting analysis.
5. Biogas production
6. Wine preparation
7. Mushroom culture
8. Charts and models pertaining to theory for spotters
9. Report of visit to Biotechnology lab

<b>SEMESTER- II</b>			
<b>Inter Disciplinary Elective II      Managerial Economics</b>			
<b>Code: 18PECE21</b>	<b>Hours / Week :6</b>	<b>Hrs / Semester: 90</b>	<b>Credits :4</b>

### **Objectives:**

To impart a basic knowledge of the concepts and tools of Economics analysis as relevant for managerial decision making and to provide a fair understanding of the aggregate economic system within a firm operates.

### **Course Outcome**

<b>CO No.</b>	<b>Expected Learning Outcome</b> On completion of this course students will be able to	<b>PSOs Addressed</b>	<b>CL</b>
<b>CO-1</b>	Understand the concept of managerial economics	<b>PSO 6</b>	<b>Understand</b>
<b>CO-2</b>	Infer the supply factors	<b>PSO 6</b>	<b>Remember</b>
<b>CO-3</b>	Gain knowledge of market strategy	<b>PSO 6</b>	<b>RememberRemember</b>
<b>CO-4</b>	Understand the profit and investment analysis	<b>PSO 6</b>	<b>Understand&amp; A</b>
<b>CO-5</b>	Gain insights to the macro policies	<b>PSO 6</b>	<b>Understand</b>

### **UNIT – I      INTRODUCTION**

**20Hrs**

Managerial Economics – Meaning, Nature and scope – Role in decision – making – Concepts of managerial economics

### **UNIT – II      SUPPLY FACTORS**

**15Hrs**

Supply meaning and determinants – Production decisions – Production function – Cost concepts – Cost output relationship – Economy of scale – Cost functions

**20Hrs**

## UNIT – IV PROFIT ANALYSIS

**15Hrs**

## UNIT – V MACRO POLICIES

**20Hrs**

### Reference Books:

1. G.S.Gupta - Managerial Economics, Tata Mc Graw Hill.
2. R.L. Varshney and K.L. Maheshwari - Managerial Economics, Sultan Chand & Sons.
3. Metha, P.L - Managerial Economics, Sultan Chand & Sons.
4. Joel Dean - Managerial Economics, Prentice Hall.
5. Rengrajan, L - Principles of Macro Economics, Tata Mc Graw Hill.

SEMESTER II			
Core V		Labour Legislation	
Code: 18PHRC21	Hrs/Week: 6	Hrs/Sem: 90	Credits: 5

### Objective:

To enlighten the students about Labour Legislation in India.

### Course Outcome

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
	On completion of this course, students will be able to:		
CO-1	Explain the basic concepts of Labour Legislation	PSO 2	Understand
CO-2	Describe the Acts related to health, safety and welfare.	PSO 2 & PSO 3	Remember
CO-3	Explain the laws related to social security and liability.	PSO 2	Understand
CO-4	Apply the laws related to gratuity and subsistence allowance.	PSO 2 & PSO 5	Apply
CO-5	To interpret the Tamilnadu State Laws.	PSO 2	Evaluate

### Unit I Basic concepts:

History of Labour Legislation - Labour in the Indian constitution - Labour administration - Functions of factory inspectorate and Judicial set up.

### Unit II Labour Laws related to Health Safety and Welfare:

Factories Act 1948

The Contract Labour Act, 1970 (Regulation and Abolition): Scope and coverage – Advisory Boards – Registration of Establishments -Licensing of contractor- Welfare and Health of contract labour – Penalties and Procedure.

The Plantation labour act 1951: Scope and coverage - Authorities and registration - Health and Welfare - General working conditions - Penalty and procedures.

#### Laws related to social security and Liability:

Employee Provident Fund and Miscellaneous Provisions Act 1952  
Employee State Insurance act 1948: Administration - Contribution and Governing rules - Benefits and Machinery to recover arrears.

Employee Deposit Linked Insurance Scheme 1976.

Maternity benefit act 1961: Right to benefit - Forfeiture of benefit - Medical bonus - Leave and Nursing breaks.

The child labour regulation and abolition Act 1986.

The employment Exchanges (Compulsory Notification of vacancies) Act 1959.

#### **Unit IV        Laws related to Gratuity and Subsistence Allowance**

Pay of gratuity act 1972 – Eligibility - Forfeiture of gratuity - Nomination and recovery.

Payment of Subsistence Allowance Act 1988: Payment - Due recovery from the employer - Savings of certain rights - Protective action on good faith.

#### **Unit V        Tamilnadu state laws and Development in Labour Legislation:**

Tamilnadu shops and establishment Act 1947 - Opening and closing hours - Prohibition of employment of children – Health and safety - Hours of work and holidays - Permissible deduction. Sexual harassment bill 2006: Importance- Features and Committees.

#### **Text Book:**

1. Kapoor, ND ,(2005) Hand Book on Industrial Law, New Delhi, Sultan Chand
2. Shrivastava S C (2002) Industrial Relations and Labour laws, Mumbai, Vikas Publications.

#### **Books for Reference:**

1. Vaidyanathan .S and Sri Vidya (2006) Factory Laws applicable in Tamilnadu, Chennai, Madras Book Agency.
2. Mishra, SN (2007) Labour and Industrial Laws, Allahabad Law agency.



SEMESTER II			
Core VIII		Total Quality Management	
Code: 18PHRC24	Hrs/Week: 6	Hrs/Sem: 90	Credits: 5

### Objective:

To enable the students to understand the basic principles and techniques of Total Quality Management

### Course Outcome

CO No.	Course Outcome	PSOs Addressed	CL
CO-1	Understand the concept of quality and total quality management.	PSO 6	Understand
CO-2	Gain insights on TQM approaches and supplier partnering.	PSO 4	Remember
CO-3	Gain knowledge on the tools and techniques of TQM	PSO 4	Remember
CO-4	State the Quality systems, ISO 9000 and ISO 14000.	PSO 4	Remember

### UNIT I Introduction to Quality and Total Quality Management

Introduction to Quality – Definitions of quality -Need for quality - Dimensions of product and service quality

Definition of TQM - Basic concepts of TQM - Characteristics of TQM - Framework of TQM – Principles of TQM - Contributions of Deming, Juran and Crosby – Barriers of TQM

### UNIT II TQM Approaches and Supplier Partnering

Continuous process improvement: introduction - Input/ Output Process Model - Juran Quality Trilogy - PDCA cycle - 5S House Keeping- Benefits of implementing 5S - Kaizen - Features of Kaizen

Supplier partnership: Partnering - Supplier selection - Supplier Rating.

### UNIT III TQM Tools and Techniques - 1

The seven traditional tools of quality: Flowchart – Check sheet – Histogram – Pareto Diagram - Cause and effect Diagram - Scatter Diagram - Control Chart  
New management tools : Affinity Diagram – Relationship Diagram – Tree Diagram – Matrix Diagram – Matrix Data Analysis – Decision Tree – Arrow Diagram

## **UNIT IV TQM Tools and Techniques - 2**

Six sigma: Concept- Six Sigma Process (DMAIC) – Advantage of Six Sigma

Quality Circles: Concept – Objectives –Characteristics – Structure of Quality Circles

Bench marking: Definition - Reason to bench mark – Types of Benchmarking - Bench marking process- Benefits and Dangers of Benchmarking

## **UNIT V Quality Systems**

Need for ISO 9000 – Benefits of ISO 9000 - ISO 9001-2000 Requirements

Quality System - Introduction to Quality System - Elements - Documentation - Quality Auditing

ISO 14000 – Concepts - Requirements - Benefits – TQM Implementation in manufacturing and service sectors (Case Study).

### **TEXTBOOK:**

1. Jayakumar.V and Raju. R, “Total Quality Management”, Lakshmi Publications, Eighth Edition, 2015

### **REFERENCES:**

1. Dale H. Besterfield et al., “Total quality Management”, Pearson Education Asia, Third Edition, Indian Reprint 2006.
2. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 8th Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman. B and Gopal .R.K., “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.



SEMESTER II			
Core IX		Statistics For Management	
Code: 18PHRC25	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

## **OBJECTIVE:**

To learn the applications of statistics for business analysis and decision making.

## **UNIT I: INTRODUCTION**

Statistics - Definition, Types, Importance and Scope, Limitations. Types of Data, Classification of data, Organising data, Methods of data classification. Frequency Distribution, constructing a frequency distribution, Types of frequency distribution.

## **UNIT II: SAMPLING DISTRIBUTION AND ESTIMATION**

Introduction to sampling distributions, sampling distribution of mean and proportion, sampling techniques.

Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

## **UNIT III: PARAMETRIC AND NON-PARAMETRIC TESTS**

**Parametric Tests:** Introduction to hypothesis and hypothesis testing , general procedure for hypothesis testing, direction of the hypothesis test, errors in hypothesis testing, hypothesis testing for population parameters with large samples (z-test), Hypothesis testing for means of small samples (t-test)

**Non-Parametric Tests:** Mann-Whitney U-test, Kruskal- Wallis test.

## **UNIT IV: CHI – SQUARE TEST AND ANOVA**

Introduction, Properties of Chi-square distribution, Conditions for the application of Chi-square test, Contingency table analysis: Chi-square test of Independence.



## **UNIT V: CORRELATION AND REGRESSION ANALYSIS**

**Correlation analysis – Meaning, Types of Correlation, , Coefficient of Determination, Karl Pearson's correlation coefficient and Spearman Rank Correlation coefficient , method of least squares .**

**Regression Analysis - Meaning, Methods to determine regression coefficients- Least squares.**

### **TEXTBOOK:**

**J.K Sharma, Business Statistics, Pearson Education, Second Edition**

### **Books for Reference:**

- 1. Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, 7th Edition, 2011**
- 2. S.P. Gupta & M.P. Gupta, Business Statistics, (Sultan Chand)**

SEMESTER I			
Elective I		Managerial Skills	
Code: 18PHRE11	Hrs/Week: 6	Hrs/Sem: 90	Credits: 5

### Objective:

- To give a clear understanding of managerial skills. Course

### Outcome

CO No.	Course Outcome	PSOs Addressed	CL
CO-1	Understand the managerial function, role of manager and managerial skills. Understand the development of managerial thought.	PSO 3	Understand
CO-2	Recall the concepts of planning and organizing.	PSO 3	Remember
CO-3	Gain knowledge on decision making skill, Coordinating skill and control skill.	PSO 3	Understand
CO-4	Understand the leadership and communication skill.	PSO 3	Remember
CO-5	Recall the objectives, scope and steps in HR audit. Understand the ethical issues in organization and the factors influencing ethical behavior at work.	PSO 3, PSO 1	Remember & Understand

### Unit 1

#### Introduction to Management:

Introduction to Management –Meaning- Definition- Management Functions – Roles of Manager– Levels of Management -Managerial Skills - meaning – conceptual Skill – technical Skill – Human Relation Skill.

Development of Management Thought – Early Classical Approaches – Neo – Classical Approaches – Modern Approaches.

### Unit II

#### Planning and Organizing Skills

Planning – Meaning of Planning- Types of Plans- Process of Planning – Making Planning Effective

Organization-Process of Organizing-Formal and Informal Organization- Organizational structure

Departmentation - Authority-Delegation-Decentralization

### **Decision Making Skill, Co-ordination Skills and Control Skills**

Meaning of Decisions – Types of Decisions – Common Difficulties in Decision Making

Co-ordination – Need, Type and Techniques - requisites for excellent Co-ordination –

Controlling – Meaning and Importance – Control Process.

### **Unit IV Leadership and Communication Skills**

Leadership – Meaning – Types – Differences between a Leader and Manager –

Characteristics of Leadership – Functional of a Leader

Communication – Definition – Purposes of Communication – Forms of Communication – Communication Process

### **Unit V Conflict Management**

Conflict Management – Levels of Organization Conflict – Stages of Conflict – Causes of Inter – Group Conflict – Management of Conflict

Organization Change - Need for planned change – Strategy for planned change – Organization Development.

### **Text Book**

P.C. Tripathi & P.N. Reddy, Principles of Managements – Tata Mc. Graw Hill-New Delhi.

### **Reference Book**

1. L.M. Prasad, Principles & Practice of Management, Sultan Chand & Sons - New Delhi
2. C.B. Gupta, Management Theory & Practice – Sultan Chand & Sons – New Delhi



<b>SEMESTER II</b>			
<b>Core IX – Digital Image Processing</b>			
<b>Code: 19PCCC21</b>	<b>Hrs/Week: 5</b>	<b>Hrs/Sem: 75</b>	<b>Credits: 4</b>

### **Vision**

To interpret images mathematically and process them for the extraction of data using matlab

### **Mission**

To equip the students with the knowledge of fundamental concepts and techniques in basic digital image processing and their applications to solve real life problems.

### **Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	calculate the Fourier transforms of standard functions both from the definition and by using tables.	2	Ap
CO-2	design and implement the different transforms like Fourier transform and Z transform.	2	Cr
CO-3	write given function in terms of sine and cosine in Fourier series and also to get knowledge in Fourier Transforms.	2	Re
CO-4	solve finite difference equations using Z- transform using MATLAB	1	Ap
CO-5	review the fundamental concepts of a digital image processing system.	3	Re
CO-6	analyze images in the frequency domain using various transforms.	2	Re
CO-7	interpret Image compression, segmentation and representation standards	3,4	An
CO-8	understand image filtering for use in various applications	1	Un

<b>SEMESTER II</b>			
<b>Core IX – Digital Image Processing</b>			
<b>Code: 19PCCC21</b>	<b>Hrs/Week: 5</b>	<b>Hrs/Sem: 75</b>	<b>Credits: 4</b>

### **Unit I- Introduction**

Introduction – steps in image processing, Image acquisition, representation, sampling and quantization, relationship between pixels. – color models – basics of color image processing.

### **Unit II - Image Enhancement**

Image enhancement in spatial domain – some basic gray level transformations – histogram processing – enhancement using arithmetic , logic operations – basics of spatial filtering and smoothing.

### **Unit III - Image Enhancement**

Image enhancement in Frequency domain – Introduction to Fourier transform: 1- D, 2 –D DFT and its inverse transform, smoothing and sharpening filters.

### **Unit IV - Image Restoration**

Image restoration: Model of degradation and restoration process – noise models – restoration in the presence of noise- periodic noise reduction.. Image segmentation: Thresholding and region based segmentation.

### **Unit V - Image Compression**

Image compression: Fundamentals – models – information theory – error free compression – Lossy compression: predictive and transform coding. JPEG standard.

### **Text Book:**

1. R.C. Gonzalez, R.E.Woods, 2002, Digital Image processing, 2nd Edition, Pearson Education.

### **Books for Reference:**

1. T.Veerarajan : Transforms and Partial Differential Equations ( Updated Edition) .
2. Rafael C. Gonzalez, Richard E. Woods: Digital Image Processing, Pearsons Education, third edition.
3. RajkumarBansal , Ashok Kumar Goel , Manoj Kumar Sharma : MATLAB and its Applications in Engineering, Pearsons Publications.



<b>SEMESTER – I</b>			
<b>Core II - J2EE</b>			
<b>Code : 19PCSC12</b>	<b>Hrs / Week : 5</b>	<b>Hrs / Sem : 75</b>	<b>Credits : 4</b>

**Vision:** To acquire knowledge on the usage of recent platforms in developing web applications

**Mission:**

- Enhancing the students skills to design and develop interactive, client-side, server-side executable web applications.
- Able to apply the skill learnt for projects.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	identifying a high-level overview of the J2EE architecture	2	Re
CO-2	identify the services and components which comprise the J2EE specification	2	Re
CO-3	explain how J2EE technology applications are packaged	1,2	Un
CO-4	illustrate Web application development using Web Components Servlet and JSP	1,5,8	Un
CO-5	summarize the features of Servlet and frameworks used in web applications development	5	Un
CO-6	understand design applications using Straut and Hibernate and Spring	1,6	Un
CO-7	finding new applications from existing beans in Enterprise beans.	1,8	An
CO-8	summarizing the types of Enterprise beans	2	Un
CO-9	recognizing the Hibernate framework in the development of Java application.	1,5	Re

<b>SEMESTER – I</b>			
<b>Core II - J2EE</b>			
<b>Code : 19PCSC12</b>	<b>Hrs / Week : 5</b>	<b>Hrs / Sem : 75</b>	<b>Credits : 4</b>

### **Unit I**

J2EE introduction – J2EE Architecture ( J2EE Tiers , Containers , Roles ) –J2EE Servers and services –Services of EJB Container – J2EE Technology – Packaging – Web services – Advantages of J2EE Applications

### **Unit II**

Enterprise Bean introduction – Benefits of Enterprise Beans - Types of Enterprise Beans – Session Bean – Entity Bean – Message-Driven Bean – The Contents of a Enterprise Bean – The Life Cycles of Enterprise Beans.

### **Unit III**

Servlet - Servlet Lifecycle - Servlet API -Object model of Servlet framework - Understanding web.xml, servlet tags and directory structure of web application - GenericServlet and HttpServlet, ServletConfig & ServletContext - Handling Form data with get and post request - Initializing a servlet - Request Dispatcher, Redirecting Request - Session Management -Filters in servlet -programs in servlet to read all parameters from form, database handling program, reading cookies values. JSP - What is JSP page? Compare it with servlet - Lifecycle of JSP page - JSP syntax using Directive, Declaration , Expression , Scriptlet, Comment - Using javabeen and Action Tag in JSP - JSP implicit objects - Using JSP standard tag library ( JSTL) - Session management - Exception handling - Custom tag - Transferring Control to Another Web Component - Using JDBC in JSP -Programs in JSP -Integrating JSP with JQuery, Bootstrap, Angular JS, JSON.

### **Unit IV**

Basic of Struts2 - Understanding MVC architecture - Struts2 framework - Understanding default-stack - comparing struts with other framework - Working with Struts2 Actions - Introducing Struts 2 actions - Packaging your actions - Implementing actions Adding workflow with interceptors - Why intercept requests? - Interceptors in action - Surveying the built-in Struts 2 interceptors - Declaring interceptors - Building your own interceptor Data transfer: OGNL and type conversion - Data transfer and type conversion: common tasks of the web application domain - OGNL and Struts 2 - Built-in type converters - Customizing type conversion Validation framework - RequiredFieldValidator Class - RequiredStringValidator Class - ExpressionValidator Class - Email Validator Class - RegexFieldValidator Class - DateRangeFieldValidator Class Struts

## Unit V

Hibernate - Introduction to Hibernate - Understanding ORM (Object Relational Mapping) - Understanding Transient, Persistent and Detached Object states - Issues while writing manual JDBC code - Hibernate and JPA (Java Persistence API) - Writing persistence classes -Steps to work with Hibernate - Handling CRUD operations in Hibernate - Mapping Inheritance between classes with tables in database -HQL -One to One and One to One mapping in Hibernate- Core Spring -Springing into action -Wiring beans. -Advanced wiring. -Aspect oriented Spring - Spring in Web and Backend -Building spring web application -JDBC with spring / Hibernate with spring.

### Text Book:

1. Elliotte Rusty Harold, “ Java Network Programming”, O’Reilly publishers, 2000

### Books for Reference:

1. Ed Roman, “Mastering Enterprise Java Beans”, John Wiley & Sons Inc., 1999.
2. Hortsman & Cornell, “CORE JAVA 2 ADVANCED FEATURES, VOL II”, Pearson Education, 2002.
3. Patrick Naughton, “COMPLETE REFERENCE: JAVA2”, Tata McGraw-Hill, 2003.
4. Struts 2 in Action , Manning publication , Donald Brown, Chad Michael Davis, and Scott Stanlick Spring in Action , Craig Walls , Manning Dreamtech press
5. Pure JSP by James Goodwill Techmedia SAMS publication
6. Hibernate in Action Manning publication , Christian Bauer and Gavin King Java Servlet Programming O’Reilly Publication-Author: Jason Hunter.
7. Struts 2 Black Book James Holmes “Struts: The Complete Reference, " 2nd Edition 2007 McGraw Hill Professional
8. Patrick Peak And Nick Heudecker, Patrick Peak, Nick Heudecker Hibernate Quickly, " 2007 Dreamtech
9. Subrahmanyam Allamaraju and Cedric Buest , "Professional Java Server Programming (J2EE 1.3 Edition), ", Shroff Publishers & Distributors Pvt Ltd.

<b>SEMESTER –I</b>			
<b>Core V- Neural Networks</b>			
<b>Code:19PCSC15</b>	<b>Hrs/week:4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 4</b>

**Vision:**

To make the students understand neural networks and thereby relate to artificial intelligence and machine learning

**Mission:**

- Learn about network models
- Understand fault diagnosis in neural nets

**Course Outcome:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	understand basic architecture of neural networks	1	Un
CO-2	understand basic learning algorithms	3	Un
CO-3	understand the classification taxonomy of NN	4	Un
CO-4	compare and analyse the training algorithms	4	An
CO-5	apply NN models to find solutions	4,6	Ap
CO-6	analyse the use of Associative memory	1	An
CO-7	learn to diagnose the cause and rectification of faults	4	Re
CO-8	compare different network models	4	An

SEMESTER –I			
Core V- Neural Networks			
Code:19PCSC15	Hrs/week:4	Hrs/Sem: 60	Credits: 4

### **Unit I: Introduction to Neural Networks**

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

### **Unit II: Essentials of Artificial Neural Networks**

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

### **Unit III: Single Layer Feed Forward Networks**

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model.

### **Unit IV: Multi- Layer Feed Forward Networks**

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

### **Unit V: Associative Memories**

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process identification, control, fault diagnosis.

### **Text Book:**

1. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004.

### **Books for Reference:**

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.
3. S. Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
4. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", Tata McGraw-Hill Inc. 2000

SEMESTER – II			
Core VI - Distributed Database Management System			
Code : 19PCSC21	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

**Vision :** To build the background of database systems by deepening the understanding of the theoretical and practical aspects of the database technologies, showing the need for distributed database technology to tackle deficiencies of the centralized database systems and finally introducing the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application.

**Mission :**

- Identify the introductory distributed database concepts and its structures.
- Describe terms related to distributed object database design and management.
- Produce the transaction management and query processing techniques in DDBMS.
- Relate the importance and application of emerging database technology.

**Course Outcome**

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand what is Distributed DBMS	4	Un
CO-2	understand various architectures of DDBMS	4	Un
CO-3	apply various fragmentation techniques in a given problem	4	Ap
CO-4	understand the steps of query processing	4	Un
CO-5	finding how optimization techniques are applies to Distributed Database	4,6	An
CO-6	learn and understand various Query Optimization Algorithms	3	Un
CO-7	understand Transaction Management & Compare various approaches to concurrency control in Distributed database	6	Un
CO-8	understand various algorithms and techniques for deadlock and recovery in Distributed database	3	Un

SEMESTER – II			
Core VI - Distributed Database Management System			
Code : 19PCSC21	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

### **Unit I : Introduction**

Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Complicating factors - Distributed DBMS Architecture Models- Autonomy, Distribution, Heterogeneity DDBMS Architecture – Client/Server, Peer to peer, MDBS

### **Unit II: Data Distribution Alternatives:**

Design Alternatives – localized data, distributed data Fragmentation – Vertical, Horizontal (primary & derived), hybrid, general guidelines, correctness rules  
Distribution transparency – location, fragmentation, replication - Impact of distribution on user queries.

### **Unit III: Query Processing**

Query Processing Problem, Layers of Query Processing Query Processing in Centralized Systems – Parsing & Translation, Optimization, Code generation, Example Query Processing in Distributed Systems – Mapping global query to local .

**Optimization of Distributed Queries:** Query Optimization, Centralized Query Optimization, Join Ordering Distributed Query Optimization Algorithms.

### **Unit IV: Distributed Transaction Management & Concurrency Control**

Transaction concept, ACID property, Objectives of transaction management, Types of transactions, Objectives of Distributed Concurrency Control, Concurrency Control anomalies, Methods of concurrency control, Serializability and recoverability, Distributed Serializability, Enhanced lock based and timestamp based protocols, Multiple granularity, Multi version schemes, Optimistic Concurrency Control techniques

### **Unit V : Distributed Deadlock & Recovery Deadlock concept, Deadlock in Centralized systems**

Deadlock in Distributed Systems – Detection, Prevention, Avoidance, Wait-Die Algorithm, Wound-Wait algorithm Recovery in DBMS - Types of Failure, Methods to control failure, Different techniques of recoverability, Write- Ahead logging Protocol, Advanced recovery techniques- Shadow Paging, Fuzzy checkpoint, ARIES, RAID levels, Two Phase and Three Phase commit protocols.

### **Text Book:**

1. Principles of Distributed Database Systems, Ozsu, Pearson Publication

**Books for Reference:**

1. Rahimi & Haug, Wiley, Distributed Database Mangement Systems,
2. Chanda Ray, Distributed Database Systems, Pearson Publication
3. Sachin Deshpande, Distributed Databases, Dreamtech
4. A. Silberschatz, H.F. Korth and S. Sudharshan, 2006, Database System Concepts, 5th Edition, Tata McGraw Hill, New Delhi.



<b>SEMESTER- II</b>			
<b>Core VII – .Net Framework Programming</b>			
<b>Code: 19PCSC22</b>	<b>Hrs / week :5</b>	<b>Hrs / Sem: 75</b>	<b>Credits :4</b>

**Vision:**

Create and deploy database driven applications and services

**Mission:**

- Learn to use controls in programming
- Learn to develop user friendly applications

**Course Outcome:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	set up a programming environment for ASP.net programs	1	Ap
CO-2	creating ASP.Net applications using standard .net controls	1	Cr
CO-3	develop a data driven web application	1,4	Ap
CO-4	connecting to data sources and managing them	1,4	Ap
CO-5	maintain session and controls related information for user used in multi-user web applications	1	Ap
CO-6	understand the fundamentals of developing modular application by using object oriented methodologies	1,4	Re
CO-7	learn to diagnose the cause of errors and handle it	1	Ap
CO-8	create and deploy ASP.NET web applications	1,4,6,8	Cr

<b>SEMESTER- II</b>			
<b>Core VII – .Net Framework Programming</b>			
<b>Code: 19PCSC22</b>	<b>Hrs / week :5</b>	<b>Hrs / Sem: 75</b>	<b>Credits :4</b>

### **Unit I**

Introduction to Visual Basic .NET : Window forms – working with controls – working with dialog boxes –MDI- Drag and drop operation – variables – Controlling Program flow.- Procedures in VB.Net-Accessing a Database.

### **Unit II**

Introducing ASP.Net – Getting started with ASP.Net applications: Web forms – creating ASP.Net Webform applications – Using ASP.Net Webforms for server controls : Beginning with server controls – Taking a closer look at web controls – Illustrating Basic web controls – Working with Validation Controls : The compare Validator – The Range Validator – Regular Expression Validator – Custom validator –Validation Summary control – Multiple validation control.

### **Unit III**

Developing ASP.Net Server controls : Developing ASP.Net server controls – Creating and using Web User Control – Creating ASP.Net Pages to web user control – Using Rich Web controls: Calendar web server control.

### **Unit IV**

Debugging ASP.Net Web Applications: Tracing ASP.Net Applications – Handling Errors in ASP.Net applications – Using ADO.Net with ASP.Net: ADO.Net – ADO.Net Object model .

### **Unit V**

Welcome to C# - Working with variables, Operators and Expressions – Writing methods applying scope – using decision statements-Using Iteration Statements – Managing Errors and Exceptions – Creating and Managing Classes – Using Arrays and Collections

#### **Text Book:**

1. Mridula Parihar, Yesh Sinhal and Nitin Pandey, “Visual Studio .Net Programming”, PHI, 2002.

#### **Books for Reference:**

1. John Sharp, Jon Jagger, “Microsoft Visual C# .Net Step by Step”, PHI, 2005.
2. Nitin Pandey, “Microsoft Asp.NET”, PHI, 2002.
3. “ASP.NET Made Simple” BPB Publications, First Edition, 2001.
4. Kiric Allen Evans, Ashwin Kamanna, Joel and Muller, “XML and ASP.NET”, Pearson Education, First Indian Reprint, 2002.
5. Andrew Trolsen, “C# and the .NET Platform”, APress, Second Print, 2006.

<b>SEMESTER- II</b>			
<b>Core X – Advanced Computer Networks</b>			
<b>Code: 19PCSC24</b>	<b>Hrs / week :4</b>	<b>Hrs / Sem: 60</b>	<b>Credits :4</b>

### **Vision**

To give exemplary graduate education in information networking, information security, and mobility.

### **Mission**

- To understand modern computer networks
- to familiarize routing algorithms
- to detect the technical problems in networking

### **Course Outcome:**

<b>CO.No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO Addressed</b>	<b>CL</b>
CO-1	solve technical problems in ARQ protocols, MAC protocols and Routing Algorithm.	3,7	Ap
CO-2	demonstrate the working of HUB and Switches.	7	Ap
CO-3	examine the Performance of ARQ Protocols, Ethernet LAN, Token Ring, RIP, TCP and UDP.	7	Ap
CO-4	identify the networking technologies and associated network standards.	7	An
CO-5	solve technical problems in ARQ protocols, MAC protocols and Routing Algorithm.	3,7	Ap
CO-6	construct the route discovery algorithm to determine the shortest path in an internet represented as a weighted graph.	5,7	Ap
CO-7	understand network architecture	7	Un
CO-8	implementation of protocols like TCP, UDP and IP using OPNET and NS-2	5,7	Ap

<b>SEMESTER- II</b>			
<b>Core X – Advanced Computer Networks</b>			
<b>Code: 19PCSC24</b>	<b>Hrs / week :4</b>	<b>Hrs / Sem: 60</b>	<b>Credits :4</b>

### **Unit I**

#### **Layered Network Architecture and Network Topologies:**

Introduction - Evolution of data Networks – Switching Techniques – Categories of networks - ISO/OSI Reference Model – TCP/IP Model, Network Topologies.

### **Unit II**

#### **Internetworking devices and Data Link Layer:**

Repeaters – Hubs – Switches – Bridges: Transparent and Source Routing– Routers. Logical Link Control – Error Detection Techniques – ARQ protocols – Framing – HDLC –Point to Point protocol. Medium Access Control – Random access Protocols – Scheduling approaches to MAC.

### **Unit III**

#### **Local Area Networks& Wide Area Networks and Network Layer:**

Ethernet- Token Bus/Ring , FDDI – Virtual LAN , WAN Technologies – Frame Relay, ATM, Wireless LAN. Internetworking – IP Addressing – Subnetting – IPv4 and IPv6– Routing – Distance Vector and Link State Routing – Routing Protocols.

### **Unit IV**

#### **Transport Layer and Services:**

Connection oriented and Connectionless Service – User Datagram Protocol – Transmission Control Protocol – Congestion Control – QoS parameters.

### **Unit V**

#### **Application Layer and Contemporary Issues:**

Domain Name System – Simple Mail Transfer Protocol – File Transfer Protocol – Hypertext Transfer Protocol - World Wide Web. Contemporary Issues

#### **Text Book:**

1. Alberto Leon-Garcia, “Communication Networks” Tata McGraw-Hill 2012.

#### **Books for Reference:**

1. Robert Gallager, “Data Networks”, Prentice Hall, 2009.
2. W. Stallings, Data and Computer Communications, Prentice Hall, 2007
3. Fred Halsall, Data communications, “Computer Networks and Open systems”, Addison Wesley 2006.
4. Bhushan Trivedy, Computer Networks, Oxford university press, 2012.

Semester – I			
Core IV		Economics of Infrastructure	
19PECC 14	Hrs/Week: 6	Hrs/ Semester: 90	Credits: 4

### Unit I - Introduction

20 Hrs

Infrastructure and economic development - Infrastructure as a public good; Social and physical infrastructure; Special characteristics of public utilities - The peak-load – Off-Load Problem – Dual Principle Controversy; Economies of scale of Joint supply; Marginal Cost Pricing vs. other methods of pricing in public utilities

### Unit II - Transport Economics

15 Hrs

The structure of Transport Costs and Location of Economic Activities - Demand for Transport – Models of Freight and Passenger Demand – Model Choice; Cost Functions in the Transport Sector – Principle of Pricing – Special Problems of Individual Modes of Transport; Inter-modal condition in the Indian Situation.

### Unit III - Energy Economics

20 Hrs

Primacy of Energy in the Process of Economic Development – Factors Determining Demand for Energy; Effects of Energy Shortages – Energy Conservation – Renewable and Non-conventional Sources of Energy – Energy Modelling – The Search for an Optimal Energy Policy in the Indian Context

### Unit IV- Supply of Energy

20 Hrs

Electricity, Gas and Water Supply- Bulk Supply and Pricing of Electricity – The Relative Economics of Thermal, Hydel and Nuclear Power Plants – The Case for a National Power Grid – Financing Water Utilities – Urban and Rural Water Supply – The Exploitation of Natural Gas – Pricing Problem.

### Unit V- Social Infrastructure

15 Hrs

Education and Economic Growth – The Case for Universal, Free, Primary Education; Structure of higher education and problems of its financing in India – Human Resources and Human Capital Development

### Text Book:

Becker.G.S. *Human Capital* (2nd Edition). New York: National Bureau of Economic Research, 1974.

### Books for Reference:

1. Crew.M.A. and P.R. Kleindorfer. *Public Utility Economics*. London: Macmillan, 1977.
2. *Economic and Political Weekly*, Various Issues.

Semester- II			
Core –VIII – Mathematics For Economists			
Sub. Code: 19PECC 24	Hours / Week :4	Hrs / Semester: 60	Credits :3

### Unit I - Functions & Equations

10 Hrs

Relations & functions – types – equations -types - Solution of linear equations in one & two variables, solution of quadratic equations- Applications

### Unit II- Differentiation

15 Hrs

Derivative of a Function – Rules of Differentiation - Application of Simple Derivation (Total, Marginal and Average Functions) - Concept of Elasticity, Inter-relationships among Total, Marginal and Average Cost and Revenues.

### Unit III - Maxima and Minima

10 Hrs

Maxima and Minima of Function of one Variable and two Variables-Partial Derivatives- First and Second order- Application

### Unit IV-Integration

10 Hrs

Meaning & definition-Types - properties of definite integrals – Rules - Application in Economics

### Unit V - Matrices and Determinants

15 Hrs

Matrices: concept, types, matrix operations, transpose, Determinants: concept, properties, Cramer's rule – rank – inverse of a matrix - matrix inversion method.

### Text Book:

Monga, G.S. *Mathematics and Statistics for Economists*. New Delhi: Vikas Publishing House, 2005.

### Books for Reference:

1. A.C. Chiang. *Fundamentals of Mathematical Economics*, New York: McGraw Hill, 2000.
2. Aggarwal.S.C. & R.K. Rana. *Basic Mathematical Economics*, New Delhi: V.K. Enterprise, 2003.
3. R.G.D. Allen. *Mathematics for Economics*. New York: Mc. Milan Press, 2003.
4. Taro Yamane. *Mathematics for Economics – An Elementary Survey*. New Delhi: Prentice Hall of India Pvt. Limited, P. S. 1990.

Semester- I			
Core III Statistics For Economists			
Code: 19PECC13	Hours / Week :6	Hrs / Semester: 90	Credits :4

**Unit I: Measures of Averages and Dispersion** **15 Hrs**

Measures of central tendency – Mean, Median, Mode Measures of Dispersion – M.D., Q.D. and S.D and relative measures of dispersion application of averages and dispersion

**Unit II: Correlation and Regression** **20 Hrs**

Meaning, assumptions and limitations of simple correlation and regression analysis – Pearson's product moment and Spearman's rank correlation co-efficient – Concept of least squares and the regression lines

**Unit III: Analysis of Time Series** **15 Hrs**

Uses – Components – Measurement – Methods of Moving Average – Semi Average – Method of least squares- Seasonal Variations and its Measurements

**Unit IV: Probability** **20 Hrs**

Various types of events – Classical and empirical definitions of probability, Laws of addition and multiplication, conditional probability and concept of interdependence, Baye's theorem and its applications- Probability Distribution-Binomial, Poisson and Normal distribution

**Unit V :Theory of Estimation and Testing of Hypothesis** **20 Hrs**

Properties of a good estimator, formulation of statistical hypotheses – Null and alternative, Goodness of fit, confidence intervals and level of significance - Type I and Type II errors - Hypothesis testing Z, t,  $\chi^2$  (chi-square) and F-test

**Text Book:**

Gupta.S.P. *Statistical Methods* (Edition). New Delhi: S.Chand& Sons Ltd,2000.

**Books for Reference**

1. Gupta.S.C. *Fundamentals of Applied Statistics*.New Delhi: S.Chand& Sons Ltd, 1993.
2. Speigal. M.R., *Theory and Problems and Statistics*.London: McGraw Hill Book Co,1992.
3. R.S.N. Pillai & Bagavathi. *Statistics*. New Delhi:S. Chand & Company Ltd, 1998.

Semester II			
Core IX – Calculus of Variations and Integral Equations			
Code: 19PMAC24	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

**Vision:**

To impart analytical ability in solving variational problems and integral equations also to formulate the laws of mechanics and basic physics.

**Mission:**

To formulate variational problems and analyze them to deduce key properties of system behavior.

**Course Outcome**

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the properties of geometrical problems	2	Un
CO-2	apply variational problems and isoperimetric problems.	2	Ap
CO-3	expose to the decomposition method.	2	E
CO-4	apply different types of integral equations.	2	Ap
CO-5	solve variational problems with constraints both algebraic and isoperimetric.	2,6	Ap
CO-6	derive the Euler - Lagrange equation for variational problems including the case of general variations.	2,5	Re, Ap
CO-7	derive conserved quantities from symmetries and use them to solve the Euler- Lagrange equations.	2,6	Re,Ap
CO-8	solve integral equations and analyze the relation between differential equations and Volterra integral equations	2	Ap



Semester II			
Core IX - Calculus of Variations and Integral Equations			
Code: 19PMAC24	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

### Unit I

Calculus of Variations and Applications: Maxima and Minima - The Simplest case - Illustrative examples - Natural boundary conditions and transition conditions - The variational Notation - The more general case. **(Chapter 2: Sec: 2.1 - 2.6)**

### Unit II

Constraints and Lagrange multipliers - Variable end points - Sturm-Liouville problems - Hamilton's principle - Lagrange's equations. **(Chapter 2: Sec: 2.7 - 2.11)**

### Unit III

Integral Equations: Introduction - Relations between differential and integral equations - The Green's function - Alternative definition of the Green's function. **(Chapter 3: Sec: 3.1 - 3.4)**

### Unit IV

Linear equations in cause and effect - The influence function - Fredholm equations with separable kernels - Illustrative example. **(Chapter 3: Sec: 3.5 - 3.7)**

### Unit V

Hilbert-Schmidt theory- Iterative methods for solving equations of the second kind - Fredholm theory. **(Chapter 3: Sec: 3.8, 3.9, 3.11)**

### Text Book

1. Francis B. Hildebrand, Methods of Applied Mathematics, second edition, Prentice-Hall of India private limited, 1968.

### Books for Reference

1. L. Elsgolts; Differential Equations and the Calculus of Variations, University Press of the Pacific, 2003.
2. Mark Kot; A First Course in the Calculus of Variations, American Mathematical Society Providence Rhode Island, 2014.

<b>Semester II</b>			
<b>Core X - Fuzzy Algebra</b>			
<b>Code :19PMAC25</b>	<b>Hrs/week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 4</b>

### **Vision**

To establish thorough knowledge on the basic mathematical elements of the theory of fuzzy sets.

### **Mission**

To provide an emphasis on differences and similarities between fuzzy sets and classical set theories.

### **Course Outcome**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	decide the difference between crisp sets and fuzzy sets.	6	Ev
CO-2	use the fuzzy set theory on statistical methods.	7	Ap
CO-3	compare statistical methods against fuzzy logic methods.	1,7	Ev
CO-4	apply fuzzy logic membership function.	2,6	Ap
CO-5	solve problems on fuzzy set theory.	2	Ap
CO-6	evaluate fuzzy statistics applications	2,7	Ap
CO-7	apply the methods of fuzzy sets and fuzzy logic in solving problems in the theory of fuzzy control.	1,7	Ap
CO-8	explain the theory of statistics fuzzy logic	5	Re, Un

Semester II			
Core X -Fuzzy Algebra			
Code:19PMAC25	Hrs/week:4	Hrs/Sem:60	Credits:4

### Unit I

From Classical sets to Fuzzy sets- Fuzzy Sets – Basic concepts – Fuzzy sets versus Crisp sets - Additional Properties of Alpha cuts - Representation of fuzzy sets- Extension Principle for Fuzzy sets.

**(Text book 1 - Chapter 1: Section 1.4, Chapter 2: Sections 2.1,2.2,2.3)**

### Unit II

Operations on Fuzzy sets - Types of operations - Fuzzy complements - Fuzzy intersections: t-Norms - Fuzzy Union: t-conorms- Combination of operations – Aggregation Operations.

**(Text book 1 –Chapter 3: Sections 3.1,3.2,3.3,3.4,3.5,3.6)**

### Unit III

Fuzzy Subgroups – Union of two Fuzzy Subgroups- Fuzzy Subgroup Generated by a Fuzzy Subsets – Fuzzy Normal Subgroups, Fuzzy Conjugate Subgroups and Fuzzy Characteristic Subgroups – Fuzzy Sylow Subgroups.

**(Text book 2 –Chapter 2: Sections 2.1,2.2,2.3,2.4)**

### Unit IV

Fuzzy Ideals and their operations –Some Elementary Properties- Union of Fuzzy Subrings-Fuzzy Subring Generated by a Fuzzy Subsets – Fuzzy Ideals and Homomorphisms.

**(Text book 2 – Chapter 3: Sections 3.1, 3.2, 3.3,3.4)**

### Unit V

Fuzzy Prime Ideals, Fuzzy Maximal Ideals and Fuzzy Semi prime Ideals of Rings – Fuzzy Prime Ideals – Fuzzy Maximal Ideals – Fuzzy Semi prime Ideals

**(Text book 2 – Chapter 4: Sections 4.1,4.2,4.3)**

### Text Books

1. Fuzzy Sets and Fuzzy Logic Theory and Applications, George J.Klir & Bo Yuan.
2. Fuzzy Algebra - volume 1 (Fuzzy Subgroups, Fuzzy Subrings and Fuzzy Ideals), By Rajesh Kumar.

### Books for Reference

1. Paul P. Wang, Da Ruan and Etienne E. Kerre: Fuzzy Logic, Springer International Edition, 2009.
2. S. Nanda and N.R. Das: Fuzzy Mathematical Concepts, Narosa Publishing House, 2012.

<b>Semester II</b>			
<b>Elective I A – Combinatorics</b>			
<b>Code:19PMAE21</b>	<b>Hrs/week: 4</b>	<b>Hrs/Sem:60</b>	<b>Credits: 3</b>

### **Vision**

To introduce combinatorial techniques for solving enumeration problems.

### **Mission**

To understand and demonstrate the basic concept of an algorithm and its applications in combinatorial mathematics.

### **Course Outcome**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	recognize the properties and behavior of permutations and combinations.	1, 6	Un
CO-2	solve problems involving strings, combinations, distributions and partitions.	2	Cr
CO-3	understand the ideas of permutations and combinations.	1,6	Un
CO-4	apply, implement and interpret the theory of combinatorics to relevant probability and statistics problems.	2	Ap
CO-5	understand the addition and multiplication principles of counting.	3	Un
CO-6	apply diverse counting strategies to solve varied problems involving combinations and distributions	2,3	Ap
CO-7	identify, formulate and solve combinatorial problems.	2	Ap
CO-8	apply combinatorial ideas to practical problems	1,6	Ap

Semester II			
Elective I A – Combinatorics			
Code: 19PMAE21	Hrs/week: 4	Hrs/Sem:60	Credits: 3

### Unit I

#### Permutations and Combinations:

Introduction, rules of sum and product, Permutations and Combinations, Distributions of distinct objects, distributions of non - distinct objects.

(Chapter 1: Sections: 1.1 -1.6)

### Unit II

#### Generating Functions:

Generating functions for combinations, enumerators for permutations, Distributions of distinct objects into non- distinct cells, partitions of integers.

(Chapter 2: Sections: 2.1 -2.5)

### Unit III

#### Recurrence Relations:

Linear Recurrence relations with constant coefficients, Solution by the technique of generating functions, Recurrence relation with two indices.

(Chapter 3: Sections: 3.1 -3.3, 3.5)

### Unit IV

#### The Principle of Inclusion and exclusion:

The principle of Inclusion and Exclusion, the general formula, Derangements, Permutations with restrictions on relative positions.

(Chapter 4: Sections: 4.1 -4.5)

### Unit V

#### Polya's Theory of Counting:

Equivalence classes under a permutation group, Equivalence classes of functions, Weights and inventories of functions, Polya's fundamental theorem.

(Chapter 5: Sections: 5.3 -5.6)

### Text Book

1. C. L. Liu: Introduction to Combinatorial Mathematics, McGraw Hill publications, 1968.

### Books for Reference

1. Normal L. Biggs, Discrete Mathematics, Oxford University Press, Oxford, 2002.
2. J.Hein, Discrete Structures, Logic and Computability, Jones and Barlett, 2002.

<b>SEMESTER-II</b>			
<b>Core-VI Medical Microbiology</b>			
<b>Code: 19PMIC22</b>	<b>Hrs/Week: 5</b>	<b>Hrs/Sem: 75</b>	<b>Credits:4</b>

**Vision:**

A centre of excellence for training and research in medical microbiology.

**Mission:**

To train quality healthcare professionals carry out creative innovative and inventive research and provide reliable diagnostic services in the field of medical microbiology.

**Course Outcome:**

<b>CO. No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO -1	recall the clinical microbiology concept to patient care	1	Re
CO -2	analyse the level information in the subject of medical microbiology	6	An
CO -3	illustrate the different classes of microbes	3	Un
CO -4	describe the applied microbiology aspects of clinical technique.	1	Un
CO- 5	describe the role of chemotherapeutic technique	4	Un
CO -6	explain the drug resistance capacity of microbes	4	Un
CO -7	outline the concepts of chemotherapy and its mode of action	4	Un
CO -8	explain the knowledge of mycology and parasitology	5	Un

SEMESTER-II			
Core-VI Medical Microbiology			
Code: 19PMIC22	Hrs/Week: 5	Hrs/Sem: 75	Credits:4

### Unit-I : Infection and transmission

Microbial diseases - sources, route of transmission. Pathogenesis - adhesion, invasion, host cell damage, release of pathogens. Microbial virulence and virulence factors - Signs and symptoms of microbial diseases. Treatment, Prevention and control of microbial infections. Immunity of microbial diseases. Diagnosis of microbial diseases - Collection, transport, preliminary processing of clinical pathogens.

### Unit- II: Bacterial diseases

Characteristics, classification, pathogenesis, pathology, diagnosis, treatment, prevention and control of diseases caused by *Staphylococci*, *Bacillus*, *Clostridium*, *Corynebacterium*, *Salmonella*, *Klebsiella*, *Vibrio*, *Pseudomonas*, *Mycobacteria*.

### Unit- III: Viral diseases

Etiology, Clinical symptoms, laboratory diagnosis and treatment-Pox virus(small pox,)-Herpes virus-(HSV I&II), Orthomyxovirus (Influenza virus, Swine Flu) - Paramyxovirus (Measles and Mumps), Enterovirus (Poliovirus), Arbovirus-(Chikungunya virus, Dengue, rubella), Hepatitis virus(HAV, HBV, HCV, HDV), HIV,SARS.

### Unit-IV: Mycology and Parasitology

Human mycotic infections caused by Dermatophytes, *Histoplasma*, *Cryptococcus*, *Candida*, opportunistic mycoses. Medical importance of *Entamoeba*, *Giardia*, *Taenia*, *Ascaris*, Laboratory techniques in parasitology.

### Unit-V: Antimicrobial agents

Classification of antimicrobial agents, Mechanism of drug action –antibacterial (Bacteriostatic and bactericidal) antifungal and antiprotozoans. Methods of testing drug sensitivity (*in vitro* and *in vivo*), antibiotic assay in body fluids. Mechanism of drug resistance and dissemination of multi drug resistance. Probiotics as therapeutic agents.

### Books for Reference:

1. Chaechter M. Medoff G. and Eisenstein BC. 1993. *Mechanism of Microbial Diseases* 2<sup>nd</sup> edition. Williams and Wilkins, Baltimore.
2. David Greenwood, Richard CD, Slack, John Forrest Peutherer. 1992. *Medical Microbiology*. 14<sup>th</sup> edition. ELBS with Churchill Livingstone.
3. Hugo WB and Russell AD. 1989. *Pharmaceutical Microbiology* 4<sup>th</sup> edition. Blackwell Scientific Publication, Oxford.

4. Joan Stokes E, Ridgway GL and Wren MWD. 1993. *Clinical Microbiology*, 7<sup>th</sup> edition. Edward Arnold. A division of Hodder and Stoughton.
5. Ronald M. Atlas. 1989. *Microbiology. Fundamentals and Applications*. 2<sup>nd</sup> edition, Maxwell Macmillan international editions.
6. Topley and Wilson's. 1990. *Principles of Bacteriology, Virology and Immunity*, 8<sup>th</sup> edition, Vol. III Bacterial Diseases, Edward Arnold, London.
7. Connie R Mahon. 2010. *Textbook of Diagnostic Microbiology*. 3<sup>rd</sup> edition. Pearson.
8. Fritz H. Kayser. 2005. *Medical microbiology*. Thieme Verlag.
9. Credic, A. Mims. 2004. *Medical microbiology*. 3<sup>rd</sup> edition. Mosby Inc.
10. Frank, Steven A. 2002. *Immunology and Evolution of Infectious Disease*. Princeton University Press.
11. Warren Levinson Ernest Jawetz 2002, *Medical Microbiology and Immunology: Examination and Board Review*, 7<sup>th</sup> Edition. McGraw-Hill/Appleton and Laye
12. Prescott L.M. Harley J.P., and Klein D.A . 2008. *Microbiology* (7th Edition) McGraw Hill, New York.
13. Pelczar Jr .M. J. Chan E.C.S. and Kreig N.R. 1993. *Microbiology*- McGraw Hill, Inc., New York.
14. Dubey R.C. and Maheswari, S. 2003. *A Text Book of Microbiology*. S. Chand & Co., New Delhi.
15. Madigan M., T., Martinko. J.M., and Parker J., Brock TD. 1997. *Biology of Microorganisms*. (8th Edition). Prentice Hall International Inc, New York.
16. Nester, E.W. Roberts, C.V. and Nester, M.T. 1995. *Microbiology, A Human perspective*. IWOA, U.S.A.
17. Stainer R.Y., Ingraham J.L., Wheelis M.L., and Painter P.R. 1986. *General Microbiology*, Macmillan Education Ltd., London.
18. Tortora, Funke, Case Addison 2001, *Microbiology – An Introduction – 7th Edition*, Wesley Longman Inc.
19. John L. Ingraham and Catherine A Ingrahani. 2000. *Introduction to Microbiology*. Books / Cole Thomas Learning, New York.

#### **Web References:**

1. <http://dmoz.org/Science/Biology/Microbiology/>
2. <http://microbiology.mtsinai.on.ca/manual/default.asp>
3. <http://cal.vet.upenn.edu/parasite/links.html>
4. <http://www.suite101.com/links.cfm/microbiology>
5. <http://www.biosci.ohio-state.edu/-zoology/parasite/home.html>



<b>SEMESTER - III</b>			
<b>Core XII</b>		<b>Quantum Mechanics -I</b>	
<b>Code :19PPHC31</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester: 90</b>	<b>Credits: 4</b>

### **Vision**

To enable students understand the fundamentals of Quantum Mechanics and their applications to microscopic systems.

### **Mission**

To enhance the knowledge of students about the fundamental concepts of Quantum Mechanics through a systematic study of Schrodinger equation and wave function, Operators and Heisenberg Uncertainty Principle, Angular Momentum, Matrix Mechanics, Various Pictures and Density matrix and their application to systems such as Linear Harmonic Oscillator, Particle in an infinite square well potential and Particle in a magnetic field.

### **Course Outcome**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO 1	recall Schrodinger equation	1	Re
CO 2	describe Ehrenfest's theorem and its verification	1	Un
CO 3	discuss Heisenberg Uncertainty principle	1	Un
CO 4	evaluate the commutation relations between the various quantum mechanical operators	1	Ev
CO 5	list the properties of Ket and Bra vectors	1	Re
CO 6	discuss the linear harmonic oscillator problem using wave formalism and matrix formulation	2	Un
CO 7	interpret equations of motion in the Schrodinger picture, Heisenberg picture and Interaction picture	1, 2	Ap
CO 8	explain Schrodinger picture, Heisenberg picture and Interaction picture	1	Un

SEMESTER - III			
Core XII		Quantum Mechanics -I	
Code :19PPHC31	Hrs/Week: 6	Hrs/Semester: 90	Credits: 4

### Unit I: Schrodinger equation and wave function

Introduction – Construction of Schrodinger equation – Solution of time dependent equation – Physical interpretation of  $\psi^* \psi$  – Conditions on allowed wave functions - Box normalization – Conservation of probability – Expectation value – Ehrenfest's theorem – Verification of Ehrenfest's theorem – Linear harmonic oscillator – particle in an infinite square well potential – Particle in a magnetic field.

### Unit II: Operators and Heisenberg Uncertainty Principle

Operators, Eigen values and Eigen functions: Linear operators, commuting and non-commuting operators – Self-adjoint and Hermitian operator – Discrete and continuous Eigen values. Classical uncertainty relation – Heisenberg uncertainty relation – Implication of uncertainty relation – Illustration of uncertainty relation – Gamma-Ray microscope – Doppler effect.

### Unit III: Angular Momentum

The Angular momentum operators — Angular momentum commutation relations – Eigen values and Eigen functions of  $L^2$  and  $L_z$  - General Angular momentum – Eigen values of  $J^2$  and  $J_z$  - Angular momentum matrices – Spin Angular momentum – Spin vectors for spin-1/2 system - Addition of angular momenta – C.G coefficients.

### Unit IV: Matrix Mechanics

Linear vector space – Matrix representation of operators and wave functions – Unitary transformation – Schrodinger equation and other quantities in matrix form – Application of matrix mechanics – Dirac's Bra and Ket notations – Properties of bra and Ket vectors – Hilbert space.

### Unit V: Various Pictures and Density matrix

Schrodinger picture – Heisenberg picture – Interaction picture – comparison of three representations – Density matrix for a single system – Density matrix of an ensemble – Time evolution of density operator – A spin  $\frac{1}{2}$  system.

### Text Books:

1. S. Rajasekar and R. Velusamy, Quantum Mechanics I: Fundamentals, CRC Press, Taylor and Francis group- Boca Raton, London, e-book version 2014.
2. G. Aruldas, Quantum Mechanics, Second edition, Twentieth printing 2019, Prentice-Hall of India Learning Private Limited, Delhi.

Unit	Book no.	Sections / Page No
I	1	2.1 – 2.9
II	1	3.1 – 3.5, 8.1 – 8.5
III	2	206 - 229
IV	1	6.1, 6.2, 6.3, 6.4, 6.6, 6.7, 6.8, 6.10, 6.11
V	1	7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9

**Books for Reference:**

1. L. Schiff, Quantum Mechanics, Third Edition 2010, Tata Mc-Graw Hill Education Private Limited, New Delhi
2. P. M. Mathews and K. Venkatesan , A Text Book of Quantum Mechanics, Tata McGraw Hill Publishing Company Limited, New Delhi, 38<sup>th</sup> reprint 2007
3. R. Shankar, Principles of Quantum Mechanics, Second Edition 1994, Plenum Publishers, New York.
4. J. J. Sakurai, Modern Quantum Mechanics, Revised edition 1994, Addison- Wesley Publishing Company.

<b>SEMESTER - III</b>			
<b>Core XV</b>		<b>Research Methodology</b>	
<b>Code : 19PPHC34</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

### **Vision**

To provide the best scientific methods in understanding the basic principles of research, both theoretical and experiment and to keep up the level of their scientific research.

### **Mission**

To represent the underlying sub disciplines of research in physics and to promote new areas of research with an emphasis an interdisciplinary and applied research.

### **Course Outcome**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO 1	list the types of research depending on the approaches	1	Re
CO 2	explain the criteria of a good research	6	Un
CO 3	understand the selection process of the problem based on necessity.	4	Un
CO 4	recall the features of good research	4	Re
CO 5	apply secondary data methods of collecting primary data	6	Ap
CO 6	understand the formulation of the selected problem	4	Un
CO 7	understand the meaning of interpretation techniques	4	Un
CO 8	list the types of reports based on the research mechanism	6	Re

SEMESTER - III			
Core XV		Research Methodology	
Code : 19PPHC34	Hrs/Week: 6	Hrs/Semester:90	Credits: 4

### Unit I: An Introduction to Research Methodology

Meaning of research-Objectives-Types of research- Research Approaches-Significance-Research methods versus methodology- Research and scientific method- Importance of knowing how research is done- Research process- Criteria of good research- Problems encountered by researchers in India.

### Unit II: Defining the Research Problem and Research design

Research problem- Selecting the problem- Necessity of defining a problem-Technique involved in defining a problem- Meaning of research design- Need- Features of good Design-Important Concepts-Basic principles of experimental designs.

### Unit III: Data Analysis

Meaning and importance of data- sources of data- use of secondary data methods of collecting primary data: general- observation-experimentation- simulation.

### Unit IV: Review of literature

Need for reviewing literature- What to review and for what purpose - Literature search procedure- Sources of literature- Planning the review work – Note taking – The planning process- Selection of a problem for research- Formulation of selected problem.

### Unit V: Interpretation and report writing

Meaning of interpretation- Technique- Precaution- Significance- Different steps- Layout of research reports - Types of reports- Oral presentation- Mechanics of writing a research report-Precautions for writing a research report.

#### Text Books:

1. CR Kothari, Research methodology methods and techniques.
2. OR Krishna swamy,M.Ranganatham, Methodology of research in social studies.

Unit	Book No.	Page Number
I	1	1-29
II	1	30-50
III	2	163-182
IV	2	63-82
V	1	403-420

#### Books for Reference:

1. MH Gopal, An introduction to research procedure in social science.
2. SP Gupta, Statistical methods.

SEMESTER - IV			
CORE XVIII		Quantum Mechanics -II	
Code :19PPHC41	Hrs/Week: 5	Hrs/Semester: 75	Credits: 4

### Vision

To enable students acquire a thorough understanding about advanced quantum mechanics and their relevance in solving advanced quantum mechanical problems.

### Mission

To enhance the knowledge of students in advanced quantum mechanics through a systematic study of Time Independent Perturbation theory, Time dependent Perturbation theory, Scattering theory, Identical particles and Relativistic Quantum Theory and their applications to quantum mechanical systems.

### Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO 1	Describe time independent perturbation theory and its application to the first order Stark effect in Hydrogen atom	1	Re
CO 2	Discuss time dependent perturbation theory and transition probability	1	Un
CO 3	Describe Einstein coefficients	2	Un
CO 4	Define classical scattering cross section	1	Re
CO 5	Describe scattering by a square well potential using Born approximation and Partial wave analysis	1	Un
CO 6	Define Identical particles, symmetric and antisymmetric wavefunctions	1	Re
CO 7	Explain Dirac's equation for a free particle	1	Ev
CO 8	Explain spin of a Dirac particle	1	Ev

SEMESTER - IV			
CORE XVIII		Quantum Mechanics -II	
Code :19PPHC41	Hrs/Week: 5	Hrs/Semester: 75	Credits: 4

### Unit I: Approximation Methods I

Time Independent Perturbation Theory: Introduction- Theory for non-degenerate case - Application to non-degenerate levels- Theory for degenerate levels- First order Stark effect in Hydrogen atom.

### Unit II: Approximation Methods II

Time Dependent Perturbation Theory: Introduction- Transition probability- constant Perturbation-Harmonic perturbation- adiabatic perturbation- sudden approximation - Semi classical theory of radiation- calculation of Einstein coefficients.

### Unit III: Scattering theory

Classical scattering cross section – Centre of mass and laboratory co-ordinate systems – Scattering amplitude – Green's function approach – Born approximation – Partial wave analysis – Scattering from a square well system.

### Unit IV: Identical particles

Introduction, Permutation symmetry, Symmetric and antisymmetric wave functions, The exclusion principle, Spin eigenfunctions of two electrons, Exchange interaction, Collisions between identical particles

### Unit V: Relativistic Quantum Theory

Klein – Gordon equation – Dirac equation for a free particle – Spin of a Dirac particle – Particle in a potential – Relativistic particle in a box – Relativistic hydrogen atom – Electron in a field – Spin orbit energy.

### Text Books:

1. S. Rajasekar and R. Velusamy, Quantum Mechanics I: Fundamentals, CRC Press, Taylor and Francis group- Boca Raton, London, e-book version 2014.

Unit	Book no.	Sections / Page No
I	1	13.1, 13.2, 13.3, 13.4, 13.5
II	1	14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8
III	1	17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8
IV	1	18.1, 18.2, 18.3, 18.4, 18.5, 18.6, 18.8
V	1	19.1, 19.2, 19.3, 19.6, 19.7, 19.9, 19.10, 19.11, 19.12

**Books for Reference:**

1. L. Schiff, Quantum Mechanics, Third Edition 2010, Tata Mc-Graw Hill Education Private Limited, New Delhi
2. P. M. Mathews and K. Venkatesan ,A Text Book of Quantum Mechanics, Tata McGraw Hill Publishing Company Limited, New Delhi, 38<sup>th</sup> reprint 2007
3. R. Shankar, Principles of Quantum Mechanics, Second Edition 1994, Plenum Publishers, New York.
4. J. J. Sakurai, Modern Quantum Mechanics, Revised edition 1994, Addison- Wesley Publishing Company.
5. G. Aruldas, Quantum Mechanics, Second edition, Twentieth printing 2019, Prentice-Hall of India Learning Private Limited, Delhi.



<b>SEMESTER - IV</b>			
<b>Core XIX</b>		<b>Condensed Matter Physics</b>	
<b>Code :19PPHC42</b>	<b>Hrs/Week: 5</b>	<b>Hrs/Semester: 60</b>	<b>Credits: 4</b>

### **Vision**

To enable the students to learn how central concepts in condensed matter physics can be applied to model physics effects.

### **Mission**

To introduce a broad spectrum of chemical bonding, crystal structure, diffraction, magnetism and a brief survey of superconductivity.

### **Course Outcome:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO 1	Recall about the crystal structure and degree of ordering to atom binding and packing	1	Re
CO 2	Compare the Energy Bands and the number of orbitals	5	Un
CO 3	Explain the physics of different types of bonds in crystalline structure	1	Un
CO 4	Classify condensed matter upon its degree of order with emphasis on scattering experiments	5	Un
CO 5	Explain the effective electron mass and apply it to describe electron dynamics in semiconductors	1	Un
CO 6	Estimate the thermal ionization of donors and acceptors	4	Ev
CO 7	Apply the knowledge of magnetism to explain natural physical process and related technological advances	2	Ap
CO 8	Assess ferromagnetic order from ant ferromagnetic order	4	Ev

SEMESTER - IV			
Core XIX		Condensed Matter Physics	
Code :19PPHC42	Hrs/Week: 5	Hrs/Semester: 60	Credits: 4

### Unit I: Crystal Structure & Crystal binding

Brillouin zones-Reciprocal lattice to sc lattice-Reciprocal lattice to bcc lattice- Reciprocal lattice to fcc lattice-Fourier analysis of the basis - Structure factor of the bcc lattice- structure factor of the fcc lattice. Crystals of inert gases-Vander waals- London interaction-Repulsive interaction-Equilibrium lattice constants-cohesive energy-Ionic crystals- Electrostatic or Madelung energy-Evaluation of the Madelung constant

### Unit II: Energy Bands

Nearly Free electron model -Bloch Functions – Kronig-Penny Model-Wave Equation of electron in a periodic potential-Number of orbitals in a band

### Unit III: Crystal vibrations

Vibrations of crystals with monatomic basis-First Brillouin zone- Group velocity- long wavelength limit-Derivation of force constants from experiment - Two atoms per primitive basis -Quantization of elastic waves - Phonon momentum – Inelastic scattering by phonons.

### Unit IV: Semiconductor Crystals

Band gap-intrinsic carrier concentration-Intrinsic mobility-impurity conductivity-Donor states-Acceptor states- Thermal ionization of donors and acceptors -thermo electric effects-semimetals-superlattices-Bloch oscillator- zener tunneling.

### Unit V: Magnetism

Langevin dia magnetism equation-Quantum theory of dia magnetism of mono nuclear systems-paramagnetism-Ferro magnetic order-curie point and the exchange of integral- Temperature dependence of saturation- magnetization- saturation magnetization at absolute zero-magnons-Quantization of spin waves-thermal excitation of magnons-ferrimagnetic order-Curie temperature and susceptibility of ferrimagnets- iron garnets- anti ferro magnetic order-susceptibility below the neel temperature-antiferro magnetic magnons.

#### Text Books:

1.Charles Kittel, Introduction to Solid state Physics, Wiley, 7<sup>th</sup> Edition, 1995.

Unit	Book No.	Page Number
I	1	33-41,49-67
II	1	163-181
III	1	89-102
IV	1	185- 187,205-218
V	1	297-302,321-344

**Books for Reference:**

1. L. V. Azaroff, Introduction to Solids (McGraw Hill), 9<sup>th</sup> Reprint, Newyork.
2. P.K.palanisamy, Solid State Physics, 2013 Reprint, Scitech publications Private Ltd, Chennai.
3. H.C.Gupta , Solid State Physics, II Edition, Vikas Publishing home Ltd, Noida.
4. R.L.Singhal, Solid State Physics, KedarNath and Ram Nath publishers, Meerut.
5. M.Ali Omar, Elementary Solid state Physics, 1975, Addison-Wesley Pub. Co. edition

SEMESTER II			
Core	VIII	Microbiology	
19PZOC24	Hrs/ Week : 4	Hrs / Sem : 60	Credits : 4

**Vision :** To prepare graduate students with thorough knowledge and understanding of the core concepts in the field of Microbiology

**Mission :** To equip the students with knowledge about Taxonomy, organization, multiplication and infection of microbes and to develop expertise in microbiological techniques.

**Course Outcome :**

CO.NO	Upon completion of this course, the students will be able to	PSO addressed	CL
CO- 1	classify micro organisms focusing on the modern trends of Taxonomy	1	Un
CO- 2	prepare media to be utilized in the cultivation of microorganisms	2	Ev
CO-3	understand the structural organization and life cycle of microorganisms	2	Un
CO-4	explain the role of microorganisms in fermentation, medicine and the production of microbial products	2	An
CO-5	gain familiarity with the unique role of pathogens in human infectious diseases	2	Ev
CO-6	identify the methodologies used in disease treatment and prevention	6	An
CO-7	demonstrate practical skills in the use of technologies and methods common to microbiology	8	Ev
CO-8	apply scientific methods in the design and execution of experiments	8	Ap

SEMESTER II			
Core	VIII	Microbiology	
19PZOC24	Hrs/ Week : 4	Hrs / Sem : 60	Credits : 4

### Unit I Classification

Classification of microorganism – Five Kingdom concept . Modern trends of bacterial Taxonomy- Ribosomal RNA and sequencing - Construction of phylogenetic tree. General characters of main groups of microorganisms.

### Unit II Cultivation of microorganisms

Preparation of culture media – Isolation and maintenance of pure culture- Cultural and morphological characteristics of bacteria – Microscopic examination of microorganisms- gram staining- acid fast staining – spore staining - capsular staining – flagellar staining.

### Unit III Microbes – Structural organization

Structural organization of bacteria, virus and fungi – Life cycle of Actinomycetes, yeast and mycoplasma.

### Unit IV Production of microbial products

Yeast fermentation and its products – Production of alcohol, beer and wine. Mixed fermentation product- Production of vinegar. Production of antibiotics - penicillin and tetracycline.

### Unit V Microbial diseases

Protozoan diseases- amebiasis and sleeping sickness. Bacterial diseases- diphtheria, tetanus and gonorrhea. Viral diseases- chikungunya, dengue fever, rabies and ebola. Fungal diseases- actinomycosis and aspergillosis.

### Books for Reference

1. Arti Kapil. 2016. *Text Book of Microbiology*. 9<sup>th</sup> Edition. University Press. Hyderabad.
2. Dubey, R .C and D.K. Maheswari. 2006. *A Text Book of Microbiology*. S chand & Co New Delhi.
3. Roger Stainer, John Lingraham, Mark I Wheelis and Page R. Painter. 1992. *General Microbiology* Mac Millan, Hampshire, London.
4. Pelzer Chan and Krieg. 1998. *Microbiology*. 2<sup>nd</sup> Edition. Tata MC Grow Hill Publishing Company, New Delhi.
5. Presscott Harley and Klein. 2005. *Microbiology*. WCB MC Graw Hill Co New York.
6. Purohit, S.S. 1991. *Microbiology – Fundamentals and Application*. M/ S Saraswathi Publication, India
7. Power, C.B, and K.F. Dagainawala. 1988. *General Microbiology* . Vol I & II. Himalaya Publishing House, Mumbai.
8. Vijaya Ramesh. 2007. *Food Microbiology*. MJP Publishers, Chennai.

## PRACTICALS

**Hrs / Week : 2**

**Credit: 1**

1. Sterilization Techniques
2. Sample handling for microbial studies
3. Preparation of culture media:  
Nutrient broth, Nutrient agar, Potato dextrose agar, Mullen- Hinters agar
4. Counting of viable cells ( CFU/ ml) by serial dilution & spread plate or pour plate methods
5. Gram staining
6. Spore staining
7. Simple biochemical tests of bacteria
  - a Acid and gas production in glucose broth
  - b Starch hydrolysis
  - c Catalase
  - d Nitrate reduction
8. Dye reduction test in milk
9. Test for antibiotic sensitivity
10. Isolation of symbiotic nitrogen fixing bacteria from root nodules
11. Observation of algae, fungi and blue green algae

### **Books for Reference:**

1. Kannan N. 1996. *Laboratory Manual in General Microbiology*. Palani Paramount Publications, Palani.
2. James Cappuccino and Natalie Sherman. 1990. *Microbiology A Laboratory Manual*. Addison - Wesly- Hyman Inc, Tokyo.
3. Dubey R.C. and D.K. Maheswari. 2008. *Practical Microbiology*. S Chand & Company Ltd., New Delhi.

Semester – I			
Elective I		A. Advanced Topics in Chemistry	
Course Code : 21PCHE11	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

**Objectives:**

- To understand about molecular modelling and drug designing.
- To have in-depth knowledge about host-guest molecules.
- To create awareness about common diseases and their treatments.

**Course Outcome:**

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	formulate molecular dynamics in drug design.	5	Ap
CO 2	perform docking using Autodock virtual screening and De nova designs.	6,8	Cr
CO 3	develop recent trends in the synthesis of crown ethers.	6	Cr
CO 4	design a green method for the synthesis of compounds using twelve principles of Green chemistry.	5,6	Cr
CO 5	compare heterogeneous liquid- liquid and heterogeneous solid- liquid reactions	2	An
CO 6	acquire knowledge about common diseases due to insects, animals, air and water borne diseases.	1,8	Un
CO 7	synthesise the nanomaterials by ultrasonication.	7	Cr
CO 8	sketch the natural cycles of environment such as the hydrological, oxygenand nitrogen cycles.	6	Cr
CO 9	differentiate chemical and photochemical reactions occurs in atmosphere.	1,5	An

Semester – I			
Elective I		A. Advanced Topics in Chemistry	
Course Code : 21PCHE11	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

### Unit I Molecular modelling and Drug designing

Introduction Molecular modelling - Drug discovery: the Evolution and process - The role of Computer assisted drug design - Process of drug discovery- Bioassay- Lipinski's rule of five - Quantum mechanical simulations - *Ab Initio* methods, Semi Empirical methods- Molecular dynamics in drug design - Docking- types of searching methods in Docking, docking methods, the scoring function, docking using Auto Dock, Virtual screening, De novo design. Cheminformatics - SMILES (Simplified Molecular Input Line Entry Specification), Applications of Cheminformatics in Drug discovery.

### Unit II Supramolecular Chemistry

Introduction - Development - Classification - Based on cavity and forces - Recent developments in Supramolecular compounds - Molecular self-assembly - Self-replicating molecular systems, Molecular self-assembly based on hydrogen bond and Metal coordinated self-assembly - Catenenes and Rotaxanes - Synthesis of crown ethers - Synthesis of Cryptands - Metal complexes with Crown ethers and Cryptands.

### Unit III Green Chemistry

Twelve principles of greenchemistry - Green solvents - Supercritical CO<sub>2</sub> and H<sub>2</sub>O - Microwave assisted reaction - Stille reaction, Suzuki reaction - Krohnke reaction -Hiyama reaction - Sonogashira reaction.

Introduction to Sonochemistry - Instrumentation - Types of Sonochemical reactions - Homogeneous reaction -Strecker reaction - Heterogeneous liquid-liquid reactions - Hydrolysis and Solvolysis - Heteogeneous solid-liquid reactions - Bouveault reactions, Barbier reaction of carbonyl compounds - Miscellaneous applications of ultrasound - Preparation of porous carbon powder - Sonochemical treatment of polluted water.

### Unit IV Pharmaceutical Chemistry

Introduction - Drugs for common diseases due to insects & animals, Air borne diseases, Water borne diseases, Respiratory diseases & Diseases of the Nervous system. Pharmaceutical Aids - Preservative, Anti-oxidants, Sequestrants - Colouring agents, Flavouring agents and artificial sweetening agents added in drugs - Different dosage forms of Drugs - Solid (Tablet), Semisolid (Paste, Cream), Liquid (Solution, Suspension, Emulsion) and Gaseous dosage form.



## Unit V Environmental Chemistry

Environmental Segments - Natural cycles of environment: the hydrological, oxygen and nitrogen cycles - Chemical and Photochemical reactions in atmosphere: SO<sub>2</sub>, O<sub>2</sub> and O<sub>3</sub> chemistry, nitrogen oxides and organic compounds - Greenhouse effect - Ozone hole - El Nino phenomenon.

Microorganisms - Catalysts of aquatic chemical reactions - Acid-base and Ion exchange reactions in soil - Nitrogen pathways and NPK in soil - Waste classification and disposal - Solid waste management.

### Text Books

1. Anand Solomon K. *Molecular modelling and Drug Design*. MJP publishers. 2016.
2. Kalsi P.S, Kalsi J.P. *Bioorganic, Bioinorganic and Supramolecular Chemistry*. New Age International Publishers. Second edition. 2010.
3. Ahluwalia V.K, Varma R.S. *Alternate Energy Processes in Chemical Synthesis: Microwave, Ultrasonic and Photo Activation*. Narosa Publishing House. New Delhi. 2008.
4. DE A.K. *Environmental Chemistr*. New age international publishers. 5<sup>th</sup> edition.

### Books for Reference

1. Khopkar S.M. *Analytical chemistry of Macrocyclic and Supramolecular compounds*. Delhi: Narosa Publishing House. Second edition 2008.
2. Ahluwalia V.K, Rajender S. Varma. *Green Solvents for Organic synthesis*. Narosa Publishing House Pvt. Ltd. 2009.
3. Paul T. Anastas. *Text Book on Green Chemistry*. OUP. 2006.
4. Raghupati Mukhopadhyay, Sriparna Datta, Rajib Kumar Das. *Textbook of Pharmaceutical chemistry & Medicinal Chemistry*. Books and Allied (P) Ltd. First Edition 2011.
5. Jayashree Ghosh. *A Textbook of Pharmaceutical Chemistry*. New Delhi: S. Chand & Company Ltd. 1997.
6. Dr. Ravikrishnan A. *Environmental Science & Engineering*. Sri Krishna High tech Publishing Company Pvt. Ltd. Eleventh edition 2015.

Semester – II			
Elective II		A. Nanoscience and Technology	
Course Code : 21PCHE21	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

### Objectives:

- To introduce and give an insight into the fascinating area of Nanoscience.
- To synthesise the nanomaterials by eco-friendly methods and characterise the synthesized nanomaterials.
- To apply in different fields for the welfare of society.

### Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	recall a thorough knowledge of basic underline disciplines of nanoscience and nanotechnology	4	Re
CO 2	explain the preparation, characterization and properties of nanomaterials	6	Un
CO 3	analyze the types and properties of carbon nanotubes	1	An
CO 4	assimilate existing and new concepts, methodology and researches and apply them in their academic research environment	7	Ev
CO 5	aware of challenges, risks and promises of nano technological development	6	Cr
CO 6	synthesise the nanomaterials by physical, chemical and biological methods.	6	Cr
CO 7	characterise the synthesized nanomaterials by various techniques.	5	Ev
CO 8	apply the nanomaterials in energy storage, food and in day-to-day life.	8	Ap

Semester – II			
Elective II		A. Nanoscience and Technology	
Course Code : 21PCHE21	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

### Unit I Introduction to Nanotechnology

Introduction - Definition - Nanoscience and Nanochemistry - Terminology used in Nanotechnology - Nanostructures (Nanoparticles, Nano scale in one dimension, two dimension and three dimension) - Classification of nanoparticles - Properties of nanomaterials - Surface property, Physico-chemical, Electrical and electronic, Redox, Optical, Mechanical and Magnetic properties - Quantum Dot, Quantum well, Quantum wire and Nanocrystal.

### Unit II Synthesis and characterisation

Synthesis of nanomaterials - Top down and Bottom up approach - Physical methods (Laser Ablation, Evaporation, Sputtering and Gas condensation) - Chemical methods (Thermolysis, Sonochemical approach and Sol-gel synthesis) - Biosynthesis (Elementary idea only) - Structural characterisation of nanomaterials - X-ray diffraction, Scanning Tunneling Microscopy and Atomic force microscopy.

### Unit III Carbon nanotubes

Carbon nanotubes - Carbon allotropes (Diamond, Graphite, Carbon nanotubes) - Types of Carbon nanotubes - Synthesis of carbon nanotubes - Electric arc Discharge method, Laser method, Chemical vapour deposition method (CVD) - Purification methods, properties and applications of Carbon nanotubes.

Fullerenes - Synthesis and purification - Properties and applications of Fullerenes.

### Unit IV Nanocomposites

Definition - Ceramic-matrix nanocomposites - Nanocomposites by mechanical alloying - Metal-matrix nanocomposites – Polymer nanomaterials - Synthesis methods - Solution intercalation - Melt intercalation - Emulsion polymerization - In-situ polymerization - Properties of polymer nanostructured materials - Material properties - Thermoplastic nanocomposites - Nylon 6 nanocomposites - Thermoset nanocomposites - Epoxy nanocomposites - Elastomer nanocomposites - TPO nanocomposites.

### Unit V Applications of Nanotechnology

Chemistry and Environment - Water purification - Energy storage - Rechargeable batteries, Hydrogen storage - Information and Communication - Heavy industry - Consumer goods (food, textiles and cosmetics) - Nano medicine - Medical applications of molecular nanotechnology (Nanorobots, Cell repair machines, nanonephrology).

### **Books for Reference**

1. Shanmugam S. *Nanotechnology*. Chennai: MJP Publishers. 2011.
2. Parthasarathy B.K. *Nanostructure and Nanomaterials*. Delhi: Isha Books. 2007.
3. Uday Kumar. *Concepts in Nanochemistry*. New Delhi: Anmol Publications Pvt. Ltd. 2013.
4. Bandyopadhyay A.K. *Nano Materials*. New Age International Publishers, 2<sup>nd</sup> Edition 2012.
5. Viswanathan B. *Nano Materials*. New Delhi: Narosa Publishing House. 2013.
6. Khanna O.P. *A Text Book of Nanochemistry*. New Delhi: Astha Publishers & Distributors. 2014.
7. Guozhong Cao. *Nanostructures & Nanomaterials: Synthesis, Properties & Applications*. Imperial College Press. 2004.

Semester – III			
Elective III		A. Research Methodology	
Course Code : 21PCHE31	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

#### Objectives:

- To provide resources to the students to stimulate basic research interest and other creative endeavours that promote entrepreneurial culture.
- To explain about various thermal and electrochemical instrumentation techniques.
- To learn about all the hyphenated techniques used for the separation of compounds.
- To interpret the results of analysis with accuracy.

#### Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	select the research topic and able to survey the literature.	3	Ev
CO 2	submit the project proposals to the funding agency.	8	Ap
CO 3	explain about the principle, instrumentation and applications of TGA, DTA and DSC.	3,6	Un
CO 4	compare principle, instrumentation and applications of potentiometry, coulometry and voltammetry.	5	An
CO 5	describe different types of Atomic spectroscopy.	1,5	Un
CO 6	interpret data using TEM, SEM, XRD and EDAX techniques.	5,7	Ev
CO 7	improve the accuracy of data in chemical analysis.	5	Ev
CO 8	defend teaching methods.	6,7	Ev

Semester – III			
Elective III	A. Research Methodology		
Course Code : 21PCHE31	Hrs / Week : 4	Hrs / Sem : 60	Credits : 4

### Unit I      Research methodology

Introduction of research–Selection of a research topic – Surveying the literature– Sources– primary source and secondary source – Identification of research problem – Actual investigation and analysis of experimental results – Reporting the results in the form of communication, paper – Dissertation and thesis writing– Project proposals to funding agency – Impact factor, citations and h-index –Publication and Indexing: Scopus, Web of Science and Google scholar – Concepts of IPR and Plagiarism.

### Unit II      Thermo and electro analytical methods

**Thermoanalytical Methods** –Principle, instrumentation and applications of Thermogravimetry (TGA), Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC).

**Electroanalytical Techniques** – Coulometry – Principle, Instrumentation and Applications. Voltammetry– Types (Stripping voltammetry, Cyclic voltammetry, Amperometry) – Principle, instrumentation and applications

### Unit III      Spectroscopic & Surface techniques

Principle, instrumentation and applications of Atomic Absorption Spectroscopy, Atomic Fluorescence Spectroscopy and Atomic Emission Spectroscopy.

Principle, instrumentation and applications of Energy dispersive spectroscopy (EDAX), Transmission electron microscopy (TEM), Scanning electron microscope (SEM) and Scanning Probe Microscopes.

### Unit IV      Data Analysis

Errors in chemical analysis – Classification of errors –Methods for determination of accuracy– Improving accuracy of analysis – Comparison between precision and accuracy – Significant figures – Mean, median, mode and standard deviation – Confidence interval – Propagation of measurement uncertainties – Comparison of results – “t” test, “f” test and “chi” square test – Rejection of results – Presentation of data – Correlation analysis and correlation coefficient – Linear regression – Related Problems.

## Unit V      Research and Teaching Methodology

Teaching – Objectives of Teaching - Phases of Teaching – Teaching methods: Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project method, Seminar – Integrating ICT in Teaching: Individualized Instruction, Ways for Effective Presentation with Power Point – Documentation – Evaluation: Formative, Summative & Continuous and comprehensive Evaluation – Later Adolescent – Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development – Teaching Later Adolescents.

### Text Books

1. Gurdeep R. Chatwal, Sham K. Anand. *Instrumental Methods of Chemical Analysis*. Mumbai: Himalaya Publishing House. 5<sup>th</sup> edition 2014.
2. Skoog D.A, West D.M.F, Holler J, Crouch. S.R. *Fundamentals of Analytical Chemistry*. Thomson Asia Pvt. Ltd. Eighth Edition, Third Reprint 2005.
3. Banwell C.N, *Fundamentals of molecular spectroscopy*. Noida: McGraw Hill Education, 4<sup>th</sup> Edition 1994.

### Books for Reference

1. Anderson J, Durston B.H, Poole. M. *Thesis and Assignment Writing*. New Delhi: Wiley Eastern. 1986.
2. Sharma B.K. *Instrumental Methods of Chemical Analysis*. Goel Publishing House, 23<sup>rd</sup> Edition 2004.
3. Willard H, Merrit Jr. L, Dean. A. *Instrumental methods of analysis*. CBS Publishers and Distributors. 2004.
4. Rajammal P. Devadas. *A Handbook of Methodology of Research*. Chennai: S.R.K. Vidyalyaya Press. 1976.
5. Dominoswki R.L. *Research Methods*. Prentice Hall. 1981.
6. Ebel H.F, Bliefert C, Russey W.E. *The Art of Scientific Writing*. Weinheim: VCH. 1988.
7. Joseph A, *Methodology for Research*. Bangalore: Theological Publications. 1986.
8. Douglas A. Skoog, James Holler F, Stanley R. Crouch. *Instrumental Analysis*. New Delhi, Cengage Learning India Private Limited. Eighth Indian Reprint 2011.
9. Asim K. Das, Mahua Das. *Fundamental Concepts of Inorganic Chemistry*. New Delhi: CBS Publishers & Distributors Pvt. Ltd. Volume 7, First Edition Reprint 2019.

Semester III			
Elective III		B. Chemical Instrumentation	
Course Code:21PCHE32	Hrs/Week:4	Hrs/Sem:60	Credits:4

**Objectives:**

- To impart the students with basic principles and concepts in Instrumental techniques.
- To understand the nature and Choice of methods of measurements.
- To learn the limits of detection and amplification.
- To demonstrate the concepts of Operational amplifiers.

**Course outcome:**

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO1	demonstrate automatic operation and computer control	1,5	Ap
CO2	precise control of current and voltage.	6,8	Ap
CO3	differentiate modulation and demodulation	5	An
CO4	point out limitation on amplifier performance	1	Cr
CO5	predict binary logic concepts, logic gates and multi-vibrators	7	Un
CO6	distinguish visual, filter and spectrophotometers.	6	Ap
CO7	control noise level in a system.	1,7	Cr
CO8	interpret the optimal value of adjustable parameters	7,8	Ev



Semester–III			
Elective III	B. Chemical Instrumentation		
Course Code: 21PCHE32	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

### Unit I Measurement and Instrumentation

Introduction - The nature of a measurement - Choice of a method of measurement - Control of variables - Basic design patterns - General properties of modules - Propagation of uncertainty - Single channel design - Limit of detection and amplification - Automatic operation and computer control.

### Unit II Operational amplifiers

The operational amplifiers – Limitations on amplifier performance – Mathematical operations - Differentiation - Integration - Measurement of current and voltage - Precise control of current and voltage.

### Unit III Signal-to-Noise Optimisation

Sensitivity and detection limits – Noise – Minimising Noise in a system – Signal averaging - Modulation: Chopping - Demodulation: Phase sensitive detection - Other methods of Optimising Signal-to-Noise ratio.

### Unit IV Digital Electronics

Binary logic concepts - Logic gates - Multivibrators - Counters - Wave shaping – Analog to digital convertors – Instruments and Digital computers.

### Unit V Instrumentation for Optical Absorption Spectrometry

Visual Photometers - Filter Photometers - Spectrophotometer - Double beam Spectrophotometer - Recording Spectrophotometers - Optimal value of adjustable parameters – Multiple internal reflection assembly – Rapid scanning spectrometer – Non-dispersive Photometers – Photometric titration equipment – Fourier transform Spectrometers.

### Textbooks

1. Strobel H.A. *Chemical instrumentation-A systematic approach to Instrumentation Analysis*. Phillipines: Addison-Wesley Publishing Company Inc. 2<sup>nd</sup> Edition 1973.

### Books for Reference

1. Jeffery G.H, Bassett J, Mendham J, Denney R.C. *Vogel's Text book of Qualitative chemical analysis*. Essex: Longman Scientific and technical. 5<sup>th</sup> Edition 1989.
2. Skoog D.A, Hollar F.J, Crouch S.R. *Principles of Instrumental analysis*. Belmont CA: Thompson Brooks/Cole. 6<sup>th</sup> Edition 2007.

<b>SEMESTER –I</b>			
<b>Core III</b>		<b>Statistics for Research</b>	
<b>Course Code: 21PCOC13</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits : 4</b>

### Objectives

- To enable the students to learn decision making principles and acquire working knowledge in testing hypothesis.
- To make the students understand the application of statistical theories and concepts to business decisions.

### Course Outcomes:

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO – 1	understand the importance of probability and theoretical distribution in statistical decision making.	1,3,4,7	Un
CO – 2	apply the sample statistics in Non parametric tests in management decision making.	1,3	Ap
CO – 3	apply analysis of variances for optimal decisions.	1,3,8	Ap
CO – 4	understand the different statistical quality control techniques like control charts.	4 ,7	Un
CO - 5	learn decision making principles under uncertainty.	3,7	Un
CO - 6	apply the sample statistics in parametrical tests in management decision making.	1,3	Ap
CO - 7	apply the Chi – Square test in statistical decisions.	1,3	Ap
CO - 8	analyse the various techniques of computing expected frequencies.	1,3,8	An

SEMESTER –I			
Core III	Statistics for Research		
Course Code: 21PCOC13	Hrs/Week: 6	Hrs/ Sem: 90	Credits : 4

**Unit I: Probability And Theoretical Distributions: (15 hours)**

Probability – Definition-Classical- Relative and subjective approach to probability– Importance of the concept of probability- Theorems -Addition and Multiplication -Mathematical Expectation – Computation of expected probability under Binomial, Poisson and Normal Distributions.

**Unit II : Tests of Hypotheses: (15 hours)**

Inferential statistics – Procedure of testing hypothesis - Types of errors -one and two tailed tests– Standard error –Sampling distribution - Estimation – Properties of good estimator – Testing large samples and small samples - Student’s ‘t’ distribution- Tests of significance of attributes and variables.

**Unit III : Analysis of Variance and Non-Parametric Test: (15 hours)**

Analysis of variance – ‘F’- test – Applications of ‘F’- test –One way classification – Two way classifications. Meaning – Advantages of non-parametric tests –Chi-square test– Definition-Degrees of freedom-Conditions-Uses- Tests of goodness of fit- Yate’s correction- Sign test- Rank-Sum tests-Mann Whitney’s ‘U’-Test - Kruskal Wallis ‘H’-Test. Limitations of non- parametric tests.

**Unit IV: Statistical Quality Control: ( 15 hours)**

Introduction – Objectives – Causes of variation in quality – Techniques of SQC – Control charts- Mean charts- Range charts- Fractions defective charts -Control charts for attributes- Uses of control charts- Advantages and Limitations of control charts – Acceptance sampling.

**Unit V : Decision Theory: (15 hours)**

Decision Environment – Introduction- Ingredients of Decision problems-Alternative courses of action- Uncertainty-Decision criteria. Optimal decisions- Pay off table – Regret table– Decision under uncertainty- Maximin principle – Minimax Principle – The Bayesian Decision Rule- EMV – EVPI – EPPI – Decision Tree Analysis- Steps in Decision tree analysis- Advantages of Decision tree analysis.

**Note: Theory – 30%, problem - 70%**

**Text Book:**

1. Gupta, S.P. *Statistical Methods*. New Delhi: Sultan Chand & Sons. Forty third Edition—2020

**Books for Reference:**

1. Levin Richard and David S. Robin. *Statistics in Management*. New Delhi: Pearsons Publications, 7<sup>th</sup> Edition ,2019
2. Sancheti D.C. and Kapoor. V.K., *Statistics- Theory, Methods and Applications*. New Delhi: Sultan Chand & Sons, 9<sup>th</sup> Edition ,2020

<b>SEMESTER –I</b>				
<b>Core IV</b>		<b>Entrepreneurial Training and Development</b>		
<b>Course Code:</b>	<b>21PCOC14</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits : 4</b>

### **Objectives**

- To activate entrepreneurial spirit and to know about financial assistance provided by government and private institutions for innovative pursuits.
- To enable the students understand the various aspects of Entrepreneurship and to analyse the entrepreneurial traits.

### **Course Outcomes:**

<b>Co. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	understand the significance of entrepreneurial skills.	1,4	Un
CO-2	know the scope for Rural Entrepreneurship	2,4	Ap
CO-3	study the concept of Women Entrepreneur	3,4,5	Ev
CO-4	training the procedure for setting up for MSME'S.	1,4	Un
CO-5	preparation of Project Report by Entrepreneurs	1,4,8	Ap
CO-6	describe Project Appraisal	1,6	Un
CO-7	evaluate guidance to Entrepreneurs for Export	3,4	Ap
CO-8	identify the institutional support provided to Entrepreneurs	2,6,8	Ev

SEMESTER – I			
Core IV Entrepreneurial Training and Development			
Course Code: 21PCOC14	Hrs/Week: 6	Hrs/Sem: 90	Credits : 4

### Unit : I Introduction

15 Hrs

Entrepreneurship – Meaning – Concepts- Importance- Functions - Entrepreneurship and Economic Development - Factors influencing entrepreneurial growth- Competence- Qualities of entrepreneurs– Types of Entrepreneurs

### Unit : II Rural Entrepreneurship, Women Entrepreneurship, MSME

19 Hrs

Rural entrepreneurship- Need – Problems – Prospects - Concept of Women Entrepreneurship – Functions and Role – Financial assistance – Grant assistance – Marketing assistance – MSME- Procedure for setting up of MSMEs - Opportunities for MSME

### Unit : III Project Identification, Formulation, Appraisal

18 Hrs

Meaning of Project- Project Identification-Project Selection- Formulation of a Project Report- Project Appraisal- Steps in Project Appraisal- Common Errors in Project Appraisal

### Unit : IV Export Assistance to Entrepreneurs

20 Hrs

Export potential – Constraints – Institutional set up for export assistance –Director of exhibitions – Director of commercial intelligence – Export promotion council –Trade representatives of India abroad – Trade development authority - Export promotion assistance – Export houses and Trade houses in India –Export procedure –Types of documents- Export incentives –Tax incentives for exports.

### Unit : V Institutional support to Entrepreneurs

18 Hrs

Institutional support to entrepreneurs- NAYE – ITCOT – SIPCOT – Industrial estates –SISI – NPC, DIC –SIDBI- Functions- - Concessions –Incentives and subsidies.

### Text Books

1. Khanka S.S. *Entrepreneurial Development*. New Delhi: S.Chand & Co Ltd, Revised edition. 2020.
2. Gupta C.B and Srinivasan N.P. *Entrepreneurial Development*. New Delhi: Sultan Chand& Sons, 1<sup>st</sup> Revised edition 2020.

### Books for Reference:

1. Vasant Desai. *Dynamics of Entrepreneurial Development and Management*. Mumbai: Himalaya Publishing House, 6<sup>th</sup> Revised Edition 2018.
2. Donald F.Kuratko. *Entrepreneurship Development and Small Business*. New Delhi: Tata McGraw Hill, 9<sup>th</sup> edition 2004
3. RangaRajan L. *Entrepreneurship Development*. Rajapalayam:Sri Ranga Publications, 2<sup>nd</sup> edition 2018.

<b>SEMESTER –II</b>			
<b>Core X</b>		<b>Financial Markets and Institutions</b>	
<b>Course Code: 21PCOC25</b>	<b>Hrs/Week: 5</b>	<b>Hrs/Sem: 75</b>	<b>Credits : 4</b>

### **Objectives**

- To enable students to understand the concept of financial system.
- To provide the students with an understanding of the structure, organization and working of financial markets and institutions in India.

### **Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO-1	understand the concepts of financial system, money market and its types	1,2	Un
CO-2	understand the constitutions, management and functions of Stock Exchange and SEBI	1,3,4	Un
CO-3	understand the present trading in stock exchanges and its merits and process.	1,2,6	Un
CO-4	examine the capital markets.	1,3	Ap
CO-5	understand the financial institutions that cater the ways of trading in OTCEI, BSE and NSE	1,6	Un
CO-6	understand various money market instruments and their utility	1,3,4	Un
CO-7	examine Depository System and its activities	1,2,6	Ap
CO - 8	examine the importance of stock exchange and their functioning under Depository and NSDL	1,3,4	Ap

SEMESTER –II			
Core X		Financial Markets and Institutions	
Course Code: 21PCOC25	Hrs/Week: 5	Hrs/Sem: 75	Credits : 4

### **Unit I Introduction**

**10 Hrs**

Financial System - Functions – Concepts of Financial System - Indian Financial System –The post 1951 period – Weaknesses of IFS – Development of Financial System in India.

### **Unit II Money Market**

**15 Hrs**

Definition – Money Market vs Capital Market – Features of a Money Market - Importance of Money Market- Composition of Money Market – Call Money Market – Commercial Bills Market or Discount Market – Treasury Bill Market – Money Market Instruments – Commercial Papers – Certificate of Deposits (CD) – Inter-bank Participation Certificate – Repo Instruments –Structure of Indian Money Market – Features or Deficiencies of Indian Money Market – Recent Developments.

### **Unit III Capital Market**

**15 Hrs**

Meaning – Stock Exchange – Distinction and Relationship between New Issue Market and Stock Exchange – Functions of New Issue Market – Methods of Floating New Issues – Functions / Services of Stock Exchanges –Listing of Stock Exchanges and Securities – Advantages and Drawbacks of Listing - SEBI Guidelines for Primary Market and Secondary Market.

### **Unit IV Capital Market Institutions**

**20 Hrs**

Over The Counter Exchange of India(OTCEI)- Features – Promoters and Participants – Trading in OTCE – National Stock Exchange (NSE) of India – Objectives - Features – Bombay Stock Exchange (BSE) – Segments – Stock Indices. Credit Rating: Meaning – Functions – Benefits – Credit Rating Agencies: CRICIL – IICRA and CARE

### **Unit V Depository System**

**15 Hrs**

Definition and Meaning-Activities and Process of Depository – Trading in Depository System – Depository System in India – SEBI (Depositories and Participants) Regulation Act, 1996 – Depository Process in India – Benefits of Depository System – NSDL – CSDL – Drawbacks – Remedial Measures.

### **Text Book:**

1. Gordon E. and Natarajan K.Financial Markets and Services.Mumbai: Himalaya Publishing House, edition.2015, Reprint 2021.

### **Books for Reference:**

1. Reserve Bank of India. Various Reports.RBI Publications, 2021.
2. Gurusamy S. Financial Service and System. Chennai:Vijay Nichole Imprints Pvt Ltd, 2009 Edition, Reprint 2014.

4. Apte P.G. *International Financial Management*. New Delhi :Tata McGraw hill Company, 8<sup>th</sup> edition 2020

<b>SEMESTER –III</b>			
<b>Core XV</b>		<b>Research Methodology</b>	
<b>Course Code: 21PCOC35</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits : 4</b>

**Objective:**

- To provide knowledge on research methods, techniques and process of research and develop skills in the application of research methods for business problem solving.

**Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO – 1	understand the research methods and steps in research process	1,2	Un
CO – 2	know the technique involved in defining a research problem	1,2,7	Un,Ap
CO – 3	identify the type of research design for different types of research work.	2,7	An
CO – 4	gain knowledge on sampling design and apply it for research	2,7,8	Un,Ap
CO – 5	understand the use of appropriate method for collection of data.	2, 3,4	An,Ap
CO – 6	process and analyze the data with appropriate statistical tools.	2,4,7	Ev,Ap
CO – 7	evaluate the result of research analysis, make suitable interpretation and use the mechanics in writing the research report.	7,8	Ev,Ap
CO – 8	understand the mechanics in writing a good research report.	7,8	Un,Ap



SEMESTER –III			
Core XV		Research Methodology	
Course Code: 21PCOC35	Hrs/Week: 4	Hrs/Sem: 60	Credits : 4

### Unit I Introduction to Research

(10 Hrs)

Introduction to Research - Meaning - Objectives - Significance - Types of Research - Steps in Research process - Meaning of research problem - Criteria for selecting the research problem - Technique involved in defining a research problem - Review of Literature: Purpose of Review .

### Unit II Research Design and Sampling Design

(12 hrs)

Research design: Meaning - Important concepts used in a research design -Contents of a research design - Types of research design.

Sampling design: Characteristics of a good sample - Criteria for selecting a sampling design - Methods of sampling.

### Unit III Collection of Data

(12 Hrs)

Collection of Data: Meaning of Primary Data and Secondary Data. Methods of Data collection: Questionnaire - Types of questions - Guidelines for designing a questionnaire - Advantages and Limitations of mailed questionnaire. Interview - Types of interviews - Advantages and Limitations of interview technique. Observation: Types of Observation - Observation tools and Recording devices - Advantages and Limitations of observation.

### Unit IV Processing and Analysis of Data

(18 Hrs)

Processing of Data- Processing Operations: Editing - Coding - Classification –Tabulation- Analysis of Data: An outline of commonly used statistical tools in research: Frequency distribution, Mean, Dispersion, Correlation, Regression, t Test, Z Test, F Test, Chi-Square Test, Factor analysis and Scaling techniques – Application of SPSS .

### Unit V Interpretation and Report Writing:

(8 Hrs)

Meaning of Interpretation - Significance of report writing - Types of reports - Steps in reportwriting- Format of a Research report - Mechanics used in writing the research report.

#### Text Book:

Kothari, C.R. *Research Methodology, Methods and Techniques*. New Delhi: New Age International (P) Ltd., Publishers. 4<sup>th</sup> edition 2019

#### Books for Reference:

1. Krishnaswamy, O.R. and Ranganathan, M. *Methodology of Research in Social Sciences*. New Delhi: Himalaya Publishing House. 2<sup>nd</sup> edition 2018.
2. Tripathi, P.C. *A Text Book of Research Methodology in Social Sciences*. New Delhi: Sultan Chand & Sons. Revised 6<sup>th</sup> edition 2010.
3. Gupta S.P. *Statistical methods*. New Delhi: Sultan Chand & Sons. 46<sup>th</sup> edition 2021.

<b>SEMESTER –IV</b>			
<b>Core XVI Advanced Cost Accounting</b>			
<b>Course Code: 21PCOC41</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits : 4</b>

### **Objective**

- To impart knowledge on the application of various methods and techniques of cost accounting and develop analytical skills in them.
- To enable the students have in depth knowledge in cost accounts and to make career choices.

### **Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO's addressed</b>	<b>Cognitive Level</b>
CO – 1	understand the application of various methods and techniques of cost accounting and develop analytical skills in them.	1,3	Un
CO – 2	understand the significance of job costing and accounting for jobs.	4,6	Ap
CO – 3	understand the significance of contract costing and calculation of profit in contract cost.	4,6	Ap
CO – 4	analyse the significance of process costing and its application in different industries.	4,6	Ap
CO - 5	apply the applications of Marginal costing techniques in managerial decision making.	4,6	Ap
CO – 6	apply the methods of costing used in service undertakings.	6,7	Ap
CO - 7	evaluate the inter firm comparison in managerial decision making.	6,7	Ev
CO - 8	evaluate the importance of uniform costing in managerial decision making.	6,7	Ev

SEMESTER –IV			
Core XVI Advanced Cost Accounting			
Course Code: 21PCOC41	Hrs/Week: 6	Hrs/Sem: 90	Credits : 4

#### UNIT I Specific Order Costing:

[22 Hrs]

**Job costing :** Features - Objectives –Pre-requisites for Job Order Costing- Advantages – Disadvantages – Procedure of Job Order Cost System - Preparation of Job Cost sheet. **Contract costing :** Features – Recording of Value and Profits on Contract - Retention money-Certificate of Work done – Profit on Incomplete Contract- Valuation of Work in Progress- Sub contracts - Escalation clause.

#### UNIT II Process Costing:

[23 Hrs]

Process costing - Features – Application of Process Costing – Comparison between Job costing and Process costing -Treatment of Normal loss, Abnormal loss and Abnormal gain-Treatment of Inter process profits -Treatment of Work-in-Progress : Calculation of Equivalent Production - Procedure for Evaluation. Joint Products and By products: Meaning of joint products and by products - Methods of apportionment of joint costs - Accounting of by products.

#### UNIT III Marginal Costing :

[23 Hrs]

Meaning of Marginal cost and Marginal costing - Cost Volume Profit Analysis: Meaning - Assumptions - Advantages - Limitations - Contribution – P/V ratio – BEP - Margin of safety. Application of marginal costing in Managerial Decision making- Cost Control – Profit Planning – Evaluation of Performances – Decision Making - Fixation of selling price - Key factor - Make or buy -Maintaining a desired level of profit-Decisions involving alternative choices-Discontinuance of a product line -Determination of Sales mix

#### UNIT IV Service Costing:

[12 Hrs]

Meaning of Service costing - Selection of cost units - Costing procedure in Transport costing - Power house costing - Costing for Lodging Houses - Canteen costing - Hospital costing - Costing for Cinema Theatres.

#### UNIT V Uniform Costing and Inter Firm Comparison

[ 10 Hrs]

Meaning - Features - Scope - Need - Objectives of Uniform costing - Areas of Uniform costing - Advantages and Disadvantages of Uniform costing - Requisites for Uniform costing. Meaning and Essentials of Inter Firm comparison - Advantages and Disadvantages of Inter Firm comparison.

**Note: Theory – 30% Problems – 70%**

#### **Text Book:**

Jain S.P and Narang K.L, *Advanced Cost Accounting*. Ludhiana : Kalyani Publishers, 25<sup>th</sup> Edition, 2016

#### **Books for Reference:**

1. Pillai R.S.N. and Bagavathi.V *Advanced Cost Accounting*. New Delhi: S.Chand&Co.Ltd., 7<sup>th</sup> Edition, 2010
2. Lal Nigam B.M. and Jain I.C. *Cost Accounting Principles and Practic*. New Delhi: PHI Learning Pvt. Ltd., 13<sup>th</sup> edition 2004
3. Saxena V.K. and Vasist. *Advanced Cost and Management Accounting*. New Delhi: Sultan Chand& Sons, 17<sup>th</sup> edition 2015.

<b>SEMESTER –III</b>			
<b>Elective II A Corporate Legal Framework</b>			
<b>Course Code: 21PCOE31</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits : 3</b>

### Objectives

- To familiarize the students with the relevant provisions of various laws influencing business.

### Course Outcomes:

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO – 1	understand the provisions of various laws.	1,3,6	Un
CO – 2	understand the role of SEBI	1,8	Un
CO - 3	familiarize with the Regulatory Environment for International Business.	4	Ap
CO-4	understand and identify the problems of consumers and redress the grievance.	1,8	Ap
CO-5	understand the Negotiable Instruments	1,3,8	Ap
CO - 6	know about consumer rights	1,8	Ap
CO – 7	understand about the operations of grievance redressal forum.	1,8	Un
CO – 8	be familiar with the regulations of SEBI	1,8	Un

<b>SEMESTER –III</b>			
<b>Elective II A Corporate Legal Framework</b>			
<b>Course Code: 21PCOE31</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits : 3</b>

### **Unit I The Companies Act, 2013**

**12 Hrs**

The Companies Act, 2013 - Definitions and Types of companies – Memorandum of Association – Articles of Association - Difference between Memorandum of Association and Article of Association –Contents- Prospectus– Contents.

### **Unit II The Negotiable Instruments Act, 1881**

**12 Hrs**

The Negotiable Instruments Act, 1881-Definition - Types of negotiable instruments–Bill of Exchange, Cheque, Promissory note- Classifications - Inland instruments - Foreign instruments- Bearer instruments- Order Instruments- Demand Instruments - Time Instruments - Ambiguous instruments - Meaning -Essentials. Criminal liability in Negotiable Instrument Act.

### **Unit III Legal Environment for Security Markets**

**12 Hrs**

Securities and Exchange Board of India Act, 1992 – Organization and Objectives of Securities and Exchange Board of India – Powers under Securities Contract Regulation Act, 1956 transferred to Securities and Exchange Board of India – Role of Securities and Exchange Board of India in controlling the security markets- Information Technology Act 2000-Non-Encumbrance in Share Markets.

### **Unit IV The Consumer Protection Act, 1986**

**12 Hrs**

The Consumer Protection Act, 1986 - Salient features - Definition - Rights of consumers – Grievance Redressal Machinery – District forum –State Commission –National Commission. Latest Amendments in Consumer Protection Act.

### **Unit V Regulatory Environment for International Business**

**12 Hrs**

Regulatory Framework of World Trade Organisation - Basic principles and Charter of World Trade Organisation- Provisions relating to preferential treatment of developing countries - Regional Groupings -Technical Standards - Anti- dumping duties and other Non-Tariff Barriers to Trade - Custom valuation.

### **Text Books:**

1. Dr. G.K. Varshney *Corporate Legal Framework*. Agra: SahityaBhawan Publications. 13<sup>th</sup> edition 2019
2. Kapoor, N.D. *Company Law*. New Delhi: Sultan Chand & Sons. 30<sup>th</sup> edition 2016

### **Books for Reference:**

1. Kapoor, N.D. *Company Law and Secretarial Practice* . New Delhi: Sultan Chand & Sons. 31st Edition :2020
2. Aswathappa. K. *Essentials of Business Environment*. Mumbai:Himalaya Publishing House. 15<sup>th</sup> edition 2019

<b>SEMESTER III</b>			
<b>CORE XI - DATA SCIENCE USING PYTHON</b>			
<b>Course Code: 21PCSC33</b>	<b>Hrs / week :4</b>	<b>Hrs / Sem: 60</b>	<b>Credits : 4</b>

**Course Objectives:**

- To enable the students to understand the concepts of data science and apply data analysis in various application areas
- To provide comprehensive knowledge of python programming paradigms required for Data Science.
- To perform a wide variety of mathematical operations on arrays using NumPy

**Course Outcomes:**

<b>CO.No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO Addressed</b>	<b>CL</b>
CO-1	explore the fundamental concepts of data science	4	An
CO-2	explain how data is collected, managed and stored for data science	4	Un
CO-3	visualize and present the inference using various tools	4	Ap
CO-4	evaluate the data analysis techniques for applications handling large data	4	Ap
CO-5	implement numerical programming, data handling and visualization through NumPy and Pandas	1	Ap
CO-6	understand and demonstrate the usage of universal functions and list of Arrays in Python	1	Ap
CO-7	understand the working of different data types and their related functions	1	Ap
CO-8	analyze the significance of python program development environment and apply it to solve real world applications	1,3	Un

**UNIT – I**

Introduction: What Is Data Science?- How Does Data Science Relate to Other Fields?- The Relationship between Data Science and Information Science- Data: Introduction- Data Types- Data Collections- Data Pre-processing–Techniques: Introduction – Data analysis and Data analytics- Descriptive Analysis- Diagnostic analytics-predictive analytics- prescriptive analytics-exploratory analysis – mechanistic analysis

**UNIT – II**

Tools for Data Science: UNIX: Introduction- Getting access to UNIX- Connecting to a UNIX server- Basic commands- Editing on UNIX- Redirecting and piping-Python: Introduction- Getting access to Python- Examples- Control structures- statistics essentials

### **UNIT – III**

Introduction to NumPy: Understanding Data Types in Python- The Basics of NumPy Arrays- Computation on NumPy Arrays: Universal Functions- Aggregations: Min, Max, and Everything in Between- Computation on Arrays: Broadcasting- Comparisons, Masks, and Boolean Logic- Fancy Indexing- Sorting Arrays- Structured Data: NumPy's Structured Arrays

### **UNIT – IV**

Data Manipulation with Pandas: Installing and using Pandas- Data Indexing and Selection- Operating on Data in Pandas- Handling Missing Data-Hierarchical Indexing-Combining Datasets-

### **UNIT – V**

Data Manipulation with Pandas: Aggregation and Grouping – Pivot Tables – Vectorized String Operations- Working with Time Series- High performance Pandas: `eval()` and `query()`

#### **Text Books:**

1. Chirag Shah. *A Hands-on Introduction to Data Science*. Cambridge University Press, 1<sup>st</sup> Edition 2020.
2. Jake VanderPlas. *Python Data Science Handbook Essential Tools for Working with Data*, O'Reilly Media, Inc., 1<sup>st</sup> Edition, 2016.

#### **Reference Books:**

1. Wes McKinney. *Python for Data Analysis*. O'Reilly Media, Inc., 1<sup>st</sup> Edition 2012.
2. Luca Massaron and John Paul Mueller. *Python for Data Science for dummies*. John Wiley & Sons, 2019.
3. Davy Cielen, Arno D.B. Meysman and Mohamed Ali. *Introducing Data Science: Big Data, Machine Learning, and More, using Python Tools*. Manning Publications, 2016.

<b>SEMESTER – III</b>			
<b>CORE XII - RESEARCH METHODOLOGY</b>			
<b>Course Code : 21PCSC34</b>	<b>Hrs / Week : 4</b>	<b>Hrs / Sem : 60</b>	<b>Credits : 4</b>

**Course Objectives:**

- To achieve outstanding scientific research in various areas of knowledge.
- To encourage distinguished research work through the creation of an attractive and stimulating environment to achieve goals.

**Course Outcomes:**

<b>CO.No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	demonstrate knowledge of research processes	8	An
CO-2	compare between methodologies and methods used in research work	8	An
CO-3	understand the fundamental concepts of research problem and research design	8	Un
CO-4	explain the concepts and procedures of sampling, data collection, analysis and reporting	3	Ap
CO-5	assess the basic function and working of analytical research tools used in computer science research	3	Re
CO-6	discuss different methodologies and techniques used in research work	8	An
CO-7	prepare a research report and examine the plagiarism and its types.	8	Ap
CO-8	apply the knowledge of teaching methods for its wide applicability.	8	Ap

**Unit - I**

Research Methodology– Introduction - Meaning of research – Objectives of research – Types of Research – Research Approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific Method – Research Process - Criteria of Good Research.

**Unit – II**

Research Problem – Selecting the Problem – Necessity of Defining the Problem – Technique involved in defining a problem – Meaning of Research Design – Features of a good design.

**Unit – III**

Sampling Design - Methods of Data Collection –Research Tools: Introduction – SPSS –



MATLAB – LaTeX – NS2 – R tool - Case Study: Presentation by students on their area of research

#### **Unit – IV**

Report writing and Thesis writing – Citations – Plagiarism – Types of Plagiarism – Tools for detecting Plagiarism – Ethical Issues within the research process – Intellectual Property Rights

#### **Unit – V**

Methodology of teaching – Objectives for teaching – Structure of teaching – Phases of teaching - Various teaching methods.

#### **Text Book:**

1. Kothari, C.R. *Research Methodology: Methods and Techniques*. New Delhi, New Age International, 2<sup>nd</sup> Edition, 2012.

#### **Reference Books:**

1. Janathan Anderson, Berry H. Durston and Millicent Poole. *Thesis and Assignment Writing*. Wiley Eastern Limited, 1992.
2. EhtiramRaza Khan and Huma Anwar. *Research Methods of Computer Science*. University Science Press, 1<sup>st</sup> Edition, 2016.
3. Dr.Prabhat Pandey and Dr.Meenu Mishra Pandey. *Research Methodology: Tools and Techniques*. Bridge Center, 1<sup>st</sup> Edition, 2015.

<b>SEMESTER – I</b>			
<b>ELECTIVE I     A- ADVANCED COMPUTER ARCHITECTURE</b>			
<b>Course Code : 21PCSE11</b>	<b>Hrs / Week : 4</b>	<b>Hrs / Sem : 60</b>	<b>Credits : 4</b>

### **Objectives:**

- To give the students a deep insight on the hardware organisation of a computer system.
- To understand various addressing modes.
- Learn the computer arithmetic principles and super scalar techniques
- Understand data storage and memory organisation

### **Course Outcomes:**

<b>CO. No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSOs Addressed</b>	<b>CL</b>
<b>CO-1</b>	understand the fundamental of computer structure.	3	Un
<b>CO-2</b>	perform computer arithmetic operations.	3,2	Ap
<b>CO-3</b>	apply the concept of cache mapping techniques.	3,1	Ap
<b>CO-4</b>	correlate the performance of I/O device	3	An
<b>CO-5</b>	conceptualize instruction level parallelism	3	An
<b>CO-6</b>	analyze different types of pipeline hazard	3	An
<b>CO-7</b>	apply various data transfer techniques in digital computer.	3,1	Ap
<b>CO-8</b>	analyze performance issues in processor and memory design of a digital computer.	5	An

### **UNIT I: Review of basics and ISA design**

CISC vs RISC - Performance measure of a computer: Performance measures, Performance parameters –Measuring the performance –Amdahl’s Law and CPU performance. Benchmarks for evaluating the performance.

Design factors - operand and opcode types – Instruction formats and addressing modes – compiler Issues – structure of modern compilers.

### **UNIT II: Pipelining**

Pipelining: Definition – Basic characteristics of pipelined processing – Functional structure of pipelined computer – pipelined processor design principles - Performance issues- different types of Pipeline hazards.

### **UNIT III: Parallelism**

Definition and types of parallelisms – Instruction level parallelism – Different types of dependencies in programs. – Dynamic scheduling – Scoreboarding – Tomasulo's approach – Branch prediction. Software Solution to ILP: Super Scalar architecture – static and dynamic scheduling on a super scalar architecture. VLIW architecture

### **UNIT IV: Shared Memory Architecture and Memory Organization**

Parallel processing Configurations – Flynn's classification – Centralized and distributed memory models. Communication models and memory architectures – Performance metrics for communication mechanisms- challenge- Cache coherence – Directory based cache coherence protocols. Memory hierarchy – strategies of Cache write – cache performance and improvements – Main Memory performance issues – Interleaved memory- Virtual Memory

### **UNIT V: Buses and I/O issues**

I/O: Storage types, Busses – Bus transactions – I/O device Performance metrics – Queuing theory – Bus Standards – I/O transfer using memory bus – Connecting bus to Cache –  
**Net Exam Related Problems**

#### **Text Book:**

1. K.A.Parthasarathy. *Advanced Computer Architecture*. Thomson Learning, Indian 2<sup>nd</sup> Edition, 2006.

#### **Reference Books:**

1. K. Hwang & F. A. Briggs. *Computer Architecture and Parallel Processing*. TMH, New Delhi 2004.
2. Kai Hwang & Naresh Jotwani. *Advanced Computer Architecture Parallelism, Scalability, Programmability*. McGraw Hill, 2<sup>nd</sup> Edition, 2011
3. D. Sima, T. Fountain & P. Kacsuk. *Advanced Computer Architectures*. Pearson Education.

SEMESTER- I			
ELECTIVE I B- CRYPTOGRAPHY AND NETWORK SECURITY			
Course Code: 21PCSE12	Hrs / week :4	Hrs / Sem: 60	Credits :4

### Objectives:

- To make the students to learn the fundamental concepts of cryptography and network security and utilize these techniques in computing system.
- To understand cryptography and network security concepts
- To develop the knowledge in cryptography theories, algorithms and systems

### Course Outcomes:

CO. No.	Upon Completion of this course, students will be able to	PSOs Addressed	CL
CO-1	understand the fundamental concepts of various encryption techniques	1,2	Un
CO-2	demonstrate the process to maintain the Confidentiality, Integrity and Availability of data	7	Ap
CO-3	distinguish between various algorithms for network security to protect against the threats in the networks	7	An
CO-4	apply the concept of Public key cryptography	1,7	Ap
CO-5	analyze solutions for effective key management and distribution	2,7	An
CO-6	apply and manage to secure a message over insecure channel by various means	7	Ap
CO-7	identify and apply the functional IP network security to protect against the threats in the networks	7	Ap
CO-8	explain the configuration of simple firewall architectures	7	Ap

### UNIT - I

Introduction: Information OSI Security Architecture - Security Attacks-Passive Attacks-Active Attacks-Security Services – Authentication-Access Control-Data Confidentiality-Data Integrity-Nonrepudiation-Availability Service-Security Mechanisms- Model for Network security

### UNIT - II

Classical Encryption Techniques -Symmetric Cipher Model- Substitution Techniques - Transposition Techniques - Block Ciphers and the Data Encryption Standard-Block Cipher Principles - The Data Encryption Standard -Strength of DES- Advanced Encryption Standard -Evaluation Criteria for AES- The AES Cipher

### **UNIT- III**

Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems - The RSA Algorithm- Key Management - Diffie-Hellman Key Exchange- Message Authentication and Hash Functions: Authentication Requirements-Authentication Functions -Message Authentication Codes - Hash Functions

### **UNIT - IV**

IP Security: IP security overview, IP security architecture, Authentication header, Encapsulating security pay load, combining security association, Key management-Web security considerations, Secure socket layer, Secure electronic transaction.

### **UNIT - V**

System Security: Intruders - Intrusion Detection - Password Management- Malicious software, Viruses and related threats, virus counter measures-Firewalls: Firewall Design Principles-Trusted Systems - Common Criteria for Information Technology Security Evaluation

#### **Text Book:**

1. William Stallings. *Cryptography and Network Security Principles and Practices*. 6<sup>th</sup> Edition, 2013.

#### **References Books:**

1. Behrouz A. Ferouzan. *Cryptography & Network Security*, Tata McGraw Hill, 2007.
2. Charlie Kaufman, Radia Perlman and Mike Speciner. *Network Security*. Prentice Hall of India, 2002.

<b>SEMESTER- II</b>			
<b>ELECTIVE II      A – ADVANCED COMPUTER NETWORKS</b>			
<b>Course Code: 21PCSE21</b>	<b>Hrs / week :4</b>	<b>Hrs / Semester: 60</b>	<b>Credits :4</b>

**Course Objectives:**

- To understand modern computer networks
- To familiarize routing algorithms
- To detect the technical problems in networking

**Course Outcomes:**

<b>CO. No.</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSOs Addressed</b>	<b>CL</b>
CO-1	describe the evolution and History of Wireless technology	7	Un
CO-2	analyse the wireless propagation channels.	7	An
CO-3	examine the Performance of ARQ Protocols, Ethernet LAN, Token Ring, RIP, TCP and UDP.	7	Ap
CO-4	identify the networking technologies and associated network standards.	7	An
CO-5	solve technical problems in ARQ protocols, MAC protocols and Routing Algorithm.	3,7	Ap
CO-6	construct the route discovery algorithm to determine the shortest path in an internet represented as a weighted graph.	2,7	Ap
CO-7	design and implement network architecture	7	An
CO-8	implementation of protocols like TCP, UDP and IP using OPNET and NS-2	7	Ap

**UNIT- I:      Wireless Services and Technical Challenges**

Types of Services- Requirements for the services,-Multipath propagation-Spectrum Limitations-Noise and Interference limited systems-Principles of Cellular networks,-Multiple Access Schemes.

**UNIT- II:      Wireless Propagation Channels**

Propagation Mechanisms (Qualitative treatment)- Propagation effects with mobile radio- Channel Classification- Link calculations-Narrowband and Wideband models.

**Unit III:      Internetworking devices and Data Link Layer**

Repeaters – Hubs – Switches – Bridges: Transparent and Source Routing– Routers- Logical Link Control – Error Detection Techniques – ARQ protocols – Framing – HDLC –

Point to Point protocol. Medium Access Control – Random access Protocols – Scheduling approaches to MAC.

**Unit IV: Local Area Networks& Wide Area Networks and Network Layer:**

Ethernet- Token Bus/Ring , FDDI – Virtual LAN ,WAN Technologies – Frame Relay, ATM, Wireless LAN. Internetworking – IP Addressing – Subnetting – IPv4 and IPv6– Routing – Distance Vector and Link State Routing – Routing Protocols.

**Unit V: Transport Layer and Application Layer**

Connection oriented and Connectionless Service – User Datagram Protocol – Transmission Control Protocol – Congestion Control –Domain Name System – Simple Mail Transfer Protocol – File Transfer Protocol – Hypertext Transfer Protocol .

**Text Books:**

1. Andreas.F. Molisch. *Wireless Communications*. John Wiley – India, 2006.
2. Alberto Leon-Garcia. *Communication Networks*. Tata McGraw-Hill, 2012.

**Reference Books:**

1. Simon Haykin and Michael Moher. *Modern Wireless Communications*. Pearson Education, 2007.
2. Rappaport. T.S. *Wireless communications*. Pearson Education, 2003.
3. W. Stallings. *Data and Computer Communications*. Prentice Hall, 2007.
4. Fred Halsall. *Data communications, Computer Networks and Open systems*. Addis Wesley 2006.
5. Behrouz A. Forouzan .*Data Communications and Networking*. McGraw Hill Companies, Inc., 4<sup>th</sup> Edition ,2007.

<b>SEMESTER- II</b>			
<b>ELECTIVE II</b>	<b>B - SOFT COMPUTING</b>		
<b>Course Code: 21PCSE22</b>	<b>Hrs / week :4</b>	<b>Hrs / Sem: 60</b>	<b>Credits :4</b>

**Course Objectives:**

- To solve real-world problems by providing approximate results that conventional and analytical models cannot solve.
- To understand the features, advantages and applications of Artificial Intelligence.
- To realize the revolution of artificial intelligence to develop hybrid systems for the industrial problems.

**Course Outcomes:**

<b>CO. No.</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSOs Addressed</b>	<b>CL</b>
CO-1	understand the concepts of Artificial Intelligence and neural networks,	1	Un
CO-2	categorize different learning algorithms	3	An
CO-3	analyze the classification taxonomy of NN	3	An
CO-4	compare different network models	7	An
CO-5	comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.	2	Ap
CO-6	implement the concepts of fuzzy sets, knowledge representation using fuzzy rules	2	An
CO-7	identify and define approximate reasoning, fuzzy inference systems, and fuzzy logic	1	An
CO-8	analyze the genetic algorithms and their applications	3	An

**UNIT – I: NEURAL NETWORKS FUNDAMENTALS**

Fundamentals of ANN: The Biological Neural Network, Artificial Neural Networks - Building Blocks of ANN and ANN terminologies: Architecture, setting of weights, activation functions-McCulloch-pitts Neuron Model-Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules – Hebbian Learning rule- Perceptron learning rule-Delta Learning Rule.

**UNIT – II: CATEGORIES OF NEURAL NETWORKS**

Models of ANN: Single layer perceptron- Architecture, Algorithm, application procedure. Feedback Networks: Hopfield Net and BAM - Feed Forward Networks: Back propagation Network (BPN) and Radial Basis Function Network (RBFN) - Self Organizing Feature Maps: SOM and LVQ.



### **UNIT – III: BASIC CONCEPTS OF FUZZY SET**

Fuzzy Sets, properties and operations - Fuzzy relations, cardinality, operations and properties of fuzzy relations, fuzzy composition

### **UNIT – IV: MEMBERSHIP FUNCTION & FIS**

Fuzzy variables - Types of membership functions - fuzzy rules: Takagi and Mamdani - fuzzy inference systems: fuzzification, inference, rule base, defuzzification.

### **UNIT-V: GENETIC ALGORITHMS**

Genetic Algorithm (GA): Biological terminology – elements of GA: encoding, types of selection, types of crossover, mutation, reinsertion – a simple genetic algorithm –General Genetic algorithm -The Schema Theorem - Classification of Genetic Algorithm - Applications of Genetic Algorithm.

#### **Text Books:**

1. S. N. Sivanandam, S. Sumathi and S.N. Deepa. *Introduction to Neural Networks using MATLAB 6.0*. Tata McGraw-Hill, New Delhi, 2006.
2. S. N. Sivanandam and S.N. Deepa. *Principles of Soft Computing*. Wiley-India, 2008.

#### **Reference Books:**

1. Simon Haykin. *Neural networks A Comprehensive Foundation*. Pearson Prentice Hall, 2005
2. S.Rajasekaran and G.A.V.Pai. *Neural Networks, Fuzzy Logic and Genetic Algorithms*. PHI, 2004.
3. S.N.Sivanandam and S.N.Deepa. *Introduction to Genetic Algorithms*. Springer, 2007.
4. Timothy J.Ross. *Fuzzy Logic with Engineering Application*. McGraw Hill, 2000.
5. Davis E.Goldberg. *Genetic Algorithms: Search, Optimization and Machine Learning*. Addison Wesley, N.Y., 2003.

<b>Semester –I</b>			
<b>Core - II                      ADVANCED MACROECONOMIC ANALYSIS- I</b>			
<b>Course Code: 21PECC12</b>	<b>Hrs / Week: 6</b>	<b>Hrs / Semester : 90</b>	<b>Credits : 4</b>

**Objectives:**

- To identify the determinants of various macroeconomic aggregates
- To evaluate the determinants of international trade and financial flows.
- To provide students with a broad overview of the aggregate economy.
- To expose the theories of economic growth and theories of the business cycle.

**Course Outcome:**

<b>CO. No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO - 1	analysis of the establishment of the functional relationship between the large aggregates.	7	Ap
CO - 2	understand the macroeconomic theoretical structure that is considered essential for the proper comprehension of the different issues and policies.	3	Ev
CO - 3	study of Macroeconomics and analysis of body of empirical economic knowledge.	6	Ap
CO - 4	understand the systemic facts and latest theoretical developments for empirical analysis.	5	An
CO - 5	identify the determinants of various macroeconomic aggregates such as output, unemployment, inflation, productivity and the major challenges associated with the measurement of these aggregates.	4	Un
CO - 6	discuss the linkages between financial markets and the real economy, and how these linkages influence the impact of economic policies over differing time horizons.	7	An
CO - 7	describe the main macroeconomic theories of short term fluctuations and long term growth in the economy.	1	Ap
CO - 8	critically evaluate the consequences of basic macroeconomic policy options under differing economic conditions within a business cycle.	3	Re

Semester –I			
Core - II		ADVANCED MACROECONOMIC ANALYSIS- I	
Course Code: 21PECC12	Hrs / Week: 6	Hrs / Semester : 90	Credits : 4

#### **UNIT-I: National Income and Accounts**

**15 Hrs**

Circular Flow of Income in two, three and four sector economy - Different forms of national income accounting - Social accounting - Input - Output accounting - Flow of funds accounting and Balance of payments accounting

#### **UNIT-II: Classical Model of Employment**

**15 Hrs**

Classical macroeconomics - Say's Law – Classical Model – Criticism

#### **UNIT-III: Consumption Function**

**20 Hrs**

Keynes' Psychological law of consumption-Implications of the law - short-run and long-run consumption function; Empirical evidence on consumption function - Income consumption relationship - Absolute income, relative income, life cycle and permanent income hypotheses

#### **UNIT-IV: Investment Function**

**20 Hrs**

Marginal efficiency of investment and level of investment - Marginal efficiency of capital and investment - Long run and short run factors - The accelerator and investment behavior - Influence of policy measures on investment

#### **UNIT-V: Neo-Classical and Keynesian Views on Interest**

**20 Hrs**

The IS-LM model; Extension of IS-LM model with government sector - Relative effectiveness of monetary and fiscal policies

#### **Text Book:**

Maria John Kennedy. *Macro Economic Theory*. New Delhi: PHI Learning, 2012.

#### **Books for Reference:**

1. Glahe Fred.R. *Macro Economics: Theory and Policy*, New York: Harcourt Brace Jovanovich Inc, 2000.
2. Laidler.D.E.W. *Demand for Money Theory and Evidence*. New York:Dum-Don Valley,1999.
3. Romer. D.L. *Advanced Macro Economics*. New York: McGraw Hill Company Limited, 2<sup>nd</sup> edition 1996
4. Shapiro.E. *Macro Economic Analysis*. New Delhi: Galgotia Publications1998
5. Ackley.G. *Macro Economics: Theory and Policy*. New York: Macmillan Publication, 2<sup>nd</sup> edition 1996.

<b>Semester– I</b>			
<b>Core - III</b>		<b>STATISTICS FOR ECONOMISTS- I</b>	
<b>Course Code: 21PECC13</b>	<b>Hrs/Week: 6</b>	<b>Hrs/ Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

- To introduce statistical methods and provide an insight into their uses in economics.
- To demonstrate application of a range of statistical techniques to economic problems.
- To understand that they will need to make informed decisions using data.
- To understand of the limitations of statistical inference and of the ethics of data analysis and statistics.

**Course Outcome:**

<b>CO. No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO Addressed</b>	<b>CL</b>
CO - 1	increase the skills in describing, analysing and interpreting statistical data	1	Le
CO - 2	make basic statistical calculations and critically evaluate the basis for these calculations;	8	Le
CO - 3	use graphical and numerical methods to calculate and illustrate descriptive statistics	2	Kn
CO - 4	identify the statistical concepts in questions about economic models	6	Ap
CO - 5	identify common problems which may affect regression analyses	4	Le
CO - 6	identify the appropriate regression model to apply to an economics dataset	2	Ap
CO - 7	manipulate the probability models that are most widely used in economics, and apply them correctly and carry out the appropriate statistical analysis	6	Kn
CO - 8	use the basic concepts of probability and bayes Theorem	7	Le

Semester– I			
Core - III STATISTICS FOR ECONOMISTS- I			
Course Code: 21PECC13	Hrs/Week: 6	Hrs/ Semester: 90	Credits: 4

**UNIT-I: Measures of Averages and Dispersion**

**15 Hrs**

Measures of central tendency – Mean, Median, Mode Measures of Dispersion – M.D., Q.D. and S.D and relative measures of dispersion application of averages and dispersion

**UNIT-II: Correlation and Regression**

**20 Hrs**

Meaning, assumptions and limitations of simple correlation and regression analysis – Pearson's product moment and Spearman's rank correlation co-efficient – Concept of least squares and the regression lines

**UNIT-III: Analysis of Time Series**

**15 Hrs**

Uses – Components – Measurement – Methods of Moving Average – Semi Average – Method of least squares- Seasonal Variations and its Measurements

**UNIT-IV: Probability**

**20 Hrs**

Various types of events – Classical and empirical definitions of probability, Laws of addition and multiplication, conditional probability and concept of interdependence, Baye's theorem and its applications- Probability Distribution-Binomial, Poisson and Normal distribution

**UNIT-V: Theory of Estimation and Testing of Hypothesis**

**20 Hrs**

Properties of a good estimator, formulation of statistical hypotheses – Null and alternative, Goodness of fit, confidence intervals and level of significance - Type I and Type II errors - Hypothesis testing Z, t,  $\chi^2$  (chi-square) and F-test

**Text Book:**

Gupta, S.P., *Statistical Methods*. New Delhi: S.Chand& Sons Ltd, 1<sup>st</sup> edition 2001

**Books for Reference**

1. Gupta, S.C., *Fundamentals of Applied Statistics*. New Delhi: S.Chand& Sons
2. Speigal. M.R., *Theory and Problems and Statistics*. London: McGraw Hill Book Co.,
3. R.S.N. Pillai & Bagavathi. *Statistics*. New Delhi: S.Chand &Company Ltd, 2006

<b>Semester – II</b>			
<b>Core - VII                      ADVANCED MACRO ECONOMIC ANALYSIS- II</b>			
<b>Course Code: 21PECC22</b>	<b>Hrs/Week: 5</b>	<b>Hrs/ Semester: 75</b>	<b>Credits: 4</b>

**Objectives:**

- To learn the fundamentals of economics and they can apply these concepts to their lives and to the world in which they live
- To identify the determinants of various macroeconomic aggregates such as output, unemployment, inflation, productivity and the major challenges associated with the measurement of these aggregates.
- To understand the prevailing economic and business policy in totality and its impact on the energy sector.
- To apply economic concepts to complex business realities as well as support them to forecast in the energy business.

<b>CO. No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO - 1	analyse of the establishment of the functional relationship between the large aggregates.	2	Le
CO - 2	understand the macroeconomic theoretical structure that is considered essential for the proper comprehension of the different issues and policies.	4	Kn
CO - 3	study of Macroeconomics and analysis of body of empirical economic knowledge.	1	Kn
CO - 4	understand the systemic facts and latest theoretical developments for empirical analysis.	4	Un
CO - 5	students will be able to identify the determinants of various macroeconomic aggregates such as output, unemployment, inflation, productivity and the major challenges associated with the measurement of these aggregates.	7	Kn
CO - 6	students will be able to discuss the linkages between financial markets and the real economy, and how these linkages influence the impact of economic policies over differing time horizons.	3	Le
CO - 7	students will be able to describe the main macroeconomic theories of short term fluctuations and long term growth in the economy.	6	Kn
CO - 8	students will be able to critically evaluate the consequences of basic macroeconomic policy options under differing economic conditions within a business cycle.	4	Ap



<b>Semester – II</b>			
<b>Core - VIII</b>		<b>STATISTICS FOR ECONOMISTS- II</b>	
<b>Course Code: 21PECC23</b>	<b>Hrs/Week: 5</b>	<b>Hrs/ Semester: 75</b>	<b>Credits: 4</b>

**Objectives:**

- To introduce statistical methods and provide an insight into their uses in economics
- To develop the skills required to work effectively and inclusively in groups, as in a real work environment.
- To write effectively and communicate their ideas regarding Descriptive & Inferential statistics with clarity.
- To understand and know how to use statistics in their research work.

**Course Outcome:**

<b>CO. No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO - 1	increase the skills in describing, analysing and interpreting statistical data	1	Le
CO - 2	make basic statistical calculations and critically evaluate the basis for these calculations;	8	Le
CO - 3	use graphical and numerical methods to calculate and illustrate descriptive statistics	2	Kn
CO - 4	identify the statistical concepts in questions about economic models	6	Ap
CO - 5	identify common problems which may affect regression analyses	4	Re
CO - 6	identify the appropriate regression model to apply to an economics dataset	12	Un
CO - 7	manipulate the probability models that are most widely used in economics, and apply them correctly and carry out the appropriate statistical analysis	16	Kn
CO - 8	use the basic concepts of probability and Bayes Theorem	17	Le



Semester – II			
Core - VIII		STATISTICS FOR ECONOMISTS- II	
Course Code: 21PECC23	Hrs/Week: 5	Hrs/ Semester: 75	Credits: 4

#### **UNIT-I: Industrial Statistics**

**15 Hrs**

Process and product control - general theory of control charts - different types of control charts for variables and attributes – Concept of Reliability – failure rate and reliability functions – reliability of series and Parallel systems and other simple configurations – renewal density and functions.

#### **UNIT-II: Optimization Techniques**

**15 Hrs**

Different types of models in Operations Research – their construction and general methods of solution – simulation and Monte – Carlo methods formulation of Linear Programming problem – Simple LP model and its graphical solution, the simple procedure, the two phase method and the M technique with artificial variables.

#### **UNIT-III: Quantitative Economics**

**15 Hrs**

Determination of trend – Seasonal and Cyclical components – Box-Jenkins method – Tests for stationary series – ARIMA models and determination of orders of autoregressive and moving average components – forecasting.

#### **UNIT-IV: Index Number**

**15 Hrs**

Commonly used Index number – Laspeyre's, Paasche's and Fisher's Ideal Index numbers – Cham-base Index number, Uses and Limitations of Index numbers, Index number of Wholesale prices- Consumer price – Agricultural production and Industrial production- test for index numbers – Proportionality, Time- reversal and circular.

#### **UNIT-V: Linear Model**

**15 Hrs**

Ordinary least square and generalised least squares methods of estimation – problem of multi- collinearity – consequences and solutions of multi- collinearity, consequences and solutions of multi- collinearity – auto correlation and its consequences – Heteroscedasticity of disturbances and its testing.

#### **Text Book:**

Gupta, S.P. *Statistical Methods*. New Delhi: S.Chand & Sons Ltd, 2<sup>nd</sup> edition 2001

#### **Books for Reference**

1. Gupta, S.C. *Fundamentals of Applied Statistics*. New Delhi: S.Chand & Sons Ltd, 1993
2. Speigal. M.R. *Theory and Problems and Statistics*. London: McGraw Hill Book Co. 1992
3. R.S.N. Pillai & Bagavathi. *Statistics*. New Delhi: S. Chand & Company Ltd, 2<sup>nd</sup> edition, 2000

<b>Semester – III</b>			
<b>Core –XIV</b>		<b>RESEARCH METHODOLOGY</b>	
<b>Course Code: 21PECC 34</b>	<b>Hrs/Week: 5</b>	<b>Hrs/ Semester: 75</b>	<b>Credits: 4</b>

**Objectives:**

- Research is a careful and detailed study of a particular problem or concern, using scientific methods.
- The main objective of research is to explore the unknown and unlock new possibilities.
- It helps the students to pursue further research such as M.Phil. & Ph.D.
- To make the students to know the basic concepts and methods in methodology.
- To make them learn about the use of computer in research.

<b>CO. No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO - 1	understand a general definition of research design.	5	Le
CO - 2	know why educational research is undertaken, and the audiences that profit from research studies.	3	Kn
CO - 3	identify the overall process of designing a research study from its inception to its report.	1	Un
CO - 4	be familiar with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research	2	Kn
CO - 5	Know the primary characteristics of quantitative research and qualitative research.	2	Le
CO - 6	identify a research problem stated in a study.	4	Kn
CO - 7	familiar with how to write a good introduction to an educational research study and the components that comprise such an introduction	6	Ap
CO - 8	distinguish a purpose statement, a research question or hypothesis, and a research objective.	4	Un

Semester – III			
Core – XIV		RESEARCH METHODOLOGY	
Course Code: 21PECC 34	Hrs/Week: 5	Hrs/ Semester: 75	Credits: 4

#### **UNIT-I: Research Formulation and Design** **15Hrs**

Motivation and objectives – Research methods vs. Methodology-Types of research – Descriptive vs. Analytical-Applied vs. Fundamental-Quantitative vs. Qualitative-Conceptual vs. Empirical-concept of applied and basic research process- criteria of good research.

#### **UNIT-II: Collection of Data** **15 Hrs**

Types of Data: Primary and Secondary data - Methods of collection of Primary Data: Direct Personal Investigation, Indirect oral investigation, Information received through local agents, key informants, correspondents and mailed questionnaire - Secondary data: Sources, Limitations of Secondary Data - Precautions in the use of Secondary Data

#### **UNIT-III: Processing and Analysis of Data** **15 Hrs**

Editing, Coding, Classification, Objects, Rules, Tabulation, Preparation of a statistical table- Requisites of a good table - Types of Tables: Format of a simple one way table and three way tables

#### **UNIT-IV: Testing of Hypothesis** **15 Hrs**

Definition of Hypothesis, Characteristics, source of Hypothesis – Formulation of Hypothesis - Importance of Hypothesis – Pre-requisites for testing of Hypothesis, testing of Hypothesis, Types of errors in testing of Hypothesis, Level of significance

#### **UNIT-V: Report Writing** **15 Hrs**

Reporting - Requirements and mechanics of Report writing -Meaning of Interpretation- Technique of Interpretation-Precaution in Interpretation-Significance of Report Writing- Different Steps in Writing Report-Layout of the Research Report-Types of Reports-Oral Presentation-Research Reports-Conclusions.

#### **Text Book:**

Kothari, C.R. *Research Methodology*. New Delhi: Himalayas Publications, 2<sup>nd</sup> edition 2013.

#### **Reference Books:**

1. Cohen, M.R. and Nagal. *Introduction to Logic and Scientific methods Book-II*. Ireland:Madison Publications, 2<sup>nd</sup> edition 1934
2. Good and Halt. *Methods in Social Research*. New Delhi:S.Chand Publications,4<sup>th</sup> edition1993
3. Kurien C.T.A. *Guide to Research in Economics*.New Delhi:S.Chand Publications. 2013

<b>Semester– IV</b>			
<b>Core -XIX</b>		<b>DIGITAL ECONOMY</b>	
<b>Course Code: 21PECC44</b>	<b>Hrs/Week: 6</b>	<b>Hrs/ Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

- To know main technologies of Digital Economy, the role of them in a company's functioning.
- To analyse the influence of Digital Economy on world economy.
- To evaluate risks of Digital Economy's functioning. Understand perspectives and problems of using digital technologies.

<b>CO. No</b>	<b>Upon Completion of this course, students will be Able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO - 1	able to know the fundamentals of the digital economy	6	Kn
CO - 2	familiarized with the nature and extent of the global digital economy today	7	Kn
CO - 3	able to evaluate the various challenges that the globalization of digital economy presents	2	Le
CO - 4	having a framework for analyzing advancement in technological innovation in the global	4	Ap
CO - 5	aware of the likely global implications of digital economy development in the future economy.	6	Kn
CO - 6	Development and global scope of digital economy,	3	Kn
CO - 7	Contemporary and potential challenges arising from global digital transformation	5	Kn
CO - 8	Future opportunities and implications related to digital economy expansion.	7	Le

Semester– IV			
Core - XIX		DIGITAL ECONOMY	
Course Code: 21PECC 44	Hrs/Week: 6	Hrs/ Semester: 90	Credits: 4

### UNIT- I: Introduction

20 Hrs

Meaning of Digital economy-digital economy and its components-Importance of digital economy- Transformation of the real economy into digital economy- Role of technology revolution in the world economy- Knowledge economy vs. Digital economy- Advantages and disadvantages of the digital economy

### UNIT- II: Digital Innovation

15 Hrs

Digital innovation and its impact on economic growth- Importance of digital innovation - low code support digital innovation-digital business innovation-digital transformation- difference between digital innovation and digital transformation- Concept of the Fourth Industrial Revolution

### UNIT-III: Digital Economy's Ecosystem

15 Hrs

Digital ecosystem- digital business ecosystem- a new regulatory framework for the digital ecosystem-features of digital ecosystem-challenges to digital ecosystems-Implications for competitive strategy-digital platform ecosystem

### UNIT-IV: Households in the Digital Economy

15 Hrs

Individualization of products and services- changing structure of consumption-potential for economic participation- Digital economy's social impact - The digital divide - Key factors of globalization and economic growth in the digital age.

### UNIT-V: States in the Digital Economy in India

20 Hrs

E-government, e-public service-digital enabling- evolving governance frameworks relevant to the digital economy – History of digital economy in India-Role of digital economy in India-challenges of digital economy in India – Importance of digital economy in India – presentation on digital economy in India

#### Text Book:

David L. Rogers.*The Digital Transformation Playbook*.New Delhi: Sultan Chand and Co,2<sup>nd</sup> edition 2000

#### Reference Book:

1. Jan A. Audestad.*Digital Economics*. Mumbai: Springer Nature Publications, 1<sup>st</sup> edition 2015.
2. T.L. Mesenbourg.*Measuring the Digital Economy In India*. Chennai: Sung Publications, 2<sup>nd</sup> edition 2001.
3. Avi Goldfarb, Shane Greenstein and Catherine Tucker. *Economic Analysis of the Digital Economy*. New Delhi: Arup & Sons, Publications, 2003
4. Eric Brousseau. Nicolas Curien.*Internet and Digital Economics: Principles, Methods and Applications*.New Delhi : Virinda Publication Pvt. Ltd 2008

<b>SEMESTER – I</b>			
<b>Core I - British Poetry</b>			
<b>Course Code: 21PENC11</b>	<b>Hrs / Week: 6</b>	<b>Hrs / Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

To familiarise students with significant poets of the British Literature.

To orient students with the moral and the cultural aesthetics of British Poetry.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO- 1	understand the unique features of British Poetry.	3	Un
CO- 2	comprehend the moral and aesthetic sensibility of British poetry.	1,8	Un
CO-3	discuss British poetry from the earliest era to the 20 <sup>th</sup> century.	1,2	An
CO-4	critically analyse poems from the social, political and cultural perspectives.	1,2	An
CO-5	analyse the influence of varied cultures on the development of early British Literature.	3	An
CO-6	discuss literary texts in their social, political, historical and cultural contexts	2	An
CO-7	analyse the wide range of themes and styles of the representative poets.	1, 2	An
CO-8	develop their ability to interpret, analyse and evaluate poems.	2	Ev

SEMESTER – I			
Core I- British Poetry			
Course Code: 21PENC11	Hrs/Week: 6	Hrs/Sem:90	Credits : 4

### Unit I

- Geoffrey Chaucer (1343-1400) : The Prologue to ‘The Canterbury Tales’  
 Edmund Spenser (1552-1599) : Amoretti- Sonnets (22 & 75)

### Unit II

- John Donne (1572-1631) : A Valediction: Forbidding Mourning  
 John Milton (1608-1674) : *Paradise Lost –Book I*  
 John Dryden (1631-1700) : Mac Flecknoe

### Unit III

- William Wordsworth (1770-1850) : Michael  
 Samuel Taylor Coleridge (1772-1834): Dejection: An Ode  
 Percy Bysshe Shelley (1792-1822) : Ode to the West Wind

### Unit IV

- Matthew Arnold (1822-1888) : The Scholar Gypsy  
 D.G. Rossetti (1828-1882) : The Blessed Damozel  
 Robert Bridges (1844-1930) : Eros

### Unit V

- T.S. Eliot (1888-1965) : The Waste Land (Part I – The Burial of the Dead)  
 Wilfred Owen (1893-1918) : The Parable of the Old Man and the Young  
 W. H. Auden (1907-1973) : The Unknown Citizen

### Text Books:

1. Lynch, Jack, ed. *The Oxford Handbook of British Poetry*. London: Oxford University Press, 2016.
2. Sen, Sudeep, ed. *The Harper Collins Book of English Poetry*. New Delhi: Harper Collins India, 2012.

### Books for Reference:

1. Gardiner, Helen. *The Metaphysical Poets*. Michigan: Penguin Book, 1967.
2. Morris, Helen. *Elizabethan Literature*. London: Oxford UP, 1956.
3. Saintsbury, George. *Elizabethan Literature*. London: Macmillan and Co. 1887.
4. Stephen Meyer Howard Abrams, eds. *The Norton Anthology of English Literature*. Vol.2. New York: W.W. Norton, 2006.

### **E-Learning Resources:**

1. Shires, Linda M. "Victorian' Poetry at the Present Time." *Victorian Literature and Culture*, vol.36, no.1, 2008, pp. 269–281. *JSTOR*, [www.jstor.org/stable/40347606](http://www.jstor.org/stable/40347606). 26 Feb. 2021.
2. Green, Eugene. "The Voices of the Pilgrims in the General Prologue to the Canterbury Tales." *Style*, vol. 9, no. 1, 1975, pp. 55–81. *JSTOR*. [www.jstor.org/stable/45108348](http://www.jstor.org/stable/45108348). 15 Jan. 2021.



<b>SEMESTER - I</b>			
<b>Core II</b>		<b>British Prose</b>	
<b>Course Code: 21PENC12</b>	<b>Hrs / Week: 6</b>	<b>Hrs / Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

To facilitate students to gain insight into some of the unique contributions of British prose writers.

To enable students acquire analytical and critical ideas of the representative writers of the age.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO- 1	acquire a comprehensive knowledge of British prose.	1,3	Re
CO-2	gain a deeper understanding of the historical and cultural contexts of British prose pieces.	4,1	Un
CO-3	identify and describe the distinct literary characteristics of British prose.	2	Ap
CO-4	relate the greatness of major prose writers with significant literary traditions of their age.	1,4	An
CO-5	classify the dimensions of British literature in the universal context.	6	An
CO-6	evaluate the specific features of prose texts.	3, 4	Ev
CO- 7	communicate ideas related to the distinct characteristics of British prose.	8	Ev
CO- 8	get necessary impetus to study more representative prose writers.	1,2	Cr

SEMESTER – I			
Core II - British Prose			
Course Code: 21PENC12	Hrs/Week: 6	Hrs/Sem:90	Credits : 4

### Unit I

Francis Bacon (1561-1626) : Of Marriage and Single Life  
Of Simulation and Dissimulation  
Jonathan Swift (1667-1745) : Tale of a Tub (Section II)

### Unit II

Oliver Goldsmith (1728-1774) : Citizen of the World (The Tibbses)  
Thomas De Quincey (1775-859) : On the Knocking at the gate in Macbeth

### Unit III

Charles Lamb (1775-1834) : A Dissertation Upon Roast Pig  
William Hazlitt (1778-1830) : On the Ignorance of the Learned  
Thomas Carlyle (1795-1881) : Past and Present (Book I Proem: Chapters 5 & 6)

### Unit IV

John Henry Newman (1801-1890) : Literature  
John Ruskin (1819-1900) : Of Queen's Gardens (Sesame and Lilies)  
Bertrand Russell (1872-1970) : Proposed Roads to Freedom (Chapter 8)

### Unit V

L. P. Jacks (1860-1955) : On a Much Neglected Virtue (The Human End)  
E. M. Forster (1879-1970) : What I Believe  
Aldous Huxley (1894-1963) : Work and Leisure

### Text Books:

1. Hazlitt, William. *Essays of William Hazlitt*. New Delhi: Nabu Press, 2008.
2. Lamb, Charles. *Charles Lamb's Essays*. New Delhi: Nabu Press, 2008.
3. Nayar. M.G. ed. *A Galaxy of English Essayists From Bacon to Beerbohm*. New Delhi: Macmillan India Ltd., 1986.

### Books for Reference:

1. Greenblatt, Stephen, Meyer Howard Abrams, eds. *The Norton Anthology of English Literature*. Vol. 2. New York: Norton, 2006.
2. Muthaiah, V.S. *Modern Prose Selections*. Chennai: B.I. Publications, 1976.
3. Peppiatt, Michael. *Francis Bacon: Anatomy of an Enigma*. New York: Farrar, Straus and Giroux, 1997.
4. Sinha, Susantha. K. ed. *English Essayists*. Bangalore: Oxford University Press, 1987.
5. William, Haydn Noore. *English Prose Down the Ages*. Madras: Blackie & Son Ltd. 1973.

## E- Resources:

1. Adams, Robert Martin. "Jonathan Swift, Thomas Swift, and the Authorship of 'A Tale of a Tub.'" *Modern Philology*, vol. 64, no. 3, 1967, pp. 198–232. *JSTOR*, [www.jstor.org/stable/436718](http://www.jstor.org/stable/436718). 12 Dec. 2020.
2. Brooks, Christopher. "Goldsmith's Citizen of the World: Knowledge and the Imposture of 'Orientalism.'" *Texas Studies in Literature and Language*, vol. 35, no. 1, 1993, pp. 124–144. *JSTOR*, [www.jstor.org/stable/40755003](http://www.jstor.org/stable/40755003). 23 Nov. 2020.
3. Dike, Clarence S. "The Humor of 'Roast Pig.'" *The English Journal*, vol. 11, no. 5, 1922, pp. 288–292. *JSTOR*, [www.jstor.org/stable/801881](http://www.jstor.org/stable/801881). 15 Jan. 2021.
4. Ulrich, John. "The Re-Inscription of Labor in Carlyle's 'Past and Present.'" *Criticism*, vol. 37, no. 3, 1995, pp. 443–468. *JSTOR*, [www.jstor.org/stable/23116609](http://www.jstor.org/stable/23116609). 11 Feb. 2021.

<b>SEMESTER – I</b>			
<b>Core III</b>		<b>Indian Writing in English</b>	
<b>Course Code: 21PENC13</b>	<b>Hrs / Week: 6</b>	<b>Hrs / Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

To enable students to widen their knowledge of Indian Writing in English.

To acquaint the students with a wide spectrum of Indian writers in English.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO- 1	perceive the values and human concern inherent in the Indian cultural context.	1,5	Re
CO- 2	acquire the philosophy of Indian theorists and intellectuals.	3,2	Un
CO- 3	analyse the major movements and writers of Indian Literature in English.	1	Un
CO- 4	learn the meaning of 'Indianness' through the study of the representative works.	1,2	Un
CO- 5	explore Indian identity, values and morals.	4	An
CO- 6	appraise the wide spectrum of Indian writing in English.	4	An
CO- 7	modify Indian sensibility and contrive new vistas to the issues at hand.	8	Ev
CO- 8	create literary sensibility and generate emotional response by reading Indian literary texts.	2,5	Cr

SEMESTER – I			
Core III		Indian Writing in English	
Course Code: 21PENC13	Hrs / Week: 6	Hrs / Semester: 90	Credits: 4

### Unit I - Poetry

Nissim Ezekiel (1924-2004)	: Background Casually
Dom Moraes (1938-2004)	: Letter to the Mother
Gieve Patel (b1940)	: Nariyal Purnima
Vikram Seth (b1952)	: From California

### Unit II – Prose

Bhabani Bhattacharya (1906-1988)	: Vivekananda's World Mission
Nirad. C. Chaudri (1925-1999)	: The World's Knowledge of India since 1947
A.P.J. Abdul Kalam (1931-2015)	: Patriotism beyond Politics and Religion

### Unit III - Drama

Mahesh Dattani (b.1958- )	: <i>Final Solutions</i>
Badal Sircar (1925 – 2011)	: <i>Evam Indrajit</i>

### Unit IV – Fiction

Gita Mehta (b.1943-)	: <i>A River Sudra</i>
Deepak Unnikrishnan (b.1980-)	: <i>Temporary People</i>

### Unit V - Short Story

Mahasweta Devi (b1926)	: Draupadhi
Jhumpa Lahiri (b1967)	: When Mr. Pirzada Came to Dine (Self Study)
Aravind Adiga (b1974)	: Last Christmas in Bandra

### Text Books:

1. Bruce, King. *Modern Indian Poetry in English*. New Delhi: Oxford University Press, 2001.
2. Dattani, Mahesh. *Final Solutions*. New Delhi: Penguin India, 2005.
3. Mehta, Gita. *A River Sudra*. New Delhi: Penguin India, 2000.
3. Sircar, Badal. *Evam Indrajit*. New Delhi: Surjeet Publications, 2018.
4. Unnikrishnan, Deepak. *Temporary People*. New Delhi : Penguin India, 2017.

### Books for Reference:

1. De Souza, Eunice, ed. *Nine Indian Women Poets – An Anthology*. OUP, 1997.
2. Iyengar, K.R. Srinivasa. *Indian Writing in English*. New Delhi: Sterling Publishers, 1994.
3. Naik, M.K. *Aspects of Indian Writing in English*. Delhi: Macmillan, 1979.
4. Naik, M. K. et al., eds. *Critical Essays on Indian Writing in English*. Dharwar, 1968.
5. Naik, M. K. *History of Indian English Literature*. New Delhi: Sahitya Akademi, 1982.
6. Peeradina, Saleem. *Contemporary Indian Poetry in English- An Assessment and Selection*. Macmillan Co. of India, 1972.

7. Sinha, Krishna Nandan. *Indian Writing in English*. New Delhi: Heritage Publishers, 1979.
8. Walsh, William. *Indian Literature*. London: Longman Group Ltd., 1990.

**E-Learning Resources:**

1. Amalendu, Bose. "Modern Indian Poetry in English". vol. 13, no. 1, JSTOR, 1970, pp. 51-59, [www.jstor.org/](http://www.jstor.org/) 21 Jan. 2021.
2. Parmar, Diren. (2019). "Mahesh Dattani's *Final Solutions*: an Analytical Study". vol. 8 no. 8, 2019, *IJHSSI*, [www.ijhssi.org/](http://www.ijhssi.org/) 12 Dec. 2021.
3. Sowmya, T.G. "Feminist Outlook in *That Long Silence* of Shashi Deshpande" vol. II, no. XIX, August 2016, Ashvamegh, [www.ashvamegh.net/](http://www.ashvamegh.net/) 10 Jan. 2021.

<b>SEMESTER – I</b>			
<b>Core IV</b>		<b>American Literature</b>	
<b>Course Code : 21PENC14</b>	<b>Hrs / Week: 6</b>	<b>Hrs / Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

To widen the knowledge of the students on the perceptions of the American writers about the social, cultural and the intellectual climate of the nation.

To study primary texts of American Literature with broader investigations into the conceptual, theoretical and cultural parameters of the literary history of the United States.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO-1	locate the significance of the American literary tradition.	1,4,7	Re
CO-2	examine the works of the representative writers of American Literature.	1,2	Un
CO-3	articulate the historical and the socio-cultural background of American Literature.	3	Ap
CO-4	appraise the historical and literary contexts, genres, themes and ethical dimensions of the representative works of American literature.	4	An
CO-5	distinguish a diverse group of authors and reveal the evolving American experience and character.	1,3	An
CO-6	analyse the major movements and works of American Literature.	4	An
CO-7	evaluate the strengths and limitations of the major trends in American Literature.	5,7	Ev
CO-8	review the roles of gender, race, age, class, ethnicity and geography in creating American ethnic literature.	6,8	Ev

SEMESTER – I			
Core IV		American Literature	
Course Code: 21PENC14	Hrs / Week: 6	Hrs / Semester: 90	Credits: 4

### Unit I – Poetry

Walt Whitman (1819-1892)	: As I Ebb'd with the Ocean of Life
Emily Dickinson (1830-1886)	: I Measure Every Grief I Meet
Robert Frost (1874-1963)	: Directive
Langston Hughes (1902-1967)	: Afro-American Fragment
Sylvia Plath (1932-1963)	: Colossus

### Unit II - Prose

Ralph Waldo Emerson (1803-1882)	: Self Reliance
Alain Locke (1886-1954)	: The New Negro

### Unit III - Drama

Amiri Baraka (1934-2014)	: <i>A Black Mass</i>
Arthur Miller (1915-2005)	: <i>Death of a Salesman</i>

### Unit IV - Fiction

F. Scott Fitzgerald (1896-1940)	: <i>The Great Gatsby</i>
Colson Whitehead (b.1969- )	: <i>The Underground Railroad</i>

### Unit V - Short Story

Edgar Allan Poe (1809- 1849)	: The Black Cat
Herman Melville (1819-1891)	: Bartleby the Scrivener (Self Study)
Flannery O' Connor (1925-1964)	: A Late Encounter with the Enemy

### Text Books:

1. Baraka, Amiri. *A Black Mass*. US: Marion Boyars, 2000.
2. Miller, Arthur. *Death of a Salesman*. London: Penguin Books, 1948.
3. Whitehead, Colson. *The Underground Railroad*. New York: Penguin Random House LLC, 2016.
4. Fitzgerald, F. Scott. *The Great Gatsby*. London: Charles Scribner's Sons, 1925.

### Books for Reference:

1. Baym, Nina, Wayne Franklin, Philip F. Gura, et al.eds. *The Norton Anthology of American Literature*. Shorter 7th ed. UK: W. W. Norton & Company, 2007.
2. Gray, Richard. *A History of American Literature*. West Sussex: Blackwell Publishing Ltd., 2012.
3. Oliver, Egbert S, ed. *American Literature: An Anthology (Vols. 1 & 2)*. Chennai: S. Chand & Company, 1967.
4. Parrington, Jr. Vernon L. *American Dreams: A Study of American Utopias*. Providence: Brown University, 1947.



**E- Resources:**

1. Kane, Joseph, and Joe Kane. *The Arthur Miller Journal*, vol. 4, no. 1, 2009, pp. 48–53. *JSTOR*, [www.jstor.org/stable/42908974](http://www.jstor.org/stable/42908974). 23. Feb. 2021.
2. Kelly, Adam. (2018). *Freedom to Struggle : The Ironies of Colson Whitehead*. *Open Library of Humanities*. 4. 10.16995/olh.332. 29 Nov. 2020.

<b>SEMESTER – II</b>			
<b>Core VI</b>		<b>British Drama</b>	
<b>Course Code : 21PENC21</b>	<b>Hrs/week :5</b>	<b>Hrs/Sem : 75</b>	<b>Credits : 4</b>

**Objectives:**

To enable the students relish the taste of British Drama.

To enhance critical outlook on the representative dramatists.

**Course Outcome:**

<b>CO.No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO Addressed</b>	<b>Cognitive Level</b>
CO-1	get a comprehensive picture of the contemporary age.	3,4	Un
CO- 2	apply the concepts of British Drama in drafting a play.	3,8	Ap
CO- 3	analyse the representative plays in British Literature.	4	An
CO- 4	discuss the aesthetic, cultural and historical aspects of British Drama.	3,4	An
CO- 5	analyse the unique differences pertaining to the theme and stylistic features of British Drama.	5	An
CO- 6	evaluate the artistic and innovative use of language employed by the representative dramatists.	6,8	Ev
CO- 7	improve the skills of critical thinking, elucidation and effective writing.	3	Cr
CO-8	develop a critical outlook in analysing the plays.	2	Cr

SEMESTER – II			
Core VI		British Drama	
Course Code : 21PENC21	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

### Unit I

Ben Jonson (1572-1637) : *The Alchemist*

### Unit II

R. B. Sheridan (1751 – 1816) : *The Rivals*

### Unit III

George Bernard Shaw (1856 – 1950) : *Pygmalion*

### Unit IV

T. S. Eliot (1888 – 1965) : *Murder in the Cathedral*

### Unit V

John Osborne (1929 – 1994) : *Look Back in Anger*

### Text Books:

1. Eliot, T. S. *Murder in the Cathedral*. New York: Faber & Faber, 1938.
2. Jonson, Ben. *The Alchemist*. Glasgow: Good Press, 2019.
3. Osborne, John. *Look Back in Anger: A Drama*. New York: Penguin Books, 1982.
4. Shaw, Bernard. *Pygmalion*. Clayton: Prestwick House, 2005.
5. Sheridan, Richard Brinsley. *The Rivals: A Comedy*. UK: Bloomsbury Publications, 1823.

### Books for Reference:

1. Gardner, Helen. *The Art of T.S. Eliot*. US: Faber Paperbacks, 1968.
2. Shaw, Bernard. *Androcles and the Lion: Overruled: Pygmalion*. HardPress Publishing, 2013.
3. Sheridan, Richard Brinsley, and Joseph Knight. *The Dramatic Works of Richard Brinsley Sheridan with an Introduction by Joseph Knight*. Oxford University Press, 1930.

### E- Resources:

1. Avery, Helen P. "The Family Reunion' Reconsidered." *Educational Theatre Journal*, vol. 17, no. 1, 1965, pp. 10–18. *JSTOR*, www.jstor.org/stable/3204921. 12 Sep. 2020.
2. Reynolds, Jean. "Shaw's *Pygmalion*: The Play's the Thing." *Shaw*, vol. 36, no. 2, 2016, pp. 238– 255. *JSTOR*, www.jstor.org/stable/10.5325/shaw.36.2.0238. 01 Oct. 2020.
3. Shanahan, John. "Ben Jonson's 'Alchemist' and Early Modern Laboratory Space." *Journal for Early Modern Cultural Studies*, vol. 8, no. 1, 2008, pp. 35–66. *JSTOR*, www.jstor.org/. 15 Nov. 2020.
4. Thompson, William R. "Identifying Rivals and Rivalries in World Politics." *International Studies Quarterly*, vol. 45, no. 4, 2001, pp. 557–586. *JSTOR*, www.jstor.org/stable/3096060. 21 Feb. 2021.

<b>SEMESTER II</b>			
<b>Core VII</b>		<b>Approaches to Literary Criticism</b>	
<b>Course Code: 21PENC22</b>	<b>Hrs / Week : 5</b>	<b>Hrs / Sem : 75</b>	<b>Credits : 4</b>

**Objectives:**

To introduce students to the diverse approaches of criticism.

To sharpen their critical perspectives of various trends.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO-1	apply literary approaches for narrative, poetic and dramatic genres.	2,5	Ap
CO-2	develop critical perspectives of various trends.	2,5	Ap
CO-3	make use of critical approaches to interpret literary texts.	2,8	Ap
CO-4	apply approaches of criticism to literary analysis.	6	Ap
CO-5	analyse theories of various early approaches of criticism.	4	An
CO- 6	modify their perspectives of various trends in criticism.	4	Ev
CO- 7	assess the functioning of rhetoric and psychology in literature.	3	Ev
CO-8	interpret literary texts using literary theories.	2,5	Cr

SEMESTER II			
Core VII		Approaches to Literary Criticism	
Course Code: 21PENC22	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

### Unit I Moral Approach

Introduction : Literature and Moral Ideals

Irving Babbitt (1865-1633) : “Genius and Taste”

### Unit II Psychological Approach

Introduction : Literature in the Light of Psychological Theory

Geoffrey Gorer (1905-1985) : “Myth in Jane Austen”

### Unit III Sociological Approach

Introduction : Literature and Social Ideals

Joseph Wood Krutch (1893-1970) : “The Tragic Fallacy”

### Unit IV Formalistic Approach

Introduction : Literature as Aesthetic Structure

Cleanth Brooks (1906-1994) : “Keats’ Sylvan Historian: History without Footnotes”

### Unit V Archetypal Approach

Introduction : Literature in the Light of Myth

Gilbert Murray (1866-1957) : “Hamlet and Orestes”

#### Text Book:

1. Scott, Wilbur. *Five Approaches to Literary Criticism*. USA: Macmillan, 1966.

#### Books for Reference:

1. Bressler, Charles. *Literary Criticism: An Introduction to Theory and Practice*, London. Prentice Hall, 1999.
2. Guerin, Wilfred, Labor, Earle et al. eds. *A Handbook of Critical Approaches to Literature*. New York: Oxford University Press, 2011.

#### E-Learning Resources:

1. Chabot, C. Larry, and C. Barry Chabot. “Jane Austen's Novels: The Vicissitudes of Desire.” *American Imago*, vol. 32, no. 3, 1975, pp. 288–308. *JSTOR*, [www.jstor.org/stable/26303124](http://www.jstor.org/stable/26303124). 20 Feb. 2021.
2. Fiet, Lowell A. “‘The Tragic Fallacy’ Revisited.” *Journal of Aesthetic Education*, vol. 10, no. 1, 1976, pp. 61–74. *JSTOR*, [www.jstor.org/stable/3332009](http://www.jstor.org/stable/3332009). 20 Feb. 2021.

Semester III			
Core XI		British Fiction	
Course Code : 21PENC31	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Objectives:

To enable students to view and experience the world of British Literary Fiction.

To help students comprehend the varied dimensions and aesthetics of British fiction.

### Course Outcome:

CO. No	Upon Completion of this course, students will be able to	PSO addressed	Cognitive Level
CO-1	understand the social and cultural background of the British writers.	1	Un
CO-2	analyse the socio-cultural problems reflected in the novels	4	An
CO-3	acquire a comprehensive knowledge of the characteristic features of British fiction.	3	Un , Ev
CO-4	relate how the British language and ideology shape human understanding.	5	Un, Ap
CO-5	distinguish the uniqueness of British fiction from other literatures	3	Ap, Ev
CO-6	develop critical thinking and review of British writing.	2	Ev
CO-7 CO-7	analyse and evaluate the theme and the nuances of narrative techniques employed in British fiction.	1	An, Ev
CO-8	formulate creative and research writing.	7	Cr, An, Ap

Semester III			
Core XI		British Fiction	
Course Code : 21PENC31	Hrs / Week :5	Hrs / Sem :75	Credits : 4

### Unit I

Thomas Hardy (1840 to 1928) : *A Pair of Blue Eyes*

### Unit II

John Buchan (1875-1940) : *Prester John*

### Unit III

Julian Barnes (b 1946) : *The Sense of an Ending*

Martin Amis (1949-2010) : *Night Train*

### Unit IV

Rose Tremain (b 1943) : *The Road Home*

### Unit V

Ken Follett (b 1974 ) : *The Pillars of the Earth*

### Text Book:

Amis, Martin. *Night Train*. Random House, 2010.

Barnes, Julian. *The Sense of an Ending*. Jonathan Cape, 2011.

Buchan, John. *Prester John*. William Blackwood, 1910.

Follett, Ken. *The Pillars of the Earth*. Macmillan, 1989.

Hardy, Thomas. *A Pair of Blue Eyes*. Leipzig Bernhard Tauchnitz, 1884.

Tremain, Rose. *The Road Home*. Little Brown & Company, 2011.

### Books for Reference:

Bar-Ilan, Meir. "Prester John Fiction and History". *History of European Ideas*. Vol. 20, 2005, pp. 291–98.

Walezak, Emilie. *Rose Tremain: A Critical Introduction*. Palgrave Macmillan, 2017.

Harrer, Elizabeth Vamado. *A Study of Thomas Hardy's A Pair of Blue Eyes*. 1949.

### E Resources

<https://esearch.sc4.edu/britishlit/web>

<https://guides.library.queensu.ca/english/websites/british-literature-by-period>

<https://www.britannica.com/art/English-literature>

Semester III			
Core XII		Recent Trends in Critical Theory	
Course Code : 21PENC32	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

**Objectives :**

To introduce students to the recent trends in literary criticism.

To enhance the critical acumen of students towards the understanding of literary texts.

**Course Outcome:**

CO. No	Upon Completion of this course, students will be able to	PSO Addressed	Cognitive Level
CO-1	understand the theoretical implications of recent critics	1	Un
CO-2	comprehend criticism based on structural analysis	2, 3	Un, Ev
CO-3	analyze the critical standpoint of feminist critics	8	An
CO-4	explore new knowledge of cultural space and identity in literary texts	1	An
CO-5	apply the theories and approach to reading of literary texts with a different critical outlook.	1, 2	Ap
CO-6	analyze the role of the reader and responses to texts	3, 6	An
CO-7	interpret attitudes and prevalent notions of national and socio-cultural consciousness	4	Ev, Ap
CO-8	develop the faculty of analytical thinking and research for higher learning	8	An, Un



Semester III			
Core XII		Recent Trends in Critical Theory	
Course Code : 21PENC32	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Unit I

Ferdinand de Saussure (1857-1913) : Nature of The Linguistic Sign  
T.S. Eliot (1888-1965) : Function of Criticism

### Unit II

F.R. Leavis (1895-1978) : Literary Criticism and Philosophy  
Michel Foucault (1926-1984) : What is an Author?

### Unit III

Edward Said (1935-2003) : Selections from Crisis in Orientalism  
Stanley Fish (b 1938) : Save the World on Your Own Time

### Unit IV

Helen Cixous (b 1937) : Sorties  
Elaine Showalter (b 1941) : Criticism in Wilderness

### Unit V

Frantz Fanon (1925 – 1961) : On National Culture  
Homi K. Bhabha (b 1949) : Of Mimicry and Man

### Text Book:

Bhaba, Homi K. *The Location of Culture*. Routledge Classics, 2017.

Lodge, David. *Modern Criticism and Theory*. Longman, 1988.

### Books for Reference:

Barry, Peter. *Beginning Theory: An Introduction to Literary and Cultural Theory*.

Manchester University Press, 2002.

Rainbow, Paul. *Essential Works of Foucault (1954-1984)*. Oxford University Press, 1998.

### E-Resources

<https://warwick.ac.uk>

<https://interestingliterature.com>

Semester III			
Core XIII		Research Methodology	
Course Code : 21PENC33	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Objectives:

To acquaint students with the fundamentals and mechanics of Research Methodology  
To enable students to implement appropriate and competent methods of research writing

### Course Outcome:

CO. No.	Upon Completion of this course, students will be able to	PSO addressed	Cognitive Level
CO-1	define and compile the features of Research Writing	1	Un, Ap
CO-2	relate the aspects of creating documentation of a research paper	9	Ap, An
CO-3	develop the ability to identify the different forms of plagiarism and avoid them in research writing.	2, 9	Un, Ap
CO-4	practise and relate the mechanics of MLA style	1, 6	Ap, Ev
CO-5	organise the research paper coherently	8	Ap, Un
CO-6	classify the principles of documentation	9	An, Ev
CO-7	edit and proof read research articles	8,3	Ap, Un
CO-8	distinguish the overall knowledge on the techniques of documentation	6, 2	An, Ev

Semester III			
Core XIII	Research Methodology		
Course Code : 21PENC33	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### **Unit – I Formatting Your Research Project: (1.1 – 1.6, 1.13 – 1.16)**

Margins-Text Formatting-Title-Running Head and Page Numbers-Internal Headings and Subheadings-Placement of the List of works Cited.

### **Unit – II Mechanics of Prose: (2.1 – 2.139)**

Spelling (2.1- 3)-Punctuation (2.4 -59) Italics in Prose (2.60 - 63) Capitalization of Terms (2.64 -70) –Names of Persons in your Prose (2.71- 88) –Titles of Works in Your Prose (2.89- 125) -Numbers (2.126 - 139)

### **Unit – III Documenting Sources: An Overview: (4.1 – 4.16)**

Why Plagiarism is a Serious Matter -Avoiding Plagiarism-Careful Research- Giving Credit-When Documentation is Not Needed-Common Knowledge- Passing Mentions-Allusions-Epigraphs.

### **Unit – IV The List of Works Cited: (5.1 – 5.132)**

Creating and Formatting Entries: An Overview -The MLA Core Elements-Author (5.3- 2) Title of Source (5.23-37) -Contributor (5.38-47) Version (5.48- 50) Number (5.51- 53) - Publisher (5.54- 67) - Publication Date (5.68- 83) Location (5.84- 99) -Ordering the List of Work Cited (5.123- 130) -Cross Reference (5.131)

### **Unit – V Citing Sources in the Text & Notes: (6.1 – 6. 62 & 6.78 – 7.4)**

In-Text Citations (6.1-30) - Quoting and Paraphrasing Sources (6.31) -Integrating Quotations into Prose (6.32-42) -Placement of Parenthetical Citations (6.43-46) -Omitting Citations for Repeated Quotations and Terms (6.47)-Punctuation with Quotations (6.48- 53)-Capitalization with Quotations (6.54-57)-Using an Ellipsis to Mark Material Omitted from Quotations (6.58-62) - Citations in Forms Other Than Print (6.78- 82) -Notes(7.1-4)

### **Text Book:**

*MLA Hand Book Ninth Edition.* The Modern Language Association of America, 2021.

### **Books for Reference:**

1. Barzun, Jacques. *Simple and Direct: Rhetoric for Writers*. 4<sup>th</sup> ed. Harper, 2001.
2. Baskerville, R. *Risk Analysis as a source of Professional Knowledge*. Maxwell Publication, 2008.
3. *MLA Style Manual and Guide to Scholarly Publishing*. 3<sup>rd</sup> ed. MLA, 2008.
4. Smith, Charles K. *Styles and Structures: Alternative Approaches to College Writing*. Norton, 1974.

Semester III			
Core XIV		Canadian Literature	
Course Code : 21PENC34	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Objectives:

To make students understand the avenues of Canadian Literature.

To help students understand the complexities of Canadian Multicultural Literature.

### Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	Cognitive Level
CO-1	demonstrate mastery of the history and background of Canadian Literature.	1, 4	Ap, Un
CO-2	develop comprehensive knowledge by combining theory with practical application	2,6	Ap, Cr
CO-3	develop an ability to recognize and identify the uniqueness of Canadian Literature	6	Cr, Ev, An
CO-4	analyse the themes of cultural identity with the socio-economic conditions of Canada.	4	An, Ev
CO-5	perceive, categorise, interpret and dramatise the characters, dramatic situations and devices used.	9	Un, An, Ap, Ev
CO-6	Appraise and distinguish the magnitude of Canadian literary genres with other Literatures.	2	Un, An, Ev
CO-7	make use of theory as a lens critically analysing the central aspects of Canadian culture and the complexities of Canadian society.	5	Un, Ap, An
CO-8	modify high-level applied, active learning experiences to bring out the new avenues for future research work.	8	An, Ap

Semester III			
Core XIV	Canadian Literature		
Course Code : 21PENC34	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Unit I - Poetry

Standish O' Grady (1766-1840) : Winter in Lower Canada  
 Alexander McLachlan (1818–1896) : Song  
 Sir Charles G.D. Roberts (1860 –1943) : The Solitary Woodsman.  
 A.J.M. Smith (1902 –1980) : The Lonely Land  
 A.M. Klein (1909 –1972) : The Rocking Chair

### Unit II -Prose

Margaret Laurence (1926 –1987) : Where the World Began  
 Margaret Atwood (1939 -) : *Survival*: Chapter Two 'Nature The Monster'

### Unit III -Drama

Judith Thompson (1954 -) : *Lion in the Streets*

### Unit IV- Fiction

Mitchell, W. O (1914 - 1998) : *Who Has Seen the Wind*

### Unit V - Short Story

Alice Munro (1931 - ) : Boys and Girls  
 Alison MacLeod (1940 -) : The Thaw  
 Leon Rooke (b.1984 - ) : The Woman Who Talked to Horses (Self Study)

### Text Books:

Atwood, Margaret. *Survival: A Thematic Guide to Canadian Literature*. McClelland & Stewart Inc, 1996.  
 Dudek, Louis. *Twentieth Century Canadian Poetry*. Trikha Pencraft International, 1982.  
 Frye, Northrop. *The Bush Garden: Essays on the Canadian Imagination*. House of Anansi Press Incorporated, 1971.  
 MacLeod, Alison. *All the Beloved Ghosts*. Penguin, 2017.  
 Munro, Alice. "Boys and Girls". *Dance of the Happy Shades*. Ryerson Press, 1968.

### Books for Reference:

Balachandran, K. *Critical Responses to Canadian Literature*. Sarup & Sons, 2004.  
 Begum, Jameela. Ed. *Canadian Literature: Perspectives*. Macmillan, 1994.  
 Naikar, Basavaraj. *Perspectives on Commonwealth Literature*. Sarup & Sons, 2004

### E Resources

<https://www.thecanadianencyclopedia.ca/en/article/literature-in-english>  
<https://www.britannica.com/art/Canadian-literature/Modern-period-1900-60>  
<https://www.bartleby.com/essay/Themes-In-Contemporary-Canadian-Literature->

Semester III			
Core XV		South Asian Writings in English	
Course Code : 21PENC35	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

**Objectives:**

To explore the South Asian national literatures as a unique discipline.

To enable the students to gain insight into the socio-cultural issues of the nations

**Course Outcome:**

CO. No.	Upon completion of this course, students will be able to	PSO addressed	Cognitive Level
CO - 1	understand South Asian texts in the historical and cultural contexts.	1	Un
CO - 2	discuss various South Asian Literatures and their traditions.	3	Un, Ap
CO -3	report critically and creatively about the cultural politics of South Asian writings in English	7,8	Un, An
CO - 4	identify the linguistic, cultural, religious, racial and other differences among South Asian writers.	4, 5	Un, Ev
CO - 5	examine themes of colonialism, identity, assimilation and resistance in literary texts.	9	An, Ev
CO - 6	demonstrate an awareness of British imperialism and the experiences of immigration as reflected in South Asian writings.	2, 9	Ap, Cr
CO - 7	define different geographical and social aspects of South Asian countries.	4	Un
CO - 8	develop their critical responses to the reading of multicultural literatures.	3	Cr

Semester III			
Core XV South Asian Writings in English			
Course Code : 21PENC35	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

#### Unit I: Poetry

Mawlana Jalaluddin Rumi (1207-1273)	:	The Guest House
Kazi Nazrul Islam (1899-1976)	:	I Sing of Heroes
Kishwar Naheed (1940)	:	We Sinful Women
Imtiaz Dharker (b. 1954)	:	Choice

#### Unit II: Prose

Homi K. Bhabha (b.1949)	:	The Ambivalence of Colonial Discourse
Madhurima Chakraborty (b.1991)	:	South Asian Literature and the World: An Introduction (pp: 217-225)

#### Unit III: Drama

Ayad Akhtar (b. 1970)	:	<i>Disgraced</i>
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#### Unit IV: Fiction:

Khaled Hosseini (b. 1965)	:	<i>The Kite Runner</i>
Shyam Selvadurai (1965)	:	<i>The Hungry Ghosts</i>

#### Unit V: Short Story

Thaslima Nasrin (b. 1962)	:	Exile: A Memoir Book
Fatima Bhutto (b. 1982)	:	Democracy

#### Text Books:

Akhtar, Ayad. *Disgraced*. 1<sup>st</sup> edition, Back Bay Books, 2012.

Bhabha, Homi. K. *The Location of Culture*. Routledge, 2012.

Hosseini, Khaled. *The Kite Runner*. Riverhead Books, 2003.

Selvaraj Shyam. *The Hungry Ghosts*. Viking, 2013.

#### Books for Reference:

Brass, Paul R. Ed. *Routledge Handbook of South Asian Politics: India, Pakistan, Bangladesh, Sri Lanka, and Nepal*. Routledge, 2010.

Brians, Paul. *Modern South Asian Literature in English*. Greenwood Press, 2003.

Bose, Sugata and Ayesha Jalal. *Modern South Asia: History, Culture, Political Economy*. 2<sup>nd</sup> ed. Oxford University Press, 1997.

Mookerjee- Leonard, Debali. *Literature, Gender, and the Trauma of Partition: The Paradox of Independence*. Routledge, 2017.

#### E-Resources

<https://www.britannica.com/art/South-Asian-arts/Literature>

<https://hdomingocom.wordpress.com/2020/12/13/literary-themes-from-different-parts-of-the-world/>

<b>Semester IV</b>			
<b>Core XVI</b>		<b>Shakespeare</b>	
<b>Course Code : 21PENC41</b>	<b>Hrs / Week : 6</b>	<b>Hrs / Sem : 90</b>	<b>Credits : 4</b>

### **Objectives:**

To help students comprehend Shakespeare's unique vision and universality.

To equip students with the wide range of Shakespearean diction and literary forms.

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	demonstrate mastery of the discipline by understanding the social and intellectual background of Shakespeare.	1,2	Un
CO-2	analyse the cultural problems that reflect an insight into the relevant, historical, traditional and social contexts.	5	An
CO-3	infer a comprehensive knowledge of the dramatic and the poetic structures in Shakespeare's works.	2	Un, An,
CO-4	relate how language shapes human values, understanding and human identity.	4	An
CO-5	implement Shakespeare's works in the modern context— involving the structuralist, existentialist and linguistic approaches.	4,5	Ap
CO-6	dramatise Shakespeare's unique vision with special reference to the immortal characters he has created intuitively in the modern perspective.	5	An, Ap
CO-7	teach Shakespearean philosophy, aesthetics and techniques	7,8	Ap
CO-8	create an ability to reconstruct the dramatic and theatrical conventions of his craftsmanship and extend textual analysis to journalistic, commercial, technical, and web-based writing	6,7,8 ,10	Cr



Semester IV			
Core XVI		Shakespeare	
Course Code : 21PENC41	Hrs / Week : 6	Hrs / Sem : 90	Credits : 4

#### Unit I: Comedy

*The Taming of the Shrew*

Feminism in Shakespeare's Plays

#### Unit II: Historical play

*Henry IV Part I*

Politics in Shakespeare's Plays

#### Unit III: Problem Play

*Troilus and Cressida*

Problem Plays of Shakespeare

#### Unit IV: Tragedy

*Othello*

Antagonism in Shakespeare's Plays

#### Unit V: Dramatic Romances

*Cymbeline*

Songs and Music in Shakespeare's Plays

#### Text Books:

Bloom, Allan and Harry V. Jaffa. *Shakespeare's Politics*. 1964 3rd Edition. Chicago University Press, 1981.

Novy, Marianne. *Shakespeare and Feminist Theory*. The Arden Shakespeare, Bloomsbury Publication, 2017.

Shakespeare, William. *The Complete Works of William Shakespeare*. Wordsworth Editions Ltd., 1997.

#### Books for Reference:

Bradley, A. C. *Shakespearean Tragedy*. Meridian Books, 1955.

Brown, Russell John. *Shakespeare and his Comedies*. Routledge, 2014.

Margreta de Grazia and Stanley Wells. Ed. *The Cambridge Companion to Shakespeare*. Cambridge University Press, 2001.

Smith, Nichol. *Shakespeare Criticism: A Selection, 1623-1840*. Oxford University Press. 1946.

Tillyard, E. M. W. *Shakespeare's Last Plays*. 3<sup>rd</sup> Impression Ed. Chatto and Windus, 1954.

Trevelyan, G.M. *English Social History*. Longmans Green and Company, 1942.

**E Resources**

<https://www.folger.edu/shakespeares-works>

<https://www.historic-uk.com/HistoryUK/HistoryofEngland/William-Shakespeare/>

<https://www.opensourceshakespeare.org/>

<b>Semester IV</b>			
<b>Core XVII</b>		<b>Study of the English Language</b>	
<b>Course Code : 21PENC42</b>	<b>Hrs / Week : 6</b>	<b>Hrs / Sem : 90</b>	<b>Credits : 4</b>

### **Objectives**

To enable students to know about the origin of English language and its evolution.

To familiarize students with the basic knowledge of theory and practice of forms and sounds in English language

### **Course Outcome:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO s addressed</b>	<b>CL</b>
CO-1	understand the influence of other languages in English	7	Un
CO-2	discuss in detail the change of meaning of words over a period of time	3,9	Un
CO-3	construct the vowel and consonant sounds using Phonetic symbols.	7	Ap
CO-4	use correct Stress and Intonation to speak English with good pronunciation.	3,7	Ap
CO-5	articulate words from different languages with the help of phonetic transcription	1, 7	Ap
CO-6	imbibe an in-depth knowledge of the phonology of the English language	3	Ap
CO-7	designate the place and manner of articulation of phonemes in the English language and categorize speech sounds into various types.	6, 3	An
CO-8	critically evaluate the significant contributions to the growth of the English language	9	Ev

Semester IV			
Core XVII		Study of the English Language	
Course Code : 21PENC42	Hrs / Week : 6	Hrs / Sem : 90	Credits : 4

### Unit I

Place of English in the Indo-European Family of Languages  
Middle English

### Unit II

Spelling and Spelling Reform  
Evolution of Standard English  
Makers of English – Bible, Milton, Shakespeare

### Unit III

Change of Meaning  
Foreign Influences on English – Latin, French, Scandinavian

### Unit IV

Basic units of Phonology: Syllable, vowel and consonant. Macro segment and Micro segment, syllable peak, coda, onset and interlude, distinction between phone, phoneme and allophone: relation between Phonetics and Phonology.

### Unit V

Phonetics – Classification of Sounds – Vowels, Consonants, Cardinal Vowel, Pure Vowels – Diphthong- Transcription

### Text Books :

Roach, Peter, *English Phonetics and Phonology: A Practical Course*. Routledge Publication, 2008.

Wood, F.T. *An Outline History of the English Language*. Laxmi Publications, 2014.

### Books for Reference:

Baugh, A.C. *History of the English Language*. 6<sup>th</sup> ed. Routledge, 2012.

Daniel, Jones. *An English Pronouncing Dictionary*. 18<sup>th</sup> ed. Cambridge University Press, 2011.

Gimson, A.C. *An Introduction to Pronunciation of English*. 4<sup>th</sup> ed. Hodder Arnold, 1989.

### E - Resource

<https://www.britannica.com/topic/Grimms-law>

<https://www.britannica.com/topic/Verners-law>

<https://www.britannica.com/science/phonetics>

Semester IV			
Core XVIII		Post-Colonial Writings in English	
Course Code : 21PENC43	Hrs / Week : 6	Hrs / Sem : 90	Credits : 4

**Objectives:**

To help students explore the generic significance and concerns of Postcolonial writings.

To enable students, discern the psycho-social deliberations of Postcolonial writers

**Course Outcome:**

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	analyse the postcolonial texts in their historical and cultural contexts.	1, 4	An
CO-2	investigate the problems related to colonization and the challenges faced by early settlers.	4	Un, An
CO3	appraise and distinguish Postcolonial Literatures on the concepts of ambivalence, mimicry and hybridity.	9	Un, Ev
CO-4	develop a critical understanding of how literature can both uphold and resist the existing structures of power.	5	Un, Ap, An
CO-5	interpret the questions of human identity and values with a sense of intellectual independence.	5	Ap, An
CO-6	evaluate and locate the available resources for research works.	9	Ap, Ev
CO-7	analytically teach Postcolonial Literature in its relationship with culture, racism, migration and diaspora colonialism, nationalism, citizenship and cosmopolitanism.	8,9	Cr, An
CO-8	synthesize multiple sources of postcolonial research and extend a textual analysis	9, 10	Ev, An

Semester IV			
Core XVIII		Post-Colonial Writings in English	
Course Code : 21PENC43	Hrs / Week : 6	Hrs / Sem : 90	Credits : 4

### Unit I - Poetry

David Diop (1927-1960)	: Africa
Chinua Achebe (1930-2013)	: Answer
Edwin Thumboo (1933 - )	: Ulysses by the Merlion
Yasmine Gooneratne (1935- )	: Big Match – 1983

### Unit II – Prose

Ania Loomba (1955- )	: <i>Colonialism/Postcolonialism</i> : Chapter One: Situating Colonial and Postcolonial Studies (7-24)
Frantz Fanon (1925-1961)	: The Negro and Psychopathology

### Unit III - Drama

Derek Walcott (1930 -2017)	: <i>Dream on Monkey Mountain</i>
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### Unit IV - Fiction

Jean Rhys (1890 - 1979)	: <i>Wide Sargasso Sea</i>
Yann Martel (1963- )	: <i>Life of Pi</i>

### Unit V - Short story

Nadine Gordimer (1923- 2014)	: Once Upon a Time
Samuel Selvon (1923 –1994)	: Johnson and the Cascadura
Rohinton Mistry (1952 - )	: Auspicious Occasion (Self study)

### Text Books:

Fanon, Frantz. “The Negro and Psychopathology,” *Black Skin, White Masks*. Trans. C. L. Markmann, Pluto Press, 2008.

Gordimer, Nadine. *Once Upon a Time*. JUMP and other stories. Bloomsbury, 2003.

Narasimhaiah. C.D. *An Anthology of Commonwealth Poetry*. Macmillan India Press, 1990.

Selvon, Samuel. *Ways of Sunlight*. St. Martin's Press, 1957. Print.

### Books for Reference:

Loomba, Ania. “Chapter One: Situating Colonial and Postcolonial Studies,” *Colonialism/Postcolonialism*. Routledge, 2004.

Margaret J.O’ Donnell. *An Anthology of Commonwealth Verse*. Blackie & Son Ltd., 1963.

William, Walsh, Ed. *Readings in Commonwealth Literature*. Oxford University Press, 2015.

### E- Resources

<https://www.thebritishacademy.ac.uk/blog/what-is-postcolonial-literature/>

<https://blog.bookstellyouwhy.com/a-brief-history-of-postcolonial-literature-part-i>

<https://literariness.org/2016/04/06/postcolonialism/>

<b>SEMESTER – II</b>			
<b>Core Elective 1 English Language Teaching: Methods and Practices</b>			
<b>Course Code: 21PENE21</b>	<b>Hrs / Week: 5</b>	<b>Hrs / Semester: 75</b>	<b>Credits: 4</b>

### **Objectives:**

To train students in pedagogical skills required for teaching English.

To equip students with methods of teaching English at different levels.

### **Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO- 1	perceive the pedagogical skills and the various approaches in learning English language.	3,7	Ap
CO- 2	adapt to different methods of teaching English .	6	Ap
CO- 3	develop the artistic and innovative use of language.	3,7	Ap
CO- 4	appraise the ways in which the content could be taught through whole class, small group and pair work or individual activities.	3	An
CO- 5	to assess the various teaching methods.	6	Ev
CO- 6	compare and contrast language structures and explain the relationship between language and literature.	7	Ev
CO- 7	design a practical and creative method of teaching the English language.	9,7	Cr
CO- 8	enhance their literary and linguistic competence.	6,8	Cr

SEMESTER – II			
<b>Core Elective 1      English Language Teaching: Methods and Practice</b>			
<b>Course Code: 21PENE21</b>	<b>Hrs / Week: 5</b>	<b>Hrs / Semester: 75</b>	<b>Credits: 4</b>

### Unit I

Origin of Language- Theories of language learning-The bow-wow theory, The ding-dong theory, The pooh-pooh theory and The gesture theory- Grimm's law – Verner's law.

### Unit II

Methods and Approaches to English language Teaching: Direct method, The Situational Approach, Audio-lingual method.

### Unit-III

Communicative approach, The Natural way, Suggestopedia, Total Physical Response, Functional-Notional approach.

### Unit IV

The Teaching of Poetry and Prose: Teaching Prose at the School Primary, Secondary and Tertiary levels.

Tests, Testing and Evaluation: The need for evaluation, Types of tests, Characteristics of a test, Testing the four skills, Technology for testing, Analysing results.

### Unit V

Technology enabled teaching, LCD & IT, Edmodo, CALL, MALL & Moodle Microteaching Method

### Text Books:

1. Krishnaswamy.N., Lalitha Krishnaswamy.M., Teaching English, *Approaches, Methods and Techniques*, Hyderabad: Macmillan, 2008.
2. Wood, F.T. *An Outline History of the English Language*, Delhi, Macmillan India Limited, 1992.

### Books for Reference:

1. Mowla, Shakila. *Techniques of Teaching English*, Hyderabad: Neelkamal Publishers, 2005.
2. Nagaraj, Geetha. *English Language Teaching Approaches, Methods, Techniques*. Bangalore: Orient Longman, 2008.
3. Varghese, Paul. C. *Teaching English as a Second Language*, New Delhi: Sterling Publishers, 1989



## **E- Resources:**

1. Lin, Chih-Chung, et al. "Development and Usability Test of an e-Learning Tool for Engineering Graduates to Develop Academic Writing in English: A Case Study." *Journal of Educational Technology & Society*, vol. 20, no. 4, 2017, pp. 148–161. *JSTOR*, [www.jstor.org/stable/26229213](http://www.jstor.org/stable/26229213). 15 Dec. 2021.
2. Richards, Jack C., and Ted Rodgers. "Method: Approach, Design, and Procedure." *TESOL Quarterly*, vol. 16, no. 2, 1982, pp. 153–168. *JSTOR*, [www.jstor.org/stable/3586789](http://www.jstor.org/stable/3586789). 26 Feb. 2021

<b>SEMESTER II</b>			
<b>Core Elective I</b>		<b>Comparative Literature: Theory and Practice</b>	
<b>Course Code 21PENE22</b>	<b>Hrs / Week : 5</b>	<b>Hrs / Sem : 75</b>	<b>Credits: 4</b>

**Objectives:**

To make students understand the nuances of comparing the literature of two different cultures.

To equip students with the techniques of Comparative Literature.

**Course Outcome:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO- 1	learn the basics of Comparative Literature.	1,3	Un
CO- 2	understand different literatures of varied interests.	8	Un
CO- 3	apply the concepts learned in their day today life.	6,7	Ap
CO- 4	do research work on comparative literature.	8	Ap
CO- 5	analyse literary texts based on the theories learnt.	3,4	An
CO- 6	evaluate the significant features of different literatures.	1,2	Ev
CO- 7	develop a critical outlook towards the reading of books.	3	Ev
CO- 8	evaluate the relationship between Literature and other forms of cultural expression.	3	Ev

SEMESTER II			
Core Elective I	Comparative Literature: Theory and Practice		
Course Code 21PENE22	Hrs / Week : 5	Hrs / Sem : 75	Credits: 4

### Unit I

Definitions and History of Comparative Literature - Study of Influences – Study of Receptions- Schools of Comparative Literature

### Unit II

Theories and Methods of comparative literary study – Principles of comparative literature

### Unit III

Oriental and Occidental Literature – comparative study –Bharathiar's 'Kuil Pattu' and Shelley's 'Cuckoo'

### Unit IV

Aesthetics-Eastern and Western

### Unit V

Anita Desai's *Fire on the Mountain* and Toni Morrison's *Beloved*

#### Text Books:

1. Desai, Anita. *Fire on the Mountain*. London: Heinemann Publishers, 1977. Print.
2. Morrison, Toni. *Beloved*. New York: Knopf Publishers, 1987. Print.

#### Books for Reference:

1. Bassnett, Susan. *Comparative Literature: A Critical Introduction*, Oxford: Blackwell, 1993. Print.
2. Das, Sisir Kumar. *Comparative Literature in India: A Historical Perspective. Fundamentals of Comparative Literature-* ENNES Publications. Print.
3. Beebee, Thomas. *Comparative Literature Studies*. United States: Penn State University Press, 1963. Print.

#### E- Resources:

1. Mix, Debbie. "Toni Morrison: A Selected Bibliography. *Modern Fiction Studies*, vol.39, no.3,1993, pp. 795-817. JSTOR, [www.jstor.org/stable/26283479](http://www.jstor.org/stable/26283479). 24 Feb. 2021. Web.
2. Khawaja, Mabel, et al. "Toni Morrison's *Beloved*." *PMLA*, vol. 112, no. 1, 1997, pp. 115–118. JSTOR, [www.jstor.org/stable/463060](http://www.jstor.org/stable/463060). 26 Feb. 2021. Web.
3. Krishna, Francine E. "Anita Desai: *Fire on the Mountain*." *Indian Literature*, vol. 25, no. 5,1982, pp. 158–169. JSTOR, [www.jstor.org/stable/23331120](http://www.jstor.org/stable/23331120). 26 Feb. 2021. Web.

Semester III			
Core Elective II		Translation: Theory and Practice	
Course Code : 21PENE31	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Objectives:

To introduce various theories of translation evolved worldwide  
To make the students better translators and facilitate employability.

### Course Outcome:

CO. No	Upon Completion of this course, students will be able to	PSO addressed	C L
CO-1	understand the history of translation of works	4	Un
CO-2	apply various theories and techniques of translation while translating a literary piece.	6	Ap
CO-3	locate and synthesize cultural complexities involved in translation.	8	An
CO-4	analyse the resultant change of meaning evolved in the process of translation.	2	Ev
CO-5	develop the ability to translate.	6	Ap
CO-6	compile new terms of expression from different fields.	3	Cr
CO-7	interpret the difficulties involved in translation.	5	An
CO-8	Critically review the thematic and technical aspects of translated texts.	4	Ev

Semester III			
Core Elective II		Translation: Theory and Practice	
Course Code : 21PENE31	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Unit I – What is translation?

Definition of translation - need and scope of translation

Types of translation - word to word, phrase to phrase and sentence to sentence level

### Unit II - History of Translation

From Bible translation to Modern Age History

### Unit III – Translation Theories and Theorists

Theories

Theorists: J.C. Catford, Eugene A. Nida and other theorists

### Unit IV – Techniques and Methods of Translation

Lexical- Semantic - Syntactic

### Unit V - Translation Practice

Passages from Literary Texts – Bharathiyar Poems, Thirukural, Short Stories, Haiku Poems

Skill components - Recipes, Compeering, Blurb (book), Film Songs and Reviews, Subtitles of films, Documentaries

### Text Book:

Venuti, Lawrence. *The Translator's Invisibility: A History of Translation*. Routledge, 2008.

### Books for Reference:

Baker, Mona. *In Other Words: A Course Book on Translation*. Routledge, 2018.

Hema, K. *Theory and Practice of Translation*. Shanlax Publications, 2019.

Malmkjaer, Kristen and Kevin Windle, eds. *The Oxford Handbook of Translation Studies*. Oxford UP, 2011.

Munday, Jeremy. *Introducing Translation Studies: Theories and Applications*. Routledge, 2001.

### E-Resources

<https://www.eupublishing.com/loi/tal>

<https://www.britannica.com/art/translation-literature>

<https://benjamins.com/catalog/hts.1>

Semester III			
Core Elective II		Basic Linguistics	
Course Code : 21PENE32	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

**Objectives:**

To develop a scientific approach to the study of English language.

To provide theoretical and practical basis for communicative competency.

**Course Outcome:**

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	comprehend the basic nature and history of linguistics.	1	Un
CO-2	comprehend the properties of language and types of linguistics.	1	Un
CO-3	distinguish, evaluate and interpret Morphemes and Morphology.	4, 7	Un
CO-4	use methods of logical analysis in analyzing a wide variety of languages and dialects.	1	Un
CO-5	analyze human language in the context of linguistics, syntax, semantics, pragmatics, phonetics and phonology.	1	An
CO-6	able to transcribe speech from language.	4	Ev
CO-7	correlate sentences with syntactic and lexical structures of sentences of natural language.	7	Ev
CO-8	provide a broad interdisciplinary perspective on work in language to emphasize the connectedness and relevance of work to other fields.	3	Cr

Semester III			
Core Elective II	Basic Linguistics		
Course Code : 21PENE32	Hrs / Week :5	Hrs / Sem : 75	Credits : 4

### Unit I

Origin of Language  
 Properties of Language  
 Animals and Human Language  
 Language Varieties

### Unit II - Morphemes & Morphology

Free and bound morphemes – derivational vs inflectional – morphological problems in description – morphs and allomorphs – word formation process

### Unit III - Syntax & Semantics

Generative grammar – deep and surface structure – transformational rule –conceptual vs associative meaning – semantic features – lexical relations

### Unit IV - Pragmatics

Speech acts – invisible meaning – context – deixis – reference – anaphora – presupposition

### Unit V - Language and Society

Sociolinguistics –Applied Linguistics – Comparative Linguistics – Computational Linguistics - Stylistics

### Text Books:

Fromkin, Victoria A. *Linguistics: An Introduction to Linguistic Theory*. Blackwell Publishing, 2000.  
 Yule, George. *The Study of Language*. Cambridge UP, 1985.

### Books for Reference:

Gut, Ulrike. *Introduction to English Phonetics and Phonology*. Peter Lang, 2009.  
 Lieber, Rochelle. *Morphology and Lexical Semantics*. Cambridge UP, 2004.  
 Rogers, Henry. *The Sounds of Language: An Introduction to Phonetics*. Taylor & Francis, 2014.  
 Trudgill, Peter. *Sociolinguistics: An Introduction to Language and Society*. 4<sup>th</sup> edition. Penguin Books, 2000.

Semester IV			
Project			
Course Code : 21PENP41	Hrs / Week : 6	Hrs / Sem : 90	Credits : 6

### Objectives:

To provide guidelines to students on how to write research papers in literature.

To encourage research culture among students.

### Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	comprehend the mechanics of research writing	3,9	Un
CO-2	acquaint with the fundamentals of Research process in characterizing and critiquing the dominant critical theories, methodologies, and practices in the field.	2	Un
CO-3	cultivate research culture by combining theory with practical application.	2	Ev
CO-4	interpret new literary works to build broad-based knowledge and skills.	7	Ev
CO-5	formulate an original and increasingly analytical thesis.	6	Cr
CO-6	avoid plagiarism and adapt research ethics.	6	Ev
CO-7	develop the thesis into a well-supported argument.	6	Cr
CO-8	document and present their work in accordance with the concepts of research methodology.	10	Cr



SEMESTER IV			
Project			
Course Code: 21PENP41	Hrs/ Week: 6	Hrs/ Sem:90	Credits : 6

**Objective:** To provide guidelines to students on how to write papers in literature.

To encourage research culture among students.

**Learning Objective:** By applying critical theories as per the genre of the work of art.

**Dissertation:** a minimum of 60 pages on a book other than the books prescribed for their study.

**Project Evaluation:**

The project will be evaluated on the basis of the students understanding of the topic, their knowledge of the fundamental aspects of research, their ability to document and present their work in accordance with the concepts of research methodology.

**Text Book:**

1. *MLA Hand Book*. 9th Edition. Modern Language Association of America, 2019.

<b>Semester III</b>		
<b>Self Study Course/MOOC (Compulsory) Travel Literature</b>		
<b>Course Code : 21PENSS31</b>		<b>Credits : 2</b>

**Objectives:**

To enable students to an explorative self-study of travel literature.

To discover and experience the uniqueness of world culture and space.

**Course Outcome:**

<b>CO.No</b>	<b>Upon Completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>Cognitive Level</b>
CO-1	comprehend the richness of travel literature.	4	Un
CO-2	locate and differentiate the socio-cultural spaces between texts.	8	Ap
CO-3	develop critical thinking and subjectivity of an observer.	6	An
CO-4	analyse the theoretical issues involved in using colonial and travel literature as a source.	2	An
CO-5	evaluate the concepts and issues such as race, gender, resistance and identity.	2	Ev
CO-6	interpret different historical methodologies and travel texts	5	Ap
CO-7	explore new avenues of travel literature.	8	Ap
CO-8	disseminate the acquired knowledge of the uniqueness of other cultures worldwide.	4	An

Semester III		
Self Study Course/MOOC (Compulsory) Travel Literature		
Course Code : 21PENSS31		Credits : 2

### Unit I

George Orwell (1903-1950) – *Burmese Days*

### Unit II

Wilfred Thesiger (1910-2003) - *Arabian Sands*

### Unit III

Heinrich Harrer (1912-2006) - *Seven Years in Tibet*

### Unit IV

Alan Booth (1946-1993) - *The Roads to Sata: A 2000 - Mile Walk Through Japan*

### Unit V

Samanth Subramaniam - *Following Fish*

### Text Books:

1. Booth, Alan. *The Roads to Sata: A 2000 - Mile Walk Through Japan*. The Penguin Group, 1986.
2. Harrer, Heinrich. *Seven Years in Tibet*. Translated by Richard Graves. Penguin Putnam Inc., 1953.
3. Orwell, George. *Burmese Days*. Harper, 1934.
4. Subramaniam, Samanth. *Following Fish*. Penguin India, 2011.
5. Thesiger, Wilfred. *Arabian Sands*. Introduction by Rory Stewart. Penguin Books, 1959.

### Books for Reference:

Campbell, Mary Baine. "Travel Writing and Its Theory." *The Cambridge Companion to Travel Writing*. Ed. Peter Hulme. and Tom Youngs. Cambridge UP, 2002, 261-78.  
Thompson, Carl. *Travel Writing*. Routledge, 2011.

<b>SEMESTER – I</b>			
<b>Core IV Principles and Methods of Archaeology</b>			
<b>Course Code: 21PHIC14</b>	<b>Hrs / Week:6</b>	<b>Hrs / Semester: 90</b>	<b>Credits:4</b>

**Objectives:**

- To develop the basic knowledge in archaeology and scientific methods of excavation.
- To develop archaeological skills.
- To enhance the quality and authenticity of history.

**Course Outcome:**

<b>CO.No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	know the basic concepts in Archaeology.	1	Un
CO-2	understand the methods of excavation.	1	Un
CO-3	appreciate the kinds of archaeology.	2	Re
CO-4	analyse the works of archaeologists.	4	An
CO-5	understand the scientific dating system.	1	Un
CO-6	update the recent archaeological excavations.	3	Ap
CO-7	apply archaeological skills to enhance historical writing.	3	Ap
CO-8	analyse the history of archaeology in the world.	4	An

SEMESTER –I			
<b>Core IV</b>	<b>Principles and Methods of Archaeology</b>		
<b>Course Code: 21PHIC14</b>	<b>Hrs / Week:6</b>	<b>Hrs / Semester: 90</b>	<b>Credits:4</b>

### **Unit I Archaeology**

Definition – Significance of Archaeology in Reconstructing History – Pre, Proto and Historical Archaeology - Kinds of Archaeology – History of Archaeology in the World – Heinrich Schliemann – Flinders Petrie – Pitt Rivers – Gordon Childe

### **Unit II Archaeology in India**

Asiatic Society – Sir William Jones – Alexander Cunningham - Archaeological Survey of India – Sir John Marshall – Robert Bruce Foote - Sir Mortimer Wheeler – Exploration – Folk Traditions - Literature – Field survey– Aerial Photography

### **Unit III Excavation Methods**

Archaeological Sites – Adichanallur – Keezhadi – Site Survey - Geophysical Survey – Kinds of Excavation – Trial Trench – Vertical Excavation – Horizontal and Burial Excavation

### **Unit IV Archaeological Recording**

Land survey – Topographical survey – Stratigraphy and its importance – Three Dimensional Recording - Drawing – Pottery - Photography

### **Unit V Dating Methods**

Glacial Chronology –Relative Dating – Absolute Dating – Radio Carbon Dating – C12, (C14 Dating) – Dendrochronology – Thermoluminescence – Archaeomagnetism – Potassium – Argon Method – Fluorine Test – Nitrogen Test – Pollen Test

### **Text Book:**

1. Venkatraman. R. *Indian Archaeology - A Survey*. Udumalpet: Ennes Publications, 1999.

### **Books for Reference:**

1. Ray. Himanshu Prabha. *Colonial Archaeology in South Asia - The Legacy of Sir Mortimer Wheeler*. New Delhi: Oxford University Press, 2008.
2. Sankalia. H.D. *New Archaeology – Its scope & Application to India*. Lucknow: Phaidon Press, 1974.
3. Surendranath Roy. *The Story of Indian Archaeology*. New Delhi: Isha Publications, 1961.

### **Journal:**

1. <http://citeseerx.ist.psu.edu/viewdoc/summary;jsessionid=84BC561CAD034E544EFCAEBE2D452EE1?doi=10.1.1.692.4315&rank=192&q=History%20of%20India&osm=&ossid=>

### **E-Learning Resources:**

1. <https://www.nationalgeographic.org/encyclopedia/archaeology/>
2. <https://www.india.gov.in/official-website-archaeological-survey-india>

<b>SEMESTER – I</b>			
<b>Core V</b>		<b>Intellectual History of India</b>	
<b>Course Code: 21PHIC15</b>	<b>Hrs / Week:6</b>	<b>Hrs / Semester: 90</b>	<b>Credits:4</b>

**Objectives:**

- To comprehend the history of Intellectuals and their thoughts and ideas.
- To conceptualize of ideas and its significance.
- To appreciate the intellectual capacity of Indians.

**Course Outcome:**

<b>CO.No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	highlight the intellectual thoughts in different perspectives.	1	Un
CO-2	know the differences between Cultural History and Intellectual History.	1	Un
CO-3	focus on intensive reasoning and deep thinking.	2	Re
CO-4	emphasize intellectual ideas for the promotion of society.	2	Re
CO-5	promote critical thinking.	3	Ap
CO-6	collaborate great minds and ideas.	5	Ev
CO-7	apply and articulate ideas in the past.	3	Ap
CO-8	examine the intersection of several disciplines.	5	Ev

SEMESTER – I			
Core V	Intellectual History of India		
Course Code: 21PHIC15	Hrs / Week:6	Hrs / Semester: 90	Credits:4

**Unit - I Intellectual History**

Definition – Nature–Scope and Purpose – Role of Individuals - Significance

**Unit - II Social Thinkers**

Raja Ram Mohan Roy – Ishwar Chandra Vidyasagar – Jyotiba and Savitri Phule-  
R.G. Bhandarkar - Keshab Chandra Sen – Veerasalingam Pantulu- Pandita Ramabai -  
D.K.Karve – Ranajit Guha - Romila Thapar

**Unit - III Religious Thinkers**

Debendranath Tagore – Saint Ramalinga Adigal- Dayananda Saraswati – Ramakrishna  
Paramahansa – Swami Vivekananda

**Unit - IV Political Thinkers**

Dadabhai Naoroji – M.G. Ranade – S.N. Banerjee – R.C. Dutt – G.K.Gokhale

**Unit - V Litterateurs and Scientists**

Bankim Chandra Chatterjee – J.C.Boss – P.C.Roy – Srinivasa Ramanuja – Amartya  
Sen – Vandhana Shiva

**Text Book:**

1. Sen. S. P. *Social and Religious Reform Movements in the Nineteenth and Twentieth Centurys*. Calcutta: Institute of Historical Studies, 1979.

**Books for Reference:**

1. Tara Chand. *History of the Freedom Movement in India*. New Delhi: Ministry of Information and Broadcasting Government of India, 1967.
2. Datta. K.K. *A Social History of Modern India*, Macmillan Co. of India, Delhi, 1975.
3. Grover. B.L. and Grover. *A New Look at Modern Indian History*. Delhi: S. Chand & Co. Ltd, 1993.
4. Naravane. V.S. *Modern Indian Thought*. New Delhi: Orient Longman Pvt. Ltd, 1979.

**Journal:**

1. <http://citeseerx.ist.psu.edu/viewdoc/summary?sessionid=84BC561CAD034E544EFCAEBE2D452EE1?doi=10.1.1.722.1051&rank=10&q=History%20of%20India&osm=&ossid=>

**E-Learning Resources:**

1. [https://scholar.harvard.edu/files/pgordon/files/what\\_is\\_intell\\_history\\_pgordon\\_mar2012.pdf](https://scholar.harvard.edu/files/pgordon/files/what_is_intell_history_pgordon_mar2012.pdf)
2. <https://www.jstor.org/stable/20023991?seq=1>

Semester – II			
Core VIII		Contemporary World Since 1945 C.E.	
Course Code : 21PHIC23	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

**Objectives:**

- To acquaint with the contemporary world events and the role of various countries.
- To create an awareness of International Relations in the present scenario.
- To assess the contemporary world issues.

**Course outcome:**

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the organization and functions of UNO.	1	Un
CO-2	understand decolonization.	1	Un
CO-3	analyse the apartheid policy of South Africa.	4	An
CO-4	assess the role of OPEC in International Politics.	5	Ev
CO-5	acquire the knowledge of Emerging New World Order.	2	Re
CO-6	analyse the nature of Cold War.	4	An
CO-7	estimate regional organizations.	5	Ev
CO-8	analyse civil rights, labour and feminist movements.	4	An



Semester – II			
Core VIII		Contemporary World Since 1945 C.E.	
Course Code : 21PHIC23	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

### Unit I Cold War

U.N.O. – Organization – Specialized Agencies –  
Achievements - Cold War - Berlin Crisis – Korean War –  
Vietnam War – Cuban Crisis – Suez Crisis

### Unit II Middle East and Europe

Arab - Israel War - Oil Crisis - OPEC – Gulf war - Iran -  
Iraq War - European Union - European Common Market -  
Decolonization

### Unit III Aftermath of Cold War

Disarmament – Disintegration of U.S.S.R. – Emerging New  
World Order – Multi-Polar, Bi – Polar and Uni - Polar -  
World Terrorism

### Unit IV Regional Organizations

NATO, SEATO, CENTO, Warsaw Pact - Common  
Wealth of Nations – Non-Alignment - SAARC, OAU,  
ASEAN, G-8, G-15, G-77

### Unit V Movements

Apartheid - Civil Rights Movement in U.S.A. – Labour  
Movement – Feminist Movement – African Diaspora

### Text Book:

1. Sen. A.K. *International Relations since 1919*. New Delhi: S. Chand & Co., Ltd, 1993.

### Books for Reference:

1. Philip Parker. *Word History: From the Ancient World to the Information Age*.
2. New Delhi, D.K. Publishers, 2017.
3. Burton. J.W. *International Relations*. Bombay: George Allen and Unwin Pvt. Ltd, 1971.
4. Frankel. Joseph. *International Relations*. New Delhi: Oxford University Press, 1967.
5. Holsti. *International Politics*. New Delhi: Prentice Hall of India Pvt. Ltd, 1978.
6. Palmer and Perkins. *International Relations*. New Delhi: Publishers and Distributors, 2000.

### E-Learning Resources:

1. <https://www.youtube.com/watch?v=MWYjNUAqvU&feature=youtu.be>
2. <https://www.youtube.com/watch?v=jCRzkW1c2dQ&feature=youtu.be>

Semester – II			
Core IX		Intellectual History of Tamil Nadu	
Course Code : 21PHIC24	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

**Objectives:**

- To appreciate the role of Intellectuals and their ideas through the ages.
- To promote intellectual ideas in various disciplines.
- To assess the growth of intellectual thoughts in Tamil Nadu.

**Course outcome:**

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand political ideas and its impact.	1	Un
CO-2	understand the philosophical ideas of the religions.	1	Un
CO-3	promote social conscious and rights.	2	Re
CO-4	analyse cultural deep insights and its impact	4	An
CO-5	focus on the development of science and technology.	2	Re
CO-6	estimate the role of intellectuals in history.	5	Ev
CO-7	evaluate the intellectual ideas in different perspectives.	5	Ev
CO-8	analysis of ideas in various disciplines.	4	An

Semester – II			
Core IX		Intellectual History of Tamil Nadu	
Course Code : 21PHIC24	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

**Unit I Political Intellectuals**

G.Subramania Iyer - Rettamalai Srinivasan - C.Rajagopalachari - E.V.Ramasamy - M.C Raja - Thillaiyadi Valliyammai - Pasumpon Muthuramalinga Thevar – Kalaiingar Karunanidhi

**Unit II Social Intellectuals**

Ayodhya Das Pandithar - Amy Carmichael - Ida Scudder - Arcot Brothers – Bharathidasan – Vallal Azagappar - Jamal Mahammed

**Unit III Religious Intellectuals**

Umaru Pulavar - Joseph Constantine Beschi – Vaikunda Swamigal – Annie Besant – Swami Sahajananda - Kirubananda Variyar

**Unit IV Cultural Icons**

C.Subramania Bharathiyar – M.S.Subbulakshmi – Kannadasan - Pattukottai Kalyana Sundaram – Padma Subramaniam

**Unit V Litterateurs and Scientists**

G.D.Naidu –Santappa - M.S.Swaminathan – A.P.J.Abdul Kalam– Rangarajan (Sujatha) - K. Sivan

**Text Book:**

1. Rajayyan. K. *History of Tamil Nadu (1585-1982)*. Madurai: Raj Publishers, 1982.

**Book for Reference:**

1. Parmarthalingam. C. *Religion Social Reform in Tamil Nadu*. Madurai: Rajkumari Publication, 1997.
2. Sen. S.P.(Ed.). *Social and Religious Reform Movements in the 19<sup>th</sup> and 20<sup>th</sup> Centuries*. Calcutta: Calcutta Institute of Historical Studies,1979.
3. Pillai. K.K. *Tamilaga Varalaru, Makkalum Panpadum (Tamil)*.Chennai: International Institute of Tamil Studies, 2004.
4. Viswanathan. E.Sa. *The Political Career of E.V.R*. Madras: Ravi and Vasanth Publication, 1983.

**Journal:**

1. <http://citeseerx.ist.psu.edu/viewdoc/summary;jsessionid=84BC561CAD034E544EFCAEBE2D452EE1?doi=10.1.1.1067.5808&rank=65&q=History%20of%20India&osm=&ossid=>

**E-Learning Resources:**

1. <https://www.tamildigitallibrary.in/>
2. <https://www.mids.ac.in/>
3. [https://rmrl.in/?page\\_id=12](https://rmrl.in/?page_id=12)

Semester–III			
Core – XV		Historical Methods – Theory and Practice	
Course Code: 21PHIC35	Hrs/Week: 5	Hrs/Sem: 75	Credits:4

**Objectives:**

- To acquire the knowledge of recent trends and techniques in Research Methodology.
- To enhance the historical writings and articles with research methodology.
- To open new avenues of historical research.

**Course Outcome:**

Co.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	enhance the research skills and recent trends in research.	1,2	Un,Re
CO-2	practice the research skills in writing projects, thesis etc.	3	Ap
CO-3	open new avenues in doing historical research.	3	Ap
CO-4	acquire skills regarding selection of topic, hypothesis, project outline and field work.	1,2	Un,Re
CO-5	equip and expose objectivity and subjectivity to present authentic facts.	1,2	Un,Re
CO-6	analyse the work of Historical writings.	4	An
CO-7	assess the work of various historians.	5	Ev
CO-8	understand the documentation in Thesis writing.	1,2	Un,Re

Semester–III			
Core – XV		Historical Method – Theory and Practice	
Course Code: 21PHIC35	Hrs/Week: 5	Hrs/Sem: 75	Credits:4

#### Unit - I      **Research**

Meaning and Definition-Types of Research–Pre-Requisites of a Researcher – Limitations.

#### Unit - II      **Methodology**

Selection of Topic - Criteria – Review of Literature –Sources – Primary-Secondary-Objectives – Historical Research Methods –Methodology-Formulation –Hypothesis –Designing the Study.

#### Unit- III      **Criticism**

Objectivity and Subjectivity –Internal and External Criticism - Collection of Data - Making Notes – Index Card - File system –Plagiarism –Methodology: Case study–Survey–Interview–Questionnaire.

#### Unit - IV      **Analysis**

Meaning–Characteristics–Analysis of data–Methods: Qualitative and Quantitative–Statistical method–Limitations.

#### Unit - V      **Documentation**

Synthesis: Format–Preliminaries–Text–Abstract–Page and Chapter format–Documentation–Footnotes- End Notes – Tables and Figures–References - Glossary–Bibliography and Appendices-Exposition.

#### **Text Book:**

1. Rajayyan. K. *Historiography–History in Theory and Method*. Madurai: Ratna Publications, 2004.

#### **Books for Reference:**

1. Ali. Sheik. *History–Its Theory and Method*. New Delhi: Macmillan India Ltd,1993.
2. Carr. E.H. *What is History?*. London: Macmillan,1961.
3. Khurana. K.L. *Concepts and Methods of Historiography*. Agra: Lakshmi Narain Agarwal, 2006.
4. Manickam. S. *Theory of History and Method of Research*. Madurai:1997.
5. Sreedharan. E. *A Text book of Historiography 500B. C to A.D. 2000*. New Delhi: Orient Longman, 2000.
6. Subramanian. N. *Historiography*. Madurai: Koodal Publishers,1993.

#### **Journals:**

1. <https://www.cambridge.org/core/journals/historical-journal/historiographical-reviews>
2. [https://doaj.org/toc/2042-4752?source=%7B%22query%22%3A%7B%22bool%22%3A%7B%22must%22%3A%5B%7B%22terms%22%3A%7B%22index.issn.exact%22%3A%5B%22042-4752%22%5D%7D%7D%5D%7D%7D%2C%22size%22%3A100%2C%22sort%22%3A%5B%7B%22created\\_date%22%3A%7B%22order%22%3A%22desc%22%7D%7D%5D%2C%22\\_source%22%3A%7B%7D%2C%22track\\_total\\_hits%22%3Atrue%7D](https://doaj.org/toc/2042-4752?source=%7B%22query%22%3A%7B%22bool%22%3A%7B%22must%22%3A%5B%7B%22terms%22%3A%7B%22index.issn.exact%22%3A%5B%22042-4752%22%5D%7D%7D%5D%7D%7D%2C%22size%22%3A100%2C%22sort%22%3A%5B%7B%22created_date%22%3A%7B%22order%22%3A%22desc%22%7D%7D%5D%2C%22_source%22%3A%7B%7D%2C%22track_total_hits%22%3Atrue%7D)

#### **E-Learning Resources:**

1. <https://youtu.be/C9XiYweRGvk>
2. <https://youtu.be/D94hTcQaEds>

Semester–IV			
Core XVII Contemporary History of India from 1947 to 2019. C.E			
Course Code: 21PHIC42	Hrs/Week:6	Hrs/Sem: 90	Credits:4

**Objectives:**

- To update the recent History of India.
- To highlight the post Independent India's important events.
- To highlight the role of various political parties in India.

**Course Outcome:**

Co.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	acquire the knowledge of Contemporary Indian History and the rule of various Prime Ministers	1,2	Un,Re
CO-2	evaluate the foreign policy of India after Independence	5	Ev
CO-3	assess the contemporary political scenario in India	5	Ev
CO-4	understand the impact of changing political priorities on social life of the people	1,2	Un,Re
CO-5	evaluate the foreign policy and domestic policy in historical context	5	Ev
CO-6	analyse the educational policy of Post Independent India	4	An
CO-7	highlight the role of various political parties in India	1,2	Un,Re
CO-8	make aware of communal issues and their solutions	1,2	Un,Re

Semester-IV			
Core XVII Contemporary History of India from 1947 to 2019 C.E			
Course Code: 21PHIC42	Hrs/Week:6	Hrs/Sem:90	Credits:4

#### Unit-I Domestic & Foreign Policy

Making of the Indian Constitution – Language policy – Linguistic states – Jawaharlal Nehru – Foreign policy – Five Year plan – Pancha sheel

#### Unit-II Lal Bahadur Shastri & Indira Gandhi Reign

Lal Bahadur Shastri – Indo-Pak war – Tashkent agreement – Anti-Hindi agitation – Indira Gandhi era – Bangladesh crisis – Indo-Russian Friendship Treaty of 1971 – Proclamation of Emergency.

#### Unit-III Janata and Congress Ministry

Jaya Prakash Narayan and Kisan movement – Janata Government – Second Ministry of Indira Gandhi – 1979 Pokhara Test – Nationalisation of Bank – Operation Blue Star – Assassination.

#### Unit-IV Congress and Janata Ministry

Rajiv Gandhi – New Educational Policy – Bofors Scandal – Foreign policy – Indo-Sri Lanka Accord – V.P. Singh – Mandal commission – P.V. Narasimha Rao – New Economic policy – Demolition of Babri Masjid – Foreign policy.

#### Unit-V United Front Government, BJP & Congress Ministry

Deva Gowda – I. K. Gujaral – BJP Government – Vajpayee – Kargil war – Operation Vijay – National Democratic Alliance Government 1999 - 2004 – Terrorist attack on Parliament – Red Fort attack – Godhra tragedy – POTA – Suffraganisation of Education – SSA – Manmohan Singh Government – Foreign policy – Demonetisation – Jammu Kashmir Re-organisation Act 2019.

#### Text Book:

1. Venkatesan. G. *Contemporary History of India*. Rajapalayam: VCPublications, 2007.

#### Books for Reference:

1. Dube. S.C. *Contemporary India and its Modernisation*. New Delhi: Vikas Publishing House, 1974.
2. Gilbert. John. G. *Contemporary History of India*. New Delhi: Anmol Publications Pvt.Ltd, 1990.
3. Kamal. K.L. *Contemporary Indian Politics*. Jaipur: R.B.S.A. Publishers, 1987.
4. Menon. V.P. *Integration of the Indian States*. Madras: Orient Longman, 1985.

#### Journal:

1. <https://journals.sagepub.com/doi/abs/10.1177/097492848203800112>
2. <http://www.worldcat.org/issn/0972-8465>
3. [https://ir.lib.hiroshima-u.ac.jp/en/list/HU\\_journals/hindas](https://ir.lib.hiroshima-u.ac.jp/en/list/HU_journals/hindas)

#### E-Learning Resources:

1. <https://youtu.be/84S5HTdWUtY>
2. <https://youtu.be/1yu53SeKHcw>
3. [https://youtu.be/qiRwd\\_6nJYs](https://youtu.be/qiRwd_6nJYs)

<b>Semester–IV</b>			
<b>Core XIX History of USA from 1865 to 2020 C.E</b>			
<b>Course Code: 21PHIC44</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits:4</b>

**Objectives:**

- To appreciate the role of American Presidents in International affairs.
- To enhance the shaping of foreign policy of USA.
- To understand the emergence of USA as a super power in the world.

**Course Outcome:**

<b>CO.No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	outline the history of USA under various Presidents.	1,2	Un, Re
CO-2	examine the New Deal measures of FDR.	4	An
CO-3	trace out awareness about the Civil Rights movement.	1,2	Un, Re
CO-4	assess the impact of US foreign policy since the First World War.	5	Ev
CO-5	understand the emergence of USA as a super power in the world.	1,2	Un, Re
CO-6	aware of Pan–American movement.	1,2	Un, Re
CO-7	analyse the historical background of Twin Tower attack.	4	An
CO-8	assess the role of USA in International politics.	5	Ev



Semester-IV			
Core XIX		History of USA from 1865 to 2020 C.E	
Course Code: 21PHIC44	Hrs/Week:6	Hrs/Sem: 90	Credits:4

#### **Unit-I Post-war reconstruction**

Lincoln's plan – Johnson's plan – Congressional plan – Ulysses Grant – Mc Kinley and Spanish American war.

#### **Unit-II Industrial Development**

Transport – Labour – Agriculture – Progressivism – Theodore Roosevelt – Big Stick diplomacy – Roosevelt Corollary – William Howard Taft –Dollar diplomacy.

#### **Unit-III USA and First World War**

Woodrow Wilson – Fourteen - points The Great Economic Depression.

#### **Unit-IV Franklin D. Roosevelt**

New Deal–Good Neighbour policy–Second World war–U.S.A. and Peace conferences–Pan American movement–Harry S. Truman – Truman Doctrine –Cold war – Marshal plan –Vietnam war and Korean war.

#### **Unit-V U.S.A in Contemporary Scenario**

Eisenhower – John F. Kennedy – Civil Rights movement – Richard Nixon – Jimmy Carter – Gerald Ford – Reagan – George Bush (Sr)–Bill Clinton–George Bush (Jr) - Twin Tower attack – Barrack Obama – Economic Policy - Donald Trump – Immigration Policy.

#### **Text Book:**

1. Rajayyan. K. *A History of the United States*. Madurai : Ratna Publications,1992.

#### **Books for References:**

1. Hofstadter Richard Miller. William and Aaron. Daniel. *The American Republic Since 1865. Vol.II* .New Jersey: Prentice Hall Inc,1959.
2. Majumdar. R.K. Srivastava. *History of the United States of America from 1845 to Present Day*. Delhi: SBD Publishers and Distributors, 1994.
3. Nambi Aroran . *History of the United States of America*. Madras: Government of Tamil Nadu, Metro Printers,1977.
4. Pratt W.Jullus. *A History of United States Foreign Policy*. New Jersey:Prentice-Hall,1965.

#### **Journals:**

- 1.<https://academic.oup.com/jah>
- 2.<https://academic.oup.com/ahr>
- 3.<https://www.press.jhu.edu/journals/reviews-american-history>

#### **E-Learning Resources:**

- 1.<https://youtu.be/SBWUrnDr4MQ>
- 2.<https://youtu.be/MWYjNUAqvU>

SEMESTER I			
Core III Accounting for HR Managers			
Code: 21PHRC13	Hrs/Week: 6	Hrs/Sem: 90	Credits: 4

**Objectives:**

- To equip the students with the conceptual framework and tools / techniques of management accounting so that efficient decisions are arrived at.
- To enable the students to use their knowledge to assess a company's performance in relation to its past performance, competitors and industry to make managerial decision.

**Course Outcome**

CO No.	On completion of this course students will be able to	PSOs Addressed	CL
CO-1	understand the concept of accounting	1,4	Un , Re
CO-2	prepare final accounts	1,4	Ap
CO-3	understand the nature ,scope and functions of managerial accounting.	1,4	Un , Re
CO-4	prepare cash flow statement.	4	Ap
CO-5	prepare fund flow statement.	4	Ap
CO-6	understand the objectives and steps in budgetary control and prepare the various types of budget.	4,6	Un , Ap
CO-7	able to use the various types of ratios for managerial decision.	4,6	An ,Cr
CO-8	apply accounting knowledge for planning and control.	1,4,6	Un ,Ap



SEMESTER I			
Accounting for HR Managers			
Core III			Credits: 4
Code: 21PHRC13	Hrs/Week: 6	Hrs/Sem: 90	

- Unit I      Accounting**  
Accounting – Definition – Purpose – Functions -Préparation of final accounts  
-Journal – Ledger – Trail balance – Trading and Profit & Loss Accounts  
(Simple Problems)
- Unit II      Management accounting**  
Meaning, definition, nature, scope and functions – advantages and limitations  
– differences between cost accounting and management accounting –  
differences between management accounting and financial accounting.
- Unit III      Cash flow and fund flow statement**  
Cash flow and fund flow statement – their importance and limitations -  
preparation of cash flow and fund flow statements.(Simple problems)
- Unit IV      Budgetary control**  
Budgetary control – Definition – Objectives – Merits and limitations – Steps  
in budgetary control – types of budgets.(Production, Cash, Sales,  
Flexible).(Simple problems)
- 
- Unit V      Ratio analysis**  
Ratio - Meaning – types of ratios – Merits and limitations – Ratio analysis  
(Activity Ratio, Liquidity ratio, Solvency ratio) (Simple problems).

#### Text Book

Pillai R.S.N and Bagavathi. *Management Accounting*. New Delhi; S. Chand Publications, 4<sup>th</sup> Edition, 2015.

#### Books for Reference:

1. Antony Atkinson and Robert S Kalplan. *Management Accounting: Information for Decision Making and Strategy Execution*. US;Prentice Hall, 6<sup>th</sup> Edition, 2011.
2. Gupta RL & Gupta VK. *Principles and Practice of Accounting*.NewDelhi ;Sultan Chand & Sons, 14<sup>th</sup> Edition, 2010.
3. MaheswariS.N.*Management Accounting & Financial Accounting*.Chennai;Vikas Publishers, 2<sup>nd</sup> Edition, 2010.



SEMESTER II			
Core-IX		Recruitment and Selection Procedures	
Code: 21PHRC24	Hrs/Week: 5	Hrs/Sem: 90	Credits: 4

**Objectives:**

- To equip the students with a blend of theory and application of the wide range of issues, principles, practices in recruitment and selection which are needed by them as HR professionals to save the organisation from performance related problems at a later stage.
- To provide conceptual knowledge and operational dimensions in recruitment and selection process with the aim of improving the business by selecting the right candidates.

**Course Outcome:**

CO No.	Upon completion of this course students will be able to	PSOs Addressed	CL
CO-1	understand the skills needed for recruitment and selection.	5	Un
CO-2	describe the meaning, functions, objective, importance of recruitment and hiring process.	5	Un
CO-3	understand the meaning, sources, advantage and disadvantages of internal and external hiring and illustrate the process of internal and external hiring.	5	Un , Ap
CO-4	write application form, bio data and resume.	5	Cr
CO-5	determine the features, purpose, types, process, advantage and disadvantage of testing and interviewing.	5	Ev
CO-7	design different ability tests and practice interview techniques.	5	Cr , Ap
CO-8	discuss the purpose, methods of collecting reference data, contents of appointment order and medical examination and develop appointment orders.	5	Un ,Cr



SEMESTER II			
Recruitment and Selection Procedures			
Core IX			Credits: 4
Code: 21PHRC24	Hrs/Week: 5	Hrs/Sem: 90	

**Unit I Recruitment**  
 Recruitment: Definition – Meaning – Features – Objective – Purpose and Importance – Process. Hiring decision: Nature of hiring: Regular – Temporary – Full time – Part time – Apprentice – Contractual and Outsourcing. Existing post or new post to be created -Need analysis - Cost analysis.

**Unit II Internal and External Recruitment**  
 Hiring Internally: Meaning – Definition – Advantages - Disadvantages in terms of cost, time, quality and suitability. Sources of internal recruitment: - Circulars, Intranet Advertisements, Employee referrals, Appointment or promotion. Hiring Externally: Meaning – Definition – Sources: Advertisement in Newspaper- TV/Radio- Internet- Search on the internet- ‘Wanted’ signboards- Consultants-Employment exchange- Campus recruitment-Employee referrals and unsolicited applications. Advantages and disadvantages of the above sources in terms of Cost, Time, Convenience, Reach of the targeted population, and Quality of applicant pool. Difference between internal recruitment and external recruitment.

**Unit III Screening of Applications**  
 Application Forms: Meaning – Definition – content - Purpose – Evaluation - Advantages and Disadvantages. Bio-data: Meaning – Definition – Purpose - Advantages and Disadvantages. Resume: Meaning – Definition – Purpose – Parts – Formats - Advantages and Disadvantages. Curriculum vitae: Meaning – Definition – Purpose – Preparing – Formats - Advantages and Disadvantages. Weighted application blanks: Meaning – Definition – Purpose – Constructing a WAB- Advantages and Disadvantages. Taking a behavioural approach to recruitment: Spotting personality patterns - Making basic assumptions - Predicting the future - Strategy Vs. technique.

**Unit IV Testing and Interviewing Procedures**  
 Testing: Meaning – Definition – Purpose - Advantages and Disadvantages. Ability tests: Clerical ability test - Mechanical ability test - Mental ability test - Physical ability test - Personality assessment test - Typing test - Shorthand test - Computer proficiency test. Interviewing: Meaning – Definition – Features – Objectives – Advantages and Disadvantages. Interview process - Planning the interview - Getting started - Examining the 5 interview areas - Examining the strengths & weaknesses - Allowing candidates to ask questions at the end - Explaining the procedure of selection and concluding with a happy note - Making the decision.



## Unit V

### Reference checking & Job offer letter

Reference Checking: Meaning – Definition – Purpose – Methods of Collecting Reference Data. – pros and cons of reference checks. Verification of character - Criminal antecedents - Previous work behavior - Educational qualifications - Verification of community certificates in public sector companies. Job offer letter: Meaning – Definition – Purpose - Contents of appointment letter, hard copy (or soft copy) - Method of delivery and retrieving the acknowledgement copy. Medical Examination & acceptance of offer for joining.

### Text Book:

Aswathappa.K. *Recruitment and Selection*. New Delhi;Tata McGraw Hill Publishing Company Ltd, 6<sup>th</sup> Edition, 2005.

### Books for Reference:

1. Lilly M.Berry.*Employee Selection*.California;Thomson Publications,1<sup>st</sup> Edition, 2002.
- 2.Robert W. Wendover. *High performance Hiring*.California; Crisp Publication, 8<sup>th</sup> Edition, 2011.



SEMESTER II			
Total Quality Management			
Core X			
Code: 21PHRC25	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

**Objectives:**

- To enable the students to understand the basic principles and techniques of Total Quality Management for effective decision making
- To equip the students to use models and quality management methodology for the implementation of total quality management in any sphere of business and public sector.

**Course Outcome**

CO No.	On completion of this course students will be able to	PSOs Addressed	CL
CO-1	discuss the concept of quality and total quality management.	4	Un
CO-2	gain insights on TQM approaches	4	Ev
CO-3	define and list the steps in supplier partnering.	4	Re
CO-4	gain knowledge on the tools and techniques of TQM	4,6	Re , Ap
CO-5	gain knowledge on the concept of six sigma and quality circles	4	Re , Ap
CO-6	discuss the concept of benchmarking	4	Un
CO-7	state the Quality systems and ISO 9000	4	Re
CO-8	examine ISO 14000.	4	An



SEMESTER II			
Core X		Total Quality Management	
Code: 21PHRC25	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

- Unit I Introduction to Quality and Total Quality Management**  
Introduction to Quality – Definitions of quality -Need for quality - Dimensions of product and service quality. Definition of TQM - Basic concepts of TQM - Characteristics of TQM - Framework of TQM – Principles of TQM - Contributions of Deming, Juran, and Crosby – Barriers of TQM –Quality statements- customer satisfaction, customer complaint, customer retention-cost of quality.
- Unit II TQM Approaches and Supplier Partnering**  
Continuous process improvement: introduction - Input/ Output Process Model - Juran Quality Trilogy - PDCA cycle - 5S House Keeping- Benefits of implementing 5S - Kaizen - Features of Kaizen .Supplier partnership: Partnering - Supplier selection –Supplier certification- Supplier Rating-Relationship development.
- Unit III TQM Tools and Techniques – 1**  
The seven traditional tools of quality: Flowchart – Check sheet – Histogram – Pareto Diagram - Cause and effect Diagram - Scatter Diagram - Control Chart  
New management tools : Affinity Diagram – Relationship Diagram – Tree Diagram – Matrix Diagram – Matrix Data Analysis – Decision Tree – Arrow Diagram - 360 degree feedback- Quality Function Development.
- Unit IV TQM Tools and Techniques – 2**  
Six sigma: Concept- Process (DMAIC) –Six Sigma Matrix- Advantage of Six Sigma. Quality Circles: Concept – Objectives –Characteristics – Structure of Quality Circles. Taguchi's Quality Loss Function- Concept- Methods. Benchmarking: Definition - Reason to bench mark – Types of Benchmarking - Benchmarking process- Benefits and Dangers of Benchmarking. Failure Mode and Effect analysis- Concept- Types - Stages –Benefits.
- Unit V Quality Systems**  
Need for ISO 9000 – Benefits of ISO 9000 - Quality System - Introduction - Elements - Documentation - Quality Auditing ISO 14000 – Concepts - Requirements - Benefits – OHSMS –ISO9001:2015 QMS-ISO14001:2015 EMS-ISO 45001:2018 OHSMS-ISO 50001 ENMSTQM Implementation in manufacturing and service sectors (Case Study).

#### Text Book:

Jayakumar.V and Raju.R. *Total Quality Management*. Chennai; Lakshmi Publications, 6<sup>th</sup> Edition, 2015.

#### Books for References:

1. Dale H. Besterfield *Total Quality Management*: Pearson Education, India, 5<sup>th</sup> Edition, 2011.



SEMESTER III			
Core XII			
Research Methodology			
Code: 21PHRC31	Hrs/Week: 5	Hrs/Sem:90	Credits: 4

#### Objectives:

- To impart the firm belief in the students that research is a crucial aspect for analysing business issues and also for providing sustainable solutions.
- To enable students to gain knowledge about the different tools and approaches of research methodology and habituate them to process the data meaningfully and draw relevant insights and arrive at sustainable solutions to the requirements of the organisation and business.

#### Course Outcome

CO No.	Course Outcome	PSOs Addressed	CL
CO-1	to help students develop a thorough understanding of the fundamental theoretical ideas and logic of research.	7	Ap
CO-2	understand the objectives of research, types of research and criteria of good research.	7	Un
CO-3	demonstrate the research problem and research design.	7	Ap
CO-4	gain knowledge of sampling design and scaling techniques and demonstrate the knowledge of scaling methods.	7	Un ,Ev
CO-5	understand and decide the methods of data collection and process the data collected.	7	Un , An
CO-6	experiment with the collection, processing and interpretation of data.	7	Ap
CO-7	to train students in learning the accepted formats for writing research report.	7	An
CO-8	analyse the findings and formulate their own reports.	7	Cr



SEMESTER III			
Core XII	Research Methodology		Credits: 4
Code: 21PHRC31	Hrs/Week: 5	Hrs/Sem:90	

- Unit I Introduction to Research and Research design**  
Meaning of Research – Objectives of Research – Types of Research – Research Process– Criteria of Good Research — Research Problem: Meaning- Selecting the problem –Techniques involved in defining a research problem- Review of literature-Research gap – Sources of literature.  
Research Design: Meaning– Concepts relating to research design- Types of research designs: Explorative, descriptive, diagnostic and experimental designs – Challenges in research.
- Unit II Sampling Method**  
Sample Design: Definition – Steps of sampling design - Types of sampling designs – Sampling Errors - Scaling: Meaning- Goodness of Measurement scales- Scaling Techniques- Comparative: Paired Comparison, Rank Order, Constant sum and Non-comparative – Graphic rating. Itemized rating (Likert, Semantic, Stapel), Single/ multiple category scale, verbal frequency scale, Multidimensional scale.
- Unit III Data Collection**  
Data Collection: Primary Methods- Observation, Interview, Questionnaire, Schedule – Difference between questionnaire and schedule- Guidelines for constructing questionnaire –Projective techniques - Collection of Secondary Data – Selection of appropriate method for data collection- Case study method - Data preparation Process – Problems in preparation process.
- Unit IV Data Analytics**  
Measures of Central Tendency Model – Multiple Correlation Model – Simple and Multiple regression Model – Time series model- Extraction of Charts – Basics of SPSS.
- Unit V Interpretation and Report Writing**  
Interpretation: Meaning- Techniques- Precautions. Report Writing – Steps in report writing- Layout of the research report- Types of reports - Mechanics of writing a research report- Oral presentation- Precautions for writing research reports.

#### Text Book:

1. Kothari. C.R. *Research Methodology*. New Delhi; Vikas Publishing Ltd,2004.

#### Books for Reference:

1. Gupta S.C and Kapoor.V.K. *Fundamentals of Applied Statistics Sultan*. New Delhi; Chand & Sons, 2006.
2. William Josiah Goode and Paul K. Hatt.*Methods of Social Research*.New Delhi; McGraw Hill, 2004.



SEMESTER III			
Core XIV			
Statistics For Management			
Code: 21PHRC33	Hrs/Week: 5	Hrs/Sem:90	Credits: 4

**Objectives:**

- To equip the students with the concepts and tools of statistics and make them competent to analyse statistical data and arrive at apt solutions as per business requirements and organisational goals.
- To impart knowledge about various statistical concepts, tools and analytical procedures and also equip them to process the data meaningfully and accurately with a view to provide effective solutions for the management of the organisation.

**Course Outcome**

CO No.	On completion of this course students will be able to	PSOs Addressed	CL
CO-1	learn the basic statistical methods with a focus on the application of these methods to the business world.	6 ,7	Ap
CO-2	understand the basic statistical concepts such as types of data, classification of data, frequency distribution and construct frequency distributions.	6 ,7	Un ,Ap
CO-3	to become aware of the concepts of sampling, sampling distributions and estimation.	6 ,7	An
CO-4	understand the concept and steps of performing a hypothesis (z, t, F) test and use it as a tool for statistical decision making in a business context.	6 ,7	An ,Ev
CO-5	understand the assumptions of an ANOVA model and apply ANOVA in a business context.	6 ,7	Un ,Ap
CO-6	understand the concept of Chi-square and use it as an analytical tool for making business decisions.	6 ,7	Un ,Ap
CO-7	to appreciate the importance and application of non-parametric tests.	6 ,7	Un
CO-8	use correlation and regression models to analyse the relationships between variables.	6 ,7	Un, Cr



SEMESTER III			
Statistics For Management			
Core XIV	Hrs/Week: 5	Hrs/Sem:90	Credits: 4
Code: 21PHRC33			

#### Unit I Introduction

Statistics - Definition, Types, Importance and Scope, Limitations. Types of Data, Classification of data, Organising data, Methods of data classification. Frequency Distribution, constructing a frequency distribution, Types of frequency distribution – Managerial Implications.

#### Unit II

##### Sampling Distribution and Estimation

Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size– Managerial Implications..

#### Unit III

##### Testing Of Hypothesis: Parametric Tests

**Hypothesis testing: Parametric Tests :** Introduction to hypothesis and hypothesis testing , general procedure for hypothesis testing, direction of the hypothesis test, errors in hypothesis testing ,hypothesis testing for population parameters with large samples (z-test), Hypothesis testing for means of small samples (t-test), Hypothesis testing based on F-distribution for two sample standard deviations. ANOVA - one and two way– Managerial Implications..

#### Unit IV

##### Chi – Square and Other Non-Parametric Tests

Introduction, Advantages and limitations of Non-parametric Methods, Properties of Chi-square distribution, Conditions for the application of Chi-square test, Contingency table analysis: Chi-square test of Independence, Chi-square tests for goodness of fit, Chi-square test for population variance. The sign test for paired data, Mann-Whitney U-test, Wilcoxon Matched pairs test, Kruskal –Wallis test– Managerial Implications.

#### Unit V

##### Correlation and Regression Analysis

Correlation analysis – Meaning, Types of Correlation, Coefficient of Determination, Karl Pearson's correlation coefficient and Spearman Rank Correlation coefficient, method of least squares . Regression analysis – Meaning, Methods to determine regression coefficients- Least squares Normal equations – Deviations method– Managerial Implications.

#### Text Book:

1. Richard I. Levin; David S. Rubin, *Statistics for Management*. Chennai; Pearson Education, 2011.
2. Sharma.J.K. *Business Statistics*. Chennai; Pearson Education, 2006.

#### Books for Reference:

1. Gupta.S.P&Gupta.M.P. *Business Statistics*.New Delhi; Sultan Chand & Sons, 2015.

<b>Semester I</b>			
<b>Core II</b>		<b>Real Analysis</b>	
<b>Course Code: 21PMAC12</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits: 4</b>

### Course Objectives

- To acquire thorough knowledge about real functions, limit functions and their properties.
- Have the knowledge of basic properties of the field of real numbers

### Course Outcome

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	Recall the basic properties of real numbers.	5,6	Re
CO-2	demonstrate the knowledge of real functions, limit of functions and their properties	2,5	Ap
CO-3	analyze the concept of differentiability of real functions and related theorems	6	An
CO-4	evaluate the continuity, differentiability and integrability of functions defined on the real line.	2,5	Ev
CO-5	analyse the concepts of continuous functions and their properties	6	An
CO-6	explain the concepts of axioms of real number systems, uniform convergence of sequences and series of functions, equicontinuity, compact and complete metric spaces, the Stone-Weierstrass theorem.	1,5	Un
CO-7	apply the concept of the series of real numbers and convergence.	2,5	Ap
CO-8	write fundamental properties of the real numbers that lead to the formal development of real analysis.	2	Cr

Semester I			
Core II		Real Analysis	
Course Code: 21PMAC12	Hrs/Week: 6	Hrs/Sem: 90	Credits: 4

### Unit I

Metric Spaces- Compact sets- Perfect sets- Connected sets.

(Chapter 2)

### Unit II

Convergent Sequences - Subsequences - Cauchy Sequences - Upper and Lower Limits - Some Special Sequences- Series of nonnegative terms - The Number e.

(Chapter 3)

### Unit III

The Root and Ratio Tests - Power Series - Summation by parts - Absolute Convergence - Addition and Multiplication of series – Rearrangements – Problems related to SET/NET.

(Chapter 3)

### Unit IV

Limits of functions - Continuous functions - Continuity and Compactness - Continuity and Connectedness - Discontinuities - Monotone functions - Infinite limits and limits at infinity - Problems related to SET/NET.

(Chapter 4)

### Unit V

The Derivative of a real function - Mean value Theorems - The continuity of derivatives - L'Hospital's Rule - Derivatives of Higher order - Taylor's Theorem.

(Chapter 5)

Problems related to SET/NET is only for Internal Examination.

### Text Book

1. Walter Rudin. *Principles of Mathematical Analysis*. McGraw-Hill International Editions. Third Edition, 1953.

### Books for Reference

1. Apostol. *Mathematical Analysis*. London. Addition Wesley Publishing Company, 1971.
2. Goldberg. *Methods of Real Analysis*. Oxford & IBH Publishing Company, 1970.

<b>Semester II</b>			
<b>Core VIII                      Calculus of Variations and Integral Equations</b>			
<b>Course Code:21PMAC24</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 4</b>

### Course Objectives

- To impart analytical ability in solving variational problems and integral equations also to formulate the laws of mechanics and basic physics.
- To provide the foundation of Calculus of variation and give examples on some applications within Physics and Engineering Sciences.

### Course Outcome

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	understand the properties of geometrical problems	2	Un
CO-2	apply variational problems and isoperimetric problems.	2	Ap
CO-3	evaluate to the decomposition method.	2	Ev
CO-4	compare different types of integral equations.	2	An
CO-5	solve variational problems with constraints both algebraic and isoperimetric.	2,6	Ap
CO-6	examine the Euler - Lagrange equation for variational problems including the case of general variations.	2,5	An
CO-7	recall symmetries and use them to solve the Euler- Lagrange equations.	2,6	Re
CO-8	solve integral equations and analyze the relation between differential equations and Volterra integral equations	2	Ap



Semester II			
Core VIII                      Calculus of Variations and Integral Equations			
Course Code: 21PMAC24	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

### Unit I

Calculus of Variations and Applications: Maxima and Minima - The Simplest case - Illustrative examples - Natural boundary conditions and transition conditions - The variational Notation - The more general case. **(Chapter 2: Sections: 2.1 - 2.6)**

### Unit II

Constraints and Lagrange multipliers - Variable end points – Sturm - Liouville problems - Hamilton's principle - Lagrange's equations. **(Chapter 2: Sections: 2.7 - 2.11)**

### Unit III

Integral Equations: Introduction - Relations between differential and integral equations - The Green's function - Alternative definition of the Green's function. **(Chapter 3: Sections: 3.1 - 3.4)**

### Unit IV

Linear equations in cause and effect - The influence function - Fredholm equations with separable kernels - Illustrative example. **(Chapter 3: Sections: 3.5 - 3.7)**

### Unit V

Hilbert-Schmidt theory- Iterative methods for solving equations of the second kind - Fredholm theory. **(Chapter 3: Sections: 3.8, 3.9, 3.11)**

### Text Book

1. Francis B. Hildebrand. *Methods of Applied Mathematics*. Prentice-Hall of India private limited. second edition, 1968.

### Books for Reference

1. L. Elsgolts. *Differential Equations and the Calculus of Variations*. University Press of the Pacific, 2003.
2. Mark Kot. *A First Course in the Calculus of Variations*. American Mathematical Society Providence Rhode Island, 2014.



<b>Semester III</b>			
<b>Core XIV</b>		<b>Research Methodology</b>	
<b>Course Code: 21PMAC35</b>	<b>Hrs/ week: 4</b>	<b>Hrs/Semester: 60</b>	<b>Credits: 4</b>

### Course Objectives

- To contribute to the development of the new statistical methodology to address substantive problems and to promote the use of these methods through publications.
- To identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research projects.

### Course Outcome

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	use Mathematical and Statistical techniques for research.	5,8	Ap
CO-2	acquire basic knowledge about various instruments and techniques in Mathematical research.	5,1	Un
CO-3	acquire knowledge in research publication and thesis writing.	5	Un
CO-4	understand the basic aspects in research.	5	Un
CO-5	practice and improve the research presentation skills with latest tools.	5	Re
CO-6	organize and conduct research in a more appropriate manner.	5	Cr
CO-7	identify appropriate research topics.	5	Ap
CO-8	select and define appropriate research problems and parameters.	5	Re

Semester III			
Core XIV		Research Methodology	
Course Code: 21PMAC35	Hrs/ week: 4	Hrs/Semester: 60	Credits: 4

### Unit I

An Introduction: Meaning of Research- Objectives of Research- Motivation of Research- Types of Research- Research approaches- Significance of Research- Research methods versus Methodology- Research and scientific method.

(Text Book: 1, Chapter: 1, pages 1-9)

### Unit II

Importance of knowing how research is done - Research Process - Criteria of Good Research.

(Text Book: 1, Chapter: 1, pages 10-20)

### Unit III

Planning the Thesis: Selecting a topic-Reviewing the literature-Designing the study-The chapter outline. Writing the Thesis: The preliminaries - The text-The reference material-The abstract - The final product-Chapter divisions and subdivisions – Spacing – Pagination - Margins- Paragraph indentation-Sample pages.

(Text Book: 2, Chapter: 3, 5)

### Unit IV

Revising the Thesis: Editing the final draft-Evaluating the final draft - Proof reading the final typed copy - Plagiarism - What is Plagiarism - Types of Plagiarism- Glossary – preventing plagiarism when writing.

(Text Book: 2, Chapter: 6, 12, <http://www.plagiarism.org/plagiarism-101/what-is-plagiarism/>)

### Unit V

Writing language of theorem: Introduction and Motivation - Mathematical style - Terminology and notation (especially in discrete mathematics) - English usage in mathematical writing.

(Text Book: 3, Pages 1-31)

### Text Books

1. C.R. Kothari. *Research Methodology*, New Age International (P) Limited, Publishers, Second Revised Edition, 2009.
2. Janathan Anderson, Berry H. Durston& Millicent Poole. *Thesis and assignment Writing*. Wiley Eastern limited, Eleventh Reprint, 1991.
3. Douglas B. West *The Grammar According to West*.

### Book for Reference

1. Leonie Elphinstone and Robert Schweitzer. *How to get a research degree* . A Survival Guide, Allen and Unwin Publication, 1998.

Semester IV			
Core XVII		Number Theory and Cryptography	
Course Code:21PMAC43	Hrs/week: 5	Hrs/Sem:75	Credits: 4

### Course Objectives

- To introduce the basic concepts of Number Theory such as Divisibility, Congruences, Congruences with Prime Modules, Quadratic Reciprocity and some functions of Number theory.
- To understand basics of cryptography and network security.

### Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	define the key notions of algebraic number theory and outline their interrelation.	5	Re
CO-2	calculate the most important number theoretical quantities introduced during the course.	5	Re
CO-3	give an account of fundamental theorems of the course and apply them in specific cases.	1,6	Re
CO-4	calculate and solve the system of linear congruences and warning problem.	2,6	Re
CO-5	differentiate the greatest integer functions and arithmetic function.	1,6	An
CO-6	define and interpret the concepts of divisibility, congruence and prime factorization.	5	Re
CO-7	explains the notions of public key encryption and digital signatures.	6	Un
CO-8	describe and implement the specifics of some of the prominent techniques for public key crypto systems and digital signature schemes	6	Re

Semester IV			
Core XVII		Number Theory and Cryptography	
Course Code:21PMAC43	Hrs/week: 5	Hrs/Sem:75	Credits: 4

### Unit I

Divisibility - primes - Congruences - Solutions of Congruences - Congruences of degree one.

(Text Book 1, Chapter: 1 & 2, Sections: 1.1, 1.2, 1.3, 2.1, 2.2, 2.3)

### Unit II

Quadratic residues - quadratic reciprocity - The Jacobi symbol.

(Text Book 1, Chapter 3, Sections: 3.1, 3.2, 3.3)

### Unit III

Greatest integer Function -Arithmetic functions- The Moebius inversion formula- Multiplication of Arithmetic functions.

(Text Book 1, Chapter: 4 Sections: 4.1, 4.2, 4.3, 4.4)

### Unit IV

The equation  $x^2 + y^2 = z^2$ - The equation  $x^4 + y^4 = z^2$  - sum of four and five squares -Waring's problem: Sum of fourth powers-sum of two squares.

(Text Book 1, Chapter: 5, Sections: 5.5, 5.6, 5.7, 5.8, 5.9, 5.10)

(without Exercise problems)

### Unit V

The Basics of Cryptography: Encryption and decryption - What is cryptography? - Conventional cryptography - Public key cryptography - How PGP works - Keys - Digital Signatures - Digital certificates - Validity and trust - Certificate Revocation - What is passphrase? RSA: Principles of Public - key Cryptosystems - The RSA Algorithm.

(Text Book 2, Chapter 1, Text Book 3, Chapter 9)

### Text Book

1. Ivan Niven and Herbert S. Zuckerman. *An introduction to the theory of numbers*. Wiley Eastern ltd, Third Edition, 1976.
2. PGP Corporation. *An introduction to Cryptography*. version 8.0, Released Oct, 2002.
3. William Stallings. *Cryptography and Network Security Principles and Practice*. Pearson India Education Services Pvt.Ltd, Seventh Edition.

### Books for Reference

1. Harriet Griffin. *Elementary Theory of Numbers*. McGraw-Hall Book Company, INC 1954.
2. G.H. Hardy and E.M. Wright. *An Introduction to the theory of numbers*. Oxford university press, Sixth Edition, 2008.
3. Mohamed Barakat, Christian Eder and Timohanke. *An Introduction to Cryptography*. September 20, 2018.

<b>SEMESTER I</b>			
<b>Core III- Biochemistry</b>			
<b>Course Code : 21PMIC13</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credits: 4</b>

**Objectives:**

To be recognized as a centre for excellence in biochemistry that provide an atmosphere to acquire skills in identifying the link between biological and human resources and transform it to enhance the quality of life

To enhance the students with a broad-based knowledge in concepts and principles of biochemistry.

**Course Outcome :**

<b>CO No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>C L</b>
CO-1	compare and contrast the structure, classification and function of the carbohydrates.	1,2	Un, Kn
CO-2	understand the structure, classification and function of lipids.	1,3	Un
CO-3	compare and contrast saturated, mono-saturated and poly-saturated fatty acids.	1	Kn
CO-4	know the structure and classification of proteins	5	Kn
CO-5	know the classification and properties of amino acids.	5	Kn
CO-6	recognize the importance of nucleic acids and its role.	6	Un
CO-7	know the dna, rna structure, function, types and importance	6	Kn
CO-8	understand the functions of enzymes, coenzymes and cofactors	5,6	Un

SEMESTER I			
Core III- Biochemistry			
Course Code : 21PMIC13	Hrs/ Week: 4	Hrs/ Sem: 60	Credits: 4

### Unit I - Nucleic acid

Nucleic acid- structure of nitrogen bases and base pairing, structure of nucleosides, nucleotides, Ribose, Deoxyribose sugar. DNA, RNA structure, function, types and importance.

### Unit II - Proteins

Proteins- classification, structure of primary, secondary, tertiary and quaternary protein, classification of amino acids, properties, peptide bond, formation and types

### Unit III - Enzymes

Enzymes- concept, definition, nature, active site, properties, classification, physico-chemical properties. Factors affecting the enzyme synthesis and activity. Allosterism – Determination of Michaelis Menten constant – Factors affecting Km Value – Mode of Enzyme action (Lock and Key model and Induced fit model)- coenzymes – Cofactors – Isozymes and Inhibitors.

### Unit IV - Carbohydrates

Carbohydrates- definition and classification- properties- optical and chemical structure of glucose, ring structure, Haworth and Fischer's projection, pyranose, furanose isomers, mutarotation, triose, pentose, hexose, heptose,- examples and structures, derived monosaccharide, glycosides, furanoacids, sugar, phosphates, uronic acids, sugar alcohol, disaccharides, glycosidic linkage, lactose, maltose, sucrose, oligosaccharide, trisaccharides, structure of raffinose- polysaccharide- homo polysaccharide, hetero polysaccharide structure, starch, cellulose, mucopolysaccharide, and biological significance.

### Unit V - Lipids

Lipids- classification, chemistry of fatty acids- unsaturated, saturated fatty acids, triglycerides, saponification, sterols, cholesterol, prostaglandins, glycolipids and function of lipids.

### Books for Reference :

1. Stryer, L., *Biochemistry*. New York: Ed. W.H. Freeman and company, 1995.
2. J.L. Jain, *Fundamental of Biochemistry*- New Delhi: S.Chand & company Ltd., 1999.
3. A.C. Deb *Concepts of Biochemistry*. Kolkata Books and Allied (P) Ltd. 7<sup>th</sup> Edition, 1999.
4. Hubert, Stryer, *Biochemistry*- New York: Freeman and Company, 1995.
5. Lehninger, *Principle of Biochemistry*. by Nelson and Cox (Worth) 3<sup>rd</sup> edition, 2009
6. A.C. Deb. *Concepts of Biochemistry*. Kolkata: Books and Allied (P) Ltd., 7<sup>th</sup> Edition, 1999

SEMESTER – I			
Core – IV Microbial Physiology			
Course Code : 21PMIC14	Hrs/ Week: 4	Hrs/ Sem: 60	Credits: 4

### Objectives:

To give the students knowledge about the physiological processes of micro organisms.

To impart advanced level information in the subject of microbial physiology.

### Course outcome:

CO No	Upon completion of this course students will be able to	PSO addressed	CL
CO -1	illustrate the basic knowledge about the microbial physiology functions and its various metabolism	3	Re
CO - 2	define various components of electron transport chain and their functions.	4,3	Re
CO -3	elaborate the bacterial growth curve and the measurement of their cell growth	4	Cr
CO - 4	explain the various bacterial transport mechanisms and their secretion system	2	Un
CO - 5	discuss about various electron transport takes place under aerobic and anaerobic condition.	1,3	Cr
CO- 6	interpret the list of fermentation mechanisms for atp regeneration.	7	Un
CO -7	prioritize various aerobic and anaerobic phototrophic bacteria with examples	1,2	E v
CO - 8	know about various pigments of the photosynthetic apparatus and learn about photosynthesis in <i>halobacteria</i> bioluminescence.	2,6	K n

SEMESTER – I			
Core – IV Microbial Physiology			
Course Code : 21PMIC14	Hrs/ Week: 4	Hrs/ Sem: 60	Credits: 4

### Unit I – Respiration and its related pathways

Definition, terminology – types - specific functions and general pattern of metabolism - anabolism Vs catabolism - metabolic pathways - linear, irreversible and branched metabolic pathways. Aerobic respiration – glycolysis - TCA cycle, gluconeogenesis and Calvin-Benson cycle.

### Unit II – Microbial growth and transport

Microbial growth- Growth curve of bacteria- Measurement of cell growth - factors affecting microbial growth: physical, chemical and biological  
Bacterial Transport: Simple, passive, active transport: Symport and Antiport and Group translocation mechanisms – Role of siderophores.

### Unit III- Electron transport chain

Electron transport chain: Functions and components ; NAD, NADP, FAD, FMN, Coenzyme Q, Cytochromes, Ferredoxin and Iron Sulphur protein – Mechanism of electron movement in aerobic and anaerobic organism - Chemiosmotic theory. Substrate level phosphorylation, Oxidative phosphorylation.  
Electron transport under anaerobic conditions - nitrate respiration, sulphate respiration, sulphur respiration, carbonate respiration, fumarate respiration and iron respiration.

### Unit IV- Fermentation

Outline mechanisms and ATP regeneration by fermentation- alcoholic fermentation by yeasts and bacteria- ethanol formation. Lactic acid fermentation- homo-fermentation, hetero-fermentation - propionic acid fermentation - formic acid fermentation – butyric acid- butanol fermentation - homo acetate fermentation- Bioluminescence.

### Unit V- Photosynthesis

Aerobic and anaerobic phototropic bacteria-purple sulphur, non-sulphur purple bacteria, green sulphur bacteria and Cyanobacteria-pigments of the photosynthetic apparatus- bacterio-chlorophylls, carotenoids and bacteriorhodopsin- localization of the pigments- regulation of pigments. Anoxygenic photosynthesis-Oxygenic photosynthesis-photosynthesis in halobacteria.

### Books for Reference:

1. Santhyanarayana. U.. *Essentials of Biochemistry*. Kolkata Books and Allied (P) Ltd., 1<sup>st</sup> Edition, 2002.
2. A.C.Deb. *Concepts of Biochemistry*. Kolkata: 7<sup>th</sup> Edition, Books and Allied (P)Ltd., 1999.
3. Prescott, Lansing M, Harley, John P, Klein Donald A, *Microbiology*. McGraw-Hill, New York, 1999.
4. David L. Nelson. *Lehninger Principle of Biochemistry*. 7<sup>th</sup> edition. 2017.
5. Stryer, *Biochemistry* 5<sup>th</sup> edn W.H. Freeman. 2001.
6. Dr.J.L.Jain, Dr.Sunjay Jain and Nitin Jain, *Fundamentals of Biochemistry*. S.Chand Publisher, VI Edition. 2005.



<b>SEMESTER-II</b>			
<b>Core-VI Medical Microbiology</b>			
<b>Course Code: 21PMIC22</b>	<b>Hrs/Week: 5</b>	<b>Hrs/Sem: 75</b>	<b>Credits:4</b>

**Objectives:**

A centre of excellence for training and research in medical microbiology.

To train quality healthcare professionals carry out creative innovative and inventive research and provide reliable diagnostic services in the field of medical microbiology.

**Course Outcome:**

<b>CO. No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO -1	recall the clinical microbiology concept to patient care	1	Re
CO -2	analyse the level information in the subject of medical microbiology	6	An
CO -3	illustrate the different classes of microbes	3	Un
CO -4	describe the applied microbiology aspects of clinical technique.	1	Un
CO- 5	describe the role of chemotherapeutic technique	4	Un
CO -6	explain the drug resistance capacity of microbes	4	Un
CO -7	outline the concepts of chemotherapy and its mode of action	4	Un
CO -8	explain the knowledge of mycology and parasitology	5	Un

SEMESTER-II			
Core-VI Medical Microbiology			
Course Code: 21PMIC22	Hrs/Week: 5	Hrs/Sem: 75	Credits:4

### Unit-I : Infection and transmission

Microbial diseases - sources, route of transmission. Pathogenesis - adhesion, invasion, host cell damage, release of pathogens. Microbial virulence and virulence factors - Signs and symptoms of microbial diseases. Treatment, Prevention and control of microbial infections. Immunity of microbial diseases. Diagnosis of microbial diseases - Collection, transport, preliminary processing of clinical pathogens.

### Unit- II: Bacterial diseases

Characteristics, classification, pathogenesis, pathology, diagnosis, treatment, prevention and control of diseases caused by *Staphylococci*, *Bacillus*, *Clostridium*, *Corynebacterium*, *Salmonella*, *Klebsiella*, *Vibrio*, *Pseudomonas*, *Mycobacteria*.

### Unit- III: Viral diseases

Etiology, Clinical symptoms, laboratory diagnosis and treatment-Pox virus(small pox,)- Herpes virus-(HSV I&II), Orthomyxovirus (Influenza virus, Swine Flu) - Paramyxovirus (Measles and Mumps), Enterovirus (Poliovirus), Arbovirus- (Chikungunya virus, Dengue, rubella), Hepatitis virus(HAV, HBV, HCV, HDV), HIV, SARS.

### Unit-IV: Mycology and Parasitology

Human mycotic infections caused by Dermatophytes, *Histoplasma*, *Cryptococcus*, *Candida*, opportunistic mycoses. Medical importance of *Entamoeba*, *Giardia*, *Taenia*, *Ascaris*, Laboratory techniques in parasitology.

### Unit-V: Antimicrobial agents

Classification of antimicrobial agents, Mechanism of drug action –antibacterial (Bacteriostatic and bactericidal) antifungal and antiprotozoans. Methods of testing drug sensitivity (*in vitro* and *in vivo*), antibiotic assay in body fluids. Mechanism of drug resistance and dissemination of multi drug resistance. Probiotics as therapeutic agents.

### Books for Reference:

1. Chaechter M. Medoff G. and Eisenstein BC. *Mechanism of Microbial Diseases* 2<sup>nd</sup> edition. Baltimore: Williams and Wilkins,. 1993.
2. David Greenwood, Richard CD, Slack, John Forrest Peutherer. *Medical Microbiology*. 14<sup>th</sup> edition. ELBS with Churchill Livingstone. 1992.
3. Hugo WB and Russell AD. *Pharmaceutical Microbiology* 4<sup>th</sup> edition. Oxford : Blackwell Scientific Publication,. 1989.

4. Joan Stokes E, Ridgway GL and Wren MWD. *Clinical Microbiology*, 7<sup>th</sup> edition. Edward Arnold. A division of Hodder and Stoughton. 1993.
5. Ronald M. Atlas. *Microbiology. Fundamentals and Applications*. 2<sup>nd</sup> edition, Maxwell Macmillan international editions. 1989.
6. Topley and Wilson's. *Principles of Bacteriology, Virology and Immunity*, London: 8<sup>th</sup> edition, Vol. III Bacterial Diseases, Edward Arnold,. 1990.
7. Connie R Mahon. *Textbook of Diagnostic Microbiology*. 3<sup>rd</sup> edition. Pearson. 2010.
8. Fritz H. Kayser. *Medical microbiology*. Thieme Verlag. 2005.
9. Credric, A. Mims. *Medical microbiology*. 3<sup>rd</sup> edition. Mosby Inc. 2004.
10. Frank, Steven A. *Immunology and Evolution of Infectious Disease*. Princeton University Press. 2002.

**Web References:**

1. <http://dmoz.org/Science/Biology/Microbiology/>
2. <http://microbiology.mtsinai.on.ca/manual/default.asp>
3. <http://cal.vet.upenn.edu/parasite/links.html>
4. <http://www.suite101.com/links.cfm/microbiology>
5. <http://www.biosci.ohio-state.edu/-zoology/parasite/home.html>

<b>SEMESTER – II</b>			
<b>Core –VII Microbial Genetics and Molecular Biology</b>			
<b>Course Code: 21PMIC23</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credit: 4</b>

**Objectives:**

To make the students knowledgeable in the field of Microbial Genetics and Molecular Biology.

To make the students aware of the concepts of Microbial Genetics and Molecular Biology.

**Course Outcome:**

<b>CO No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	relate the genetics of microorganisms	1	Re
CO-2	recall the molecular mechanisms of microorganisms	1	Re
CO-3	explain all important topics to prepare for competitive exams	5	Un
CO-4	examine the history of molecular biology	2	An
CO-5	analyse about nucleic acids, their damage and repair mechanism	6	An
CO-6	compare all gene transfer methods	2	Ev
CO-7	interpret the central dogma of molecular biology	1	Un
CO-8	agree the concept of mutation	2	Ev

SEMESTER – II			
Core –VII Microbial Genetics and Molecular Biology			
Course Code: 21PMIC23	Hrs/ Week: 4	Hrs/ Sem: 60	Credit: 4

### Unit I: DNA-The Genetic Engineering

Historical aspects and current concepts of Molecular Biology - Experimental evidence for Nucleic acids as genetic information carriers - DNA features: Superhelicity, linking number, topological properties – Melting of DNA - DNA replication: General principles, Experimental proof for modes of replication, proof reading – Enzymology of DNA replication.

### Unit II: DNA Damage and Repair

Relationships between replication and cell cycle- Inhibitors of DNA replication (Blocking precursor synthesis, nucleotide polymerization and altering DNA structure),- DNA damage and repair – Types of DNA damage (Dimeration, oxidative damage, alkylation pyrimidine dimers) – Repair pathways : Methyl directed very short patch repair, nucleotide excision repair, base excision repair, recombinational repair and SOS repair.

### Unit III: Central Dogma of Molecular Biology

Transcription in Prokaryotes - General principles, basic apparatus, types of RNA polymerases, steps in initiation, elongation and termination, inhibitors of RNA synthesis – Polycistronic and monocistronic RNAs – Control of transcription by RNA polymerases, promoter regions, sigma factors – Controlled termination: Attenuation and anti – termination– Protein synthesis: Steps, details of initiation elongation and termination, role of various factors, inhibitors – Signal hypothesis. Regulation of gene expression: Operation concept, catabolite repression, instability of bacterial RNA, negative regulation (*E.coli*, lac operon), Positive regulation (*E.coli* ara operon) – Regulation by attenuation (trp operon). Maturation and processing of RNA: Methylation, trimming of rRNA - Capping, Poly adenylation and splicing of mRNA – Cutting and modification of tRNA.

### Unit IV: Gene as a Unit of Mutation and Recombination

Mutants and mutation, mutagens, revertants, spontaneous mutation, mutant isolation, mutagenesis and it's types, suppression – Plasmids: Types, detection, transfer, replication and properties. Transposable elements – Nomenclature, classes, IS elements, Transposons – Composite structure and complex transposon structure, mechanism of transposition.

### Unit V: Gene Transfer Mechanisms

Transformation modes, transformation, natural and artificial competence, DNA uptake, molecular mechanisms of transformation in *Bacillus* sp and *E.coli* recombination and genetic mapping, Bacterial conjugation – F plasmid, structure and function, origin of conjugation (Hfr and F+) Interrupted and uninterrupted mating, time map and recombination map, conjugation in *E.coli*, colicins and col factors. Transduction – Generalized and Specialized – Lambda phage and P1 Mechanism of gene transfer through lambda and P1 Phages – HFT and LFT lysate – Co transduction – Transduction mapping.

**Books for Reference:**

1. David Freifelder, George M. Malacinski. *Molecular Biology*. Narosa Publishing House. 1993.
2. Avinash ., Kakoli Upadhyay MolBio - *Fundamentals of Molecular Biology* . Himalaya Publishing House. 2005.
3. Satyanarayana. U. *Biotechnnnology* – Books and Allied (P) Ltd. 2013
4. Mohan P. Arora., Gurdarshan., Sandhu. S. *Genetics*. 5<sup>th</sup> edition. Himalaya Publishing House.' 2004
5. Sambamurty.A.V.S.S . *Molecular Biology*. Narosa Publishing House. 2011.
6. Veer Bala Rastogi. *Fundamentals of Molecular Biology*. India : Ane Books. 2010
7. Jeyanthi,G.P . *Molecular Biology*. Chennai: MJP Publisher, 2009
8. Raja Pandian.K., Shanthi. S. *Molecular Biology and Microbial Genetics*. PBS Book Enterprises. 2011.

SEMESTER-III			
Core-IX- Industrial and Pharmaceutical Microbiology			
Course Code:21PMIC31	Hrs/Week:5	Hrs/Sem:75	Credits:4

### Objectives:

1. To impart the professional ability and skill by increasing the global knowledge,  
Understanding and application in Industrial and Pharmaceutical Microbiology.
2. To empower the learners to address current and future challenges faced by the  
humanity using Industrial and Pharmaceutical Microbiology.

### Course outcome:

CO No	Upon completion of this course, students will be able to	PSO addressed	CL
CO -1	revise the idea about the usage of microorganisms in the field of industrial microbiology	3	An
CO -2	analyse the knowledge of various industrial and pharmaceutical products and its impacts on the society.	4	Un
CO -3	knowledgeable in industrial fermentation	3	Un
CO -4	have an insight on industrial microbiological techniques	2	Re
CO -5	understands in the field of pharmaceutical microbiology	1	Un
CO-6	Knowledge of basics and applied microbiological aspects of industries.	1	Un
CO-7	acquire the knowledge about production of various industrial and pharmaceutical products	4,5	Un
CO-8	know the detail knowledge about antibiotics and production of hormones	2,3,4	Un, Ap

SEMESTER-III			
Core-IX- Industrial and Pharmaceutical Microbiology			
Course Code: 21PMIC31	Hrs/Week:5	Hrs/Sem:75	Credits:4

### Unit-I- Basics of Industrial Microbiology

Historical account of microbes in industrial Microbiology; Screening, isolation, preservation and improvement of industrially important microorganisms; Strain improvement; Fermenter - principles and design - types of Fermenter, Instrumentation and control- aeration and agitation. Raw materials and media formulation for fermentation processes; Industrial Sterilization; Microbial growth kinetics in Batch, Continuous and Fed batch fermentation. Downstream processing.

### Unit-II- Microbial products

Microbial production of industrially important products: Solvents (Alcohol and Acetone); Aminoacids (Glutamic acid and Lysine); Organic acids (Citric acid and Acetic acid); Enzymes (Microbial rennet, Amylase, Protease); Biopolymers (Xanthan gum and PHB); Biopreservatives (Nisin); Antibiotics - (Penicillin, Cephalosporin and Streptomycin); Vitamins (Riboflavin and Cyanocobalamin); Production of Hormones (Auxins and Gibberellins). Production of protein in bacteria and yeast (Chymosin production) – Synthetic and recombinant vaccines.

### Unit-III- Bio pesticides and Bio fertilizers

Bio pesticides – history of development, production of bio pesticides from bacteria (BT), fungi (*Trichoderma viride*), virus (NPV) and their applications against different types of pathogens. Bio fertilizer – mass production of bio fertilizer (*Rhizobium*, *Azotobacter*), quality control and field applications.

### Unit-IV- Basics of Pharmaceutical Microbiology

Properties of antimicrobial agents, types of chemotherapeutic agents – Synthetic, Semi synthetic, Natural therapeutic agents. Types of antibiotics and their mode of action: antibacterial, antifungal, antiviral, antiprotozoal. Pharmaceutical Formulation (Tablets, Capsule, Ointments, Syrup, Gel), stages of pharmaceutical product development.



## **Unit-V- Spoilage and preservation of Pharmaceutical products**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Objectives of preservation, the ideal preservative, preservative system. Antimicrobial preservatives and their properties. Preservative stability and efficacy.

### **Text books:**

- 1) Dubey, R.C. *A Textbook of Biotechnology*. New Delhi: S Chand and Company Limited. 4<sup>th</sup> Rev. Edition 2006.
- 2) Gupta, P.K. *Elements of Biotechnology*. Meerut: Rastogi Publications, 2005.
- 3) Jogdand, S. N. *Gene Biotechnology*. New Delhi: Himalaya publishing house. 4th Edition, 2016.
- 4) Reed, G Prescott and Dunn. *Industrial Microbiology*. US: Macmillan Publication. 1982.

### **Books for Reference:**

- 1) Wulf Crueger. *A Text Book of Industrial Microbiology*. New Delhi: Panima Publishing Corporation. 1<sup>st</sup> edition 2000
- 2) Patel A.H. *Industrial Microbiology*. India: Macmillan Limited. 2017.
- 3) Casida L.E. *Industrial Microbiology*. New York: Eastern Limited. 1986.

<b>SEMESTER-III</b>			
<b>Core-X- Genetic Engineering</b>			
<b>Course Code -21PMIC32</b>	<b>Hrs/Week:5</b>	<b>Hrs/Sem:75</b>	<b>Credits:4</b>

**Objectives:**

1. To promote applicable genetics, bioengineering, and bio technological knowledge through education and state of the art technologies
2. Educate students for technical competence and knowledge management in different areas of Genetic engineering.

**Course outcomes:**

<b>C O No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO's Addressed</b>	<b>CL</b>
CO- 1	Explain the knowledge about cloning	2	An,Un
CO -2	Perceive the applications of genetic engineering in various fields	4	Un, Re
CO- 3	Understands the hazardous and potential risk in releasing transgenic into environment	5	Un
CO -4	Create the techniques used in genetic engineering	2	An, Re
CO -5	Understands the concepts of blotting techniques and its applications	3	Un
CO -6	Discuss the cloning techniques and the production of transgenic materials	4	Un,An
CO -7	Understand the synthesis of genetically modified commercial products	4	Un
CO- 8	Make use of enzymology in genetic engineering	1	Cr

<b>SEMESTER-III</b>			
<b>Core-X- Genetic Engineering</b>			
<b>Course Code -21PMIC32</b>	<b>Hrs/Week:5</b>	<b>Hrs/Sem:75</b>	<b>Credits:4</b>

### **Unit – I: Gene cloning and vectors**

Biology of vectors – Cosmids, phasmids, specialized vectors – Plant viral vectors, Animal viral vectors, Virus vectors and other plasmid vectors – Biology of host – *Escherichia coli*, *Saccharomyces cerevisiae*. Cloning strategies: Cloning of genomic DNA, cDNA cloning

### **Unit II: Enzymology of genetic engineering**

Restriction enzymes – Types - Nomenclature – Recognition sequences – Cleavage patterns. Other enzymes used in Genetic engineering – DNA Ligase, Nuclease, Alkaline phosphatase, Kinase, Reverse transcriptase, Taq DNA polymerase, Thermal transferase, DPN1 enzyme.

### **Unit-III: Recombinant techniques**

Blotting techniques – Southern, Northern and Western Blotting – Transformation of E.coli- PCR – types and variation- RFLP – AFLP – RAPD – SSCP and VNTR- Construction of cDNA library – Molecular mapping of genome – Genetic and physical maps.

### **Unit- IV: Synthesis of commercial products by Recombinant microorganisms**

Antibiotics, Vitamins, Amino acids, Recombinant vaccines, Hormones, Monoclonal antibodies, Biopolymers. Genetic engineering of bio-degradative pathways – Manipulation by Transfer of plasmids and Gene alteration.

### **Unit – V: Cloning in plants and animals**

Transgenic plant (Golden rice, Tearless onion, Colourful cauliflower, FlavrSavr Tomato) – Transgenic animal (Transgenic Fish, Transgenic Mouse, Transgenic Pig, Dolly) – GEM (Super bug) – Ethical aspects of Biotechnology

## Books for Reference:

1. Burrell, M.M. *Enzymes of Molecular Biology*, Humana press. 1993.
2. Chirikjian, J.G. *Biotechnology- Theory and Techniques*. Vol.II, Jones and Burtlett Publishers. 1995.
3. Gerhardt, P., Murray, R.G., Wood, W.A., and Kreig, N.R. *Methods for General and Molecular Bacteriology*. Washington D.C: ASM Press, 1994.
4. Cafferty. Mc. J., Hoogenboom, H.R. and Chiswell, D.J. *Antibody Engineering- A Practical Approach*, Oxford University Press, 1996.
5. Lewin, B. *Genes VII*, Oxford: Oxford University Press,. 2000.
6. Murray Moo Young . *Plant Biotechnology*. Pergamon Press. 1992.
7. Radledge, C. and Kristiansen, B. *Basic Biotechnology*. 2<sup>nd</sup> Edition. Cambridge University Press. 2001.
8. Das. H.K. *Text Book of Biotechnology*. New Delhi: Wiley Dreamtech India (P) Ltd., 2005.
9. Rigby. P.W.J.Ed. *Genetic Engineering*. London: 6th Academic press, 1987.
10. Wiseman.A. *Principles of Biotechnology*. New York: Chapman and Hall, 1983.
11. Desmond.S.T., Nicholl. *An Introduction to Genetic Engineering*. Cambridge Press. 1994.
12. Winnacker, E.L. *From Genes to Clones. Introduction to Gene technology*. New Delhi: Panima Publishing Corporation, 1<sup>st</sup> Edition. 1987.
13. Brown, T.A. *Gene Cloning – An Introduction*. Chapman and Hall, UK: 3<sup>rd</sup> Edition. 1995.
14. Glick, B.K. and Pasternik, J.J. *Molecular Biotechnology. Principles and applications of recombinant DNA*. ASM Press. 2<sup>nd</sup> Edition. 1998.
15. Mitra. *Genetic engineering*. Chennai: Published by Macmillan India Ltd., 2005.
16. Jogdand S.N . *Gene biotechnology*. Mumbai: Himalaya Publishing House, 2005.
17. Satyanarayan, *Biotechnology*. Kolkata: Books and Allied (P) Ltd., 1<sup>st</sup> edition, 2005.
18. Preeti Joshi, *Genetic engineering and its application*. Agrobios. India: 1<sup>st</sup> edition, 2002.
19. Bernad R Glick, *Molecular Biotechnology - Principles and Applications of Recombinant DNA*. Washington, D.C: ASM Press, 3<sup>rd</sup> edition, 2003.
20. Ramawat K and Shaily Goyal, *Molecular Biology and Biotechnology*. New Delhi: S.Chand and company Ltd., 1<sup>st</sup> edition, 2010.

<b>SEMESTER –III</b>			
<b>Core – XII Research Methodology</b>			
<b>Course Code : 21PMIC34</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 4</b>

**Objectives:**

1. To impart advanced level information in the subject of Research methodology.
2. To show various biological techniques used in research, and study about research project, paper presentation and article publication.

**Course Outcome:**

<b>CO No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	Analyse the laboratory equipment's	2	An
CO-2	Evaluate the rights granted by IPR	6	Ev
CO-3	determine the process involved in centrifugation and chromatography techniques	6	Ev
CO-4	Examine electrophoresis techniques	6	An
CO-5	Apply research methods in biological science.	1	Ap
CO-6	Estimate project writing method and to estimate Data's used in projects.	1	Ev
CO-7	Identify the journals to publish articles	1	AP
CO-8	Design article to present on seminar and the conference	5	Cr

<b>SEMESTER –III</b>			
<b>Core – XII Research Methodology</b>			
<b>Course Code : 21PMIC34</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 4</b>

### **Unit – I: Isolation, Fractionation and Separation**

Isolation, Fractionation and Separation of cellular constituents – Isolation of chloroplasts, mitochondria and nucleic acids – homogenization –Manual, mechanical and sonication –centrifugation-centrifuges and their uses- Micro centrifuge, high speed refrigerated centrifuges, ultra centrifuges, differential and density gradient centrifugation – Chromatography –paper, thin layer-separation of amino acids and sugars-Gas liquid chromatography, HPLC and HPTLC.

### **Unit – II: Separation and estimation of macromolecules and other compounds**

Electrophoresis –principles, factors affecting electrophoretic mobility – Agarose Gel Electrophoresis, PAGE, SDS-PAGE and Starch gel electrophoresis. Spectroscopic techniques – principles, mechanism and applications of UV –visible, Flame photometer and AAS - Estimation of cellular constituents- Sugars, amino acids and proteins.

### **Unit – III: Research and Project writing methods, Article publication**

Research-definition, objectives, types and importance - Research methods in biological sciences - Research process- Literature survey – sources –scientific databases- Research report writing – Parts of Thesis and Dissertation – Presentation in seminars and conferences – Writing scientific paper – Organization of scientific paper – Importance of title – Publication in research journals – Standards of Research journals- Peer – review – impact factor – citation index – Preparation of manuscript – Proof correction – proof correction marks- method of correcting proof- Writing chapters in books – Preparation of Research proposal and funding agencies – Research fellowships.

### **Unit – IV: Biostatistics**

Basic definitions and applications of biostatistics – Population, Sample, Data, variable, sampling. Data Collection and presentation – Types of data - methods of collection of primary and secondary data - methods of data presentation – Graphical presentation. Measures of central tendency: Mean, Median, Mode. Correlation – Positive and Negative correlation and calculation of Karl Pearson's coefficient of correlation. Regression – Linear regression and multiple linear regression - regression equation. ANOVA, one way and two way classification.

## **Unit – V:IPR**

Introduction to Intellectual property rights, copyright, related rights, trademarks, geographical indication, industrial design, patents and protection of new varieties of plants.

### **Textbooks:**

1. Veerakumari L. *Bioinstrumentation*. Chennai: MJP Publishers. 2006.
2. Gurumani N. *Scientific thesis writing and Paper presentation*. Chennai: MJP Publishers. 2010.

### **Books for Reference:**

1. Dr. Simmi Kharb. *Scientific Writing and Project management in Biotechnology*. NewDelhi: University Science Press. 2009.
2. 4 Gurumani. N. *Research Methodology for Biological Sciences*. Chennai: MJP Publishers. 2006.
3. Vijayalakshmi Ponnuraj. G. and C. Sivapragasam. *Research Methods (Tips and Techniques)*. Chennai: MJP Publishers. 2008.

<b>SEMESTER - IV</b>			
<b>CORE XII</b>		<b>NUCLEAR AND PARTICLE PHYSICS</b>	
<b>Code:21PPHC43</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester: 90</b>	<b>Credits:5</b>

**Objectives:**

- To enhance the knowledge of nuclear reactor, bombs and the elementary particles
- To extend the knowledge about different nuclear models, nuclear decay, properties of nuclear forces and elementary particles.

**Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSOs addressed</b>	<b>CL</b>
CO 1	List the basic atomic properties of nuclei	1	Re
CO 2	Classify the different types of nuclear reactions	5	Un
CO 3	Examine the different types of nuclear models and their properties	6	An
CO 4	Categorize the nuclear forces and the theories related to it	1	An
CO 5	Classify the types of elementary particles	1	Ev
CO 6	Distinguish the fission and fusion	1	An
CO 7	Relate the deuteron properties and reactions	2	Ap
CO 8	Examine the origin of various terms in nuclear physics	1	An



SEMESTER - IV			
CORE XII		NUCLEAR AND PARTICLE PHYSICS	
Code:21PPHC43	Hrs/Week: 6	Hrs/Semester: 90	Credits:5

### UNIT I: Theories of Decay

Gamow's theory of alpha decay - General features of beta ray spectrum - Fermi's theory of beta decay-Forms of interaction and selection rules- parity selection rules-Parity in beta decay-The neutrino (Helicity of Neutrino) - electron capture.

### UNIT II: Nuclear reaction

Introduction of nuclear reaction-Conservation laws-Q value equation -Theories of nuclear reaction- Particle induced nuclear reactions-Electromagnetic radiation induced nuclear reactions-Compound Nucleus-Reciprocity theorem- Direct reactions- Theory of stripping and pick up reactions-Statistical theory of nuclear reaction.

### UNIT III: Nuclear models & Nuclear Energy

Liquid drop model- The Shell model- nuclear fission- Mass and energy of Fission Fragments-Neutron emission in fission Process-Prompt and Delayed Neutrons- Spontaneous Fission- Barrier Penetration-Theory of Spontaneous Fission-The Nuclear Chain Reaction.

### UNIT IV: Nuclear Forces

The Deuteron -Ground state of Deuteron -Excited states of deuteron- Meson theory of nuclear force - Nucleon-nucleon scattering - Neutron proton scattering at low energies- Spin dependence of n-p scattering- Effective range theory of n-p scattering.

### UNIT V: Elementary Particles

Classification of elementary particles- Fundamental Interactions-Conservation laws- C-P-T Theorem-SU (2) and SU (3) symmetries-baryon octet-Meson Octet-Baryon decouplet - Gellmann-Okubo mass Formula-Quarks.

**Text Books:**

1. Pandya M L and Yadav R P S. *Elements of Nuclear Physics*. Meerut : Kedar Nath & Ram Nath publications .Revised Reprint. 2008.
2. Tayal D C. *Nuclear Physics*. Himalaya Publishing House. Reprint 1985.

**Books for reference:**

1. Irving Kaplan. *Nuclear Physics*. USA: Wesley publishing company. Nineteenth Reprint, Second Edition.
2. Sharma R C. *Nuclear Physics*. Meerut : Kedar Nath & Ram Nath publications .6<sup>th</sup> revised edition.
3. Devanathan V. *Nuclear Physics*. New Delhi: Narosa Publishing. Revised Reprint. 2008.

<b>SEMESTER - I</b>			
<b>ELECTIVE – I</b>		<b>A. CRYSTAL GROWTH &amp; THIN FILMS</b>	
<b>Code : 21PPHE11</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

**Objectives:**

- Make the students to know the crystal growth and thin film techniques and to know their characterization techniques
- Make the students to choose their own project independently

**Course Outcome:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO 1	generate an understanding of self-assembly during the process of growth	1	Un
CO 2	apply the processskills of scientific inquiry during experimentation	4	Ap
CO 3	Classify the arrangement of SEM, TEM	4	Ev
CO 4	apply the techniques of SEM and TEM to their own research projects	5	Ap
CO 5	distinguish the differences and similarities between different deposition techniques.	1	An
CO 6	categorize selection of deposition techniques for various applications	1	An
CO 7	use more techniques for the preparation of crystals and thin films	4	Ap
CO 8	recognize appropriate material for the fabrication of a device	4	Re

SEMESTER - I			
ELECTIVE - I		A. CRYSTAL GROWTH & THIN FILMS	
Code : 21PPHE11	Hrs/Week: 6	Hrs/Semester:90	Credits: 4

### UNIT I: Introduction

Crystal growth – significance of Single crystals - crystal growth techniques- chemical physics of crystal growth. Nucleation – Theories of nucleation - classical theory of nucleation – Heterogeneous nucleation- Kinetics of crystal growth.

### UNIT II: Growth Techniques

Solution growth: Low temperature solution growth – crystal growth system – High temperature solution growth. Gel growth: various types of gel – Experimental procedure– Biological crystallization.

### UNIT III: Characterization Technique

Diffraction analysis – X-ray diffraction- electron & neutron diffraction - TEM, instrumental details - SEM – AFM Thermal analysis-thermo gravimetric analysis-differential thermal analysis-differential scanning calorimeter- Micro hardness (Nano hardness) – Classification of hardness test –Vickers hardness test – Knoop hardness test.

### UNIT IV: Thin film

Preparation of thin films: thermal evaporation- flash evaporation -electron gun beam method – cathodic sputtering- chemical vapour deposition. Thickness measurements – ellipsometry – interferometry.

### UNIT V: Technological application of thin film

Thermistor-varistor-strain gauge element-capacitor - active devices-microelectronics, IC and other applications- Discrete resistive components: resistors-carbon films-oxide and nitride films- cermet films-metal films.

**Text Books:**

1. Dr. Santhana Ragavan P and Ramasamy P. *Crystal growth processes and methods*. Kru Publications. 2000.
2. Rajendran V. *Material Science*. New Delhi: McGraw hill. 1<sup>st</sup> reprint 2012.
3. Goswami A. *Thin film fundamental*. New Delhi: New age international (P) Ltd. 1<sup>st</sup> Edition 1996.

**Books for Reference:**

1. Brice J C. *Crystal growth processes*. London: Blackie & Son Ltd. 1986.
  2. Pamplin B R. *Crystal growth*. 2<sup>nd</sup> Edition 1980.
  3. Hurle D T J, *Crystal pulling from melt*. 1990.
- Raghavan V. *Material science & Engineering – A first course*. 5<sup>th</sup>

<b>SEMESTER - I</b>			
<b>ELECTIVE -I</b>		<b>B. RESEARCH METHODOLOGY</b>	
<b>Code : 21PPHE12</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

**Objectives:**

- Enable the students to understand research problem and research design
- Enable the students to understand the steps behind research paper writing

**Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSOs addressed</b>	<b>CL</b>
CO 1	List the types of research depending on the approaches	1	Re
CO 2	Explain the criteria of a good research	6	Un
CO 3	Examine the selection process of the problem based on necessity.	4	An
CO 4	Recall the features of good research	4	Re
CO 5	Apply secondary data methods of collecting primary data	6	Ap
CO 6	Grade the formulation of the selected problem	4	Ev
CO 7	Identify the meaning of interpretation techniques	4	An
CO 8	Predict the types of reports based on the research mechanism	6	Cr

<b>SEMESTER - I</b>			
<b>ELECTIVE -I</b>		<b>(B) RESEARCH METHODOLOGY</b>	
<b>Code : 21PPHE12</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

### **UNIT I: An Introduction to Research Methodology**

Meaning of research-Objectives-Types of research- Research Approaches-Significance- Research methods versus methodology- Research and scientific method- Importance of knowing how research is done- Research process- Criteria of good research- Problems encountered by researchers in India.

### **UNIT II: Defining the Research Problem and Research design**

Research problem- Selecting the problem- Necessity of defining a problem-Technique involved in defining a problem- Meaning of research design- Need- Features of good Design- Important Concepts-Basic principles of experimental designs.

### **UNIT III: Plagiarism**

Plagiarism - Forms of plagiarism - Unintentional plagiarism - Examples of plagiarism - Consequences - How to avoid plagiarism - Being aware of and identifying different types of plagiarism - Things you can do to avoid plagiarism - Types of plagiarism - Online plagiarism - Web of science - h-index - Scopus.

### **UNIT IV: Review of literature**

Need for reviewing literature- What to review and for what purpose - Literature search procedure- Sources of literature- Planning the review work – Note taking – The planning process- Selection of a problem for research- Formulation of selected problem.

### **UNIT V: Interpretation and report writing**

Meaning of interpretation- Technique- Precaution- Significance- Different steps- Layout of research reports - Types of reports- Oral presentation- Mechanics of writing a research report- Precautions for writing a research report.

**Text Books:**

1. Kothari C R and Gaurav Garg. *Research methodology methods and techniques*. Delhi: New age international. 3<sup>rd</sup> Edition 2014.
2. Krishna swamy O R, Ranganatham M. *Methodology of research in social studies*. Mumbai: Himalaya Publishing House. 2<sup>nd</sup> Edition 2011.
3. <https://www.ox.ac.uk/students/academic/guidance/skills/plagiarism> (Plagiarism)
4. <https://www.scanmyessay.com/plagiarism/consequences-of-plagiarism.php> (Consequences)
5. <https://www.scanmyessay.com/plagiarism/types-of-plagiarism.php> (Types of plagiarism)
6. <https://www.scanmyessay.com/plagiarism/how-to-avoid-plagiarism.php> (How to avoid plagiarism)
7. <https://www.scanmyessay.com/plagiarism/online-factors.php> (Online plagiarism)
8. [https://en.m.wikipedia.org/wiki/Web\\_of\\_Science](https://en.m.wikipedia.org/wiki/Web_of_Science) (Web of science)
9. <https://en.m.wikipedia.org/wiki/H-index> (h-index)
10. <https://en.m.wikipedia.org/wiki/Scopus> (Scopus)

**Books for Reference:**

1. Gupta S P. *Statistical methods*. New Delhi: Sultan Chand & Sons. 40<sup>th</sup> Edition. 2011.
2. Saravanavel P. *Research Methodology*. Jaipur: Kitab Mahal. Reprint, 16<sup>th</sup> Edition 2010.



<b>SEMESTER - II</b>			
<b>ELECTIVE - II      A. BIO-MEDICAL INSTRUMENTATION</b>			
<b>Code :21PPHE21</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

**Objectives:**

- Give the students basic knowledge about different life saving machines
- Enable the students to understand the principle behind the working of these instruments

**Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSOs addressed</b>	<b>CL</b>
CO 1	Define resting and action potentials	1	Re
CO 2	Classify the uses of electrode paste	1	Ap
CO 3	Discuss the principle of operation of different types of transducers	1	Un
CO 4	Interpret the output of bio potential recorders such as ECG, EEG and EMG	1	Ev
CO 5	Investigate internal and external pacemakers	1	An
CO 6	Illustrate the working of different kinds of radiation monitoring instruments	1	Ap
CO 7	Recognise the importance of computers in medicine	1	Un
CO 8	Evaluate the need for various imaging techniques such as Computer Tomography, Thermography and MRI	1	Ev

<b>SEMESTER - II</b>			
<b>ELECTIVE - II      A. BIO-MEDICAL INSTRUMENTATION</b>			
<b>Code :21PPHE21</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

### **UNIT I: Human physiological systems and transducers**

Cells and their structure-resting and action potentials – Design of medical instruments – Components of the Bio-medical instrument system – Electrodes: electrode potential-purpose of electrode paste-electrode material-Types of electrodes – Transducers Types: active – magnetic induction type-piezoelectric-photovoltaic-thermo electric-passive-resistive

### **UNIT II: Bio-Potential Recorders**

Introductions- characteristics- ECG: origin-lead configuration-practical consideration- analysis – EEG: origin-brain waves –analysis – EMG:recording set up-determination of conduction velocities in motor nerves

### **UNIT III: Physiological Assist Devices And Operation Theatre Equipments**

Pacemakers: energy requirements to excite heart muscle-methods of stimulation-different modes of operation:Ventricular synchronous pacemaker-Atrial synchronous pacemaker Kidney Machine: Renal function-dialysis-hemodialysis-peritoneal dialysis – Ventilators – Anesthesia machine

### **UNIT IV: Safety Instruments**

Radiation Safety Instrumentation-Physiological Effect due to 50 Hz current passage – Microshock and Macroshock – Electrical accidents in hospitals – Devices to protect against electrical hazards.

### **UNIT V: Advances In Biomedical Instrumentation**

Computers in medicine – Lasers in medicine – Endoscopes – cryogenic surgery – Nuclear Imaging techniques – Computer Tomography –MRI

#### **Text Books:**

1. Dr. Arumugam M. *Biomedical Instrumentation*. Chennai: Anuradha publications. 10th Edition 2013.

<b>SEMESTER - II</b>			
<b>ELECTIVE II B. MICROPROCESSOR AND MICROCONTROLLER</b>			
<b>Code :21PPHE22</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

- Enable the students to understand microprocessor and microcontroller
- Enable them to write simple programs
- Enable them to interface microprocessor and microcontroller with other simple devices

**Course Outcomes:**

<b>CO No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSOs addressed</b>	<b>CL</b>
CO 1	Understand the architectures and instruction sets of microprocessors and microcontrollers	1	Un
CO 2	Verify bus transactions, memory organisation and address decoding, basic I/O interfaces and port addressing	1	Ev
CO 3	Apply and implement learned algorithm design techniques and data structures to solve the problems	2	Ap
CO 4	Understand the interfacing of peripheral devices like I/O ports, keyboards, displays, ADCs, DACs, stepper motor	1	Un
CO 5	Analyze concepts associated with interfacing a microprocessor to memory and to I/O devices	6	An
CO 6	Estimate how to control components of a microprocessor based system through the use of interrupts	4	Cr
CO 7	Recall a microprocessor programming model at a level that enables to write assemble language programs for the processor meeting given specifications	6	Re
CO 8	Understand the popular 8051 Microcontroller ,the processor family and Time delay	1	Un

<b>SEMESTER - II</b>			
<b>ELECTIVE II     B. MICROPROCESSOR AND MICROCONTROLLER</b>			
<b>Code :21PHE22</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester: 90</b>	<b>Credits: 4</b>

### **UNIT I: Microprocessor Architecture and Instruction set**

Intel 8085 Architecture-Instruction format-8085 programming model-instruction classification-8085 Instruction set – Data transfer operations – Arithmetic instructions – Logic operations-Branch operations.

### **UNIT II: Microprocessor Programming & Counters and Time Delays**

Writing assembly language programs-Programming techniques: Looping, Counting and Indexing –Stack-Subroutine- -8085 Interrupt-counters and time delays

### **UNIT III: Microprocessor Interfacing**

Techniques for time delay-Basic interfacing concept-8255(PPI)-Interfacing Keyboard and Seven Segment Display- Microprocessor based stepper motor-waveform generator using ADC and DAC

### **UNIT IV: Microcontroller Programming**

Addressing mode of microcontroller 8051-arithmetic and logical instruction-8051 assembly language programmes: addition, subtraction, division, multiplication- interfacing 8051 with LED display and keyboard.

### **UNIT V: Addressing Modes & Delay**

Register Addressing -Direct byte addressing- Register indirect addressing-Immediate addressing-Logical Instructions-Time delay for 8051-Assembling and running an 8051 program

**Text Books:**

1. Ramesh Gaonkar. *Microprocessor Architecture Programming and Applications with The 8085*. India: Penram International Publishing Private Limited. Fifth edition. 2011.
2. Karuna Sagar D, *Microcontroller, 8051*. Delhi: Narosha publishing house PVT Ltd, Print.2011.
3. Dr.Godse A P. *Microprocessor and Microcontroller*. Technical Publications. Fourth Revised edition.2017.

**Books for reference:**

1. Aditya.P.Mathur. *Introduction to Microprocessors*. New Delhi: Tata Mc Graw Hill Education P Ltd. Third Edition.
2. Ram B and Sanjay Kumar. *Fundamental of microprocessors and micro controllers*. New Delhi: Dhanpat rai Publications (P) Ltd. seventh revised Edition.

<b>SEMESTER - III</b>			
<b>ELECTIVE -III     A. NANO SCIENCE AND TECHNOLOGY</b>			
<b>Code: 21PPHE31</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Semester:90</b>	<b>Credits: 4</b>

#### **UNIT I: Synthesis and Characterization of Nanoparticles**

History of Nanotechnology- Nano structures - Synthesis of oxide nano particles- Synthesis of metallic nano particles - Synthesis of semiconductor nanoparticles - Structural characterization (X-Ray Diffraction, Scanning Tunneling Microscopy, Atomic Force Microscopy)-Properties of Nanomaterials.

#### **UNIT II: Carbon nanotube**

Carbon nanotube - Carbon allotropes (Diamond, Graphite, Carbon nanotubes) - Types of Carbon nanotubes – Graphene sheet to single walled nanotube - Synthesis of carbon nanotubes (Electric arc -Discharge method, Laser method, Fluidised bed CVD method, Solar production of Carbon nanotubes) -Purification and properties of Carbon nanotubes.

#### **UNIT III: Quantum well, Quantum wire and Quantum dots**

Introduction - preparation of Quantum nanostructures - Fermi gas and Density of states –Calculation of the density of states in 1,2 and 3 dimension- Infrared detector - Quantum wire (Production,Structure, Use), Quantum dot - Application of Quantum dots – Quantum dot information storage, Quantum dot Infrared photodetectors-Quantum dot Lasers.

#### **UNIT IV: Magneto electronics**

Magneto electronics: Nano crystalline soft magnetic materials-Permanent magnetic materials-TheoreticalBackground-Super para magnetism-Coulomb Blockade-Single electron transistor-Spintronics-Giant magneto resistance-Quantum Hall Effect-fractional Quantum Hall Effect.

#### **UNIT V: Applications of Nanotechnology**

Applications of Nanotechnology: Chemistry and Environment - Energy applications of Nanotechnology -Information and Communication- Heavy industry - Consumer goods - Nano medicine -Tissue engineering-medical applications of molecular nanotechnology (Nanorobots, Cell repair machines, Nano nephrology)

**Text Books:**

1. Dr. Geraldin Jayam S R. *Nano Physics*.

**Books for Reference:**

1. Shanmugam S. *Nanotechnology*. Chennai: MJP Publishers. 2011.
2. Parthasarathy B K. *Nanostructure and Nanomaterials*. Delhi: Isha Books. 2007.
3. Uday Kumar. *Concepts in Nano chemistry*. New Delhi: Anmol Publications Pvt. Ltd. 2013.
4. Bandyopadhyay A K. *Nano Materials*. New Age International Publishers. 2<sup>nd</sup> Edition. 2012.
5. Viswanathan B. *Nano Materials*. New Delhi: Narosa Publishing House. 2013.

SEMESTER I			
Core I Advanced General Psychology			
<b>Code:</b> <b>21PPSC11</b>	<b>Hrs/Week:6</b>	<b>Hrs/ Sem: 90</b>	<b>Credit: 4</b>

**Vision:** To impart advanced knowledge on the subject of psychology.

**Mission:** To get detailed understanding on the principles of the origin of psychology as a discipline.

**Course Outcomes:**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
<b>CO-1</b>	know the nature, goal and historical origins of psychology.	1 & 2	Re, Un
<b>CO-2</b>	learn the concepts of sensation, perception and consciousness by associating with daily activities.	1 & 2	Un, An
<b>CO-3</b>	understand about cognitive elements such as memory, language and thought.	4 & 5	Re, An
<b>CO-4</b>	apply the concepts of general psychology by inculcating them in one's daily life.	3 & 4	Ap, Cn
<b>CO-5</b>	know about intelligence, learning and conditioning and how they are acquired in individuals.	PO 5 & 7	Un
<b>CO-6</b>	evaluate the importance of every concepts and understand their key elements.	5 & 6	Ev, An
<b>CO-7</b>	evaluate the pros and cons of every element in psychology by discussions.	6 & 8	Ev, Ap
<b>CO-8</b>	have a clear knowledge gained on the advanced concepts of psychology.	2,4 & 8	Cr



## **UNIT I-Introduction**

Definition of Psychology, Goals of Psychology, The Historical Origins of Psychology, Contemporary Psychological Perspectives, The Study of the Biological Bases of Psychology - Neurons, the Building Blocks of the Nervous System, The Organization of the Brain, The Autonomic Nervous System, The Endocrine System and Evolution, Genes, and Behavior

## **UNIT II- Sensory Processes, Perception and Consciousness**

**Sensory processes** – Characteristics of sensory modalities, Abstraction, Divisions of labor in the brain and Perceptual development.

**Perception** – Attention, Localization, Recognition, Hypnosis, Psychoactive drugs and PSI phenomena.

**Consciousness** – Aspects of consciousness, Sleep and dreams, Learning and Motivation.

## **UNIT III-Memory, Language and Thought**

**Memory** – Three Important Distinctions, Sensory Memory, Working Memory, Long-Term Memory, Implicit Memory, Constructive Memory, Improving Memory.

**Language and Thought** – Language and Communication, The Development of Language, Concepts and Categorization: The Building Blocks of Thought, Reasoning, Imaginal Thought and Thought in action: Problem Solving.

## **UNIT IV-Motivation, Emotion and Stress**

**Motivation** - Drives and Homeostasis, Incentive Motivation and Reward, Hunger, Eating, and Eating Disorders, Gender and Sexuality.

**Emotion** - Components of Emotion, Three Theories of Emotion, Cognitive Appraisal and Emotion, Bodily Changes and Emotion, Responses to Emotion: Emotion Regulation, Emotions, Gender, and Culture, Aggression. **Stress** - Characteristics of Stressful Events, Psychological Reactions to Stress, Physiological Reactions to Stress, Psychological Factors and Stress Responses, Coping and managing stress.

## **UNIT V-Intelligence, Learning and Conditioning**

**Intelligence** – Assessment of Intellectual Abilities, Contemporary Theories of Intelligence, Genetics and Intelligence, Emotional Intelligence and General Learning Disability.

**Learning and Conditioning** – Classical Conditioning, Instrumental Conditioning, Learning and Cognition, Learning and Cognition.

**Text Book:**

1. Atkinson & Hilgard's (2014). *Introduction to Psychology*, 16th Edition, Oxford & I.B.H. Publishing co. Pvt. Ltd, New Delhi.

**Reference:**

1. Lahey, Benjamin B. (2012). *Psychology: an introduction / Benjamin Lahey*.—11th ed, Published by McGraw-Hill.
2. Baron, R.A., (2002) "*Psychology*", 5<sup>th</sup> Edition, Pearson Education, New Delhi.
3. Kalat, J. W. (1996). *Introduction to psychology*. Pacific Grove: Brooks/Cole Publ.
4. Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (1986). *Introduction to psychology*. New York: McGraw-Hill.
5. Robert S. Feldman (2006). *Understanding Psychology*. Sixth Edition. Tata McGraw-Hill Companies, New Delhi.

<b>SEMESTER I</b>			
<b>Core: IV</b>		<b>Physiological Psychology</b>	
<b>Code: 21PPSC14</b>	<b>Hrs/ Week: 5</b>	<b>Hrs/ Sem: 75</b>	<b>Credit: 4</b>

**Vision:** To impart knowledge about the physiology that contributes or affects behaviour.

**Mission:** To develop Psychologists with a thorough knowledge of physical functioning of the body.

**Course Outcomes:**

<b>CO No</b>	<b>Upon completion of this course, the person will be able to</b>	<b>PSO Addressed</b>	<b>CL</b>
CO 1	learn the basic concepts of physiological psychology	1,2	Re
CO 2	gain knowledge about the various concepts of biology to treat mental issues	1,2	Re, Un
CO 3	analyze the various causes of psychological illnesses due to faulty physical functioning	2,5	An
CO 4	create new methods of treating people with mental disorders with a physical approach	2,5	Un, Cr
CO 5	learn the skill of administering biological psychology to the shaping of behaviour	2,4	Un
CO 6	understand and analyze the basic thinking processes of people with psychological issues due to physical reasons	2,4,5	Un, An
CO 7	gain knowledge on the means of improving physical and mental health	2,4	Un, Ev
CO 8	create new techniques in physiological psychology	2	Cr

## **UNIT I: Introduction to Physiological Psychology**

**Physiological Psychology:** Philosophical origin. Historical development. Approaches to study brain & behavior - Understanding Physiological Psychology – Applications. Research methods – methods to study the functions of living brain – methods of recording Physiological activity.

**Evolution & Genetics** – Chromosomes and genetic materials – process of cell division – understanding heredity – nature vs nurture.

## **UNIT II: Neuron & Nervous system**

**Cells of the nervous system** – neurons – supporting cells – The blood-brain barriers. **Nervous system** – Basic features of the nervous system: Meninges – The ventricular system and production of cerebrospinal fluid. The central NS: Development of CNS – Forebrain – midbrain – hindbrain – spinal cord. The peripheral NS: spinal nerves – cranial nerves – the autonomic NS.

## **UNIT III: Sensory processes of brain**

**Vision:** The eyes – connections between eye & brain – the perception of colour – analysis of form. **Audition:** The stimulus – anatomy of the ear – anatomy of hair cells & the transduction of auditory information – auditory pathway – behavioral functions of auditory system. **Vestibular system:** Anatomy– receptor cells & vestibular pathway. **Somatosenses:** The stimuli – anatomy of skin – perception of cutaneous stimulation – perception of pain. **Gustation:** The stimuli – anatomy of taste buds – perception of gustatory information. **Olfaction:** The stimulus – anatomy – transduction – perception of specific odors.

## **UNIT IV: Sleep, ingestive behavior & reproductive behaviour**

Physiological and behavioural description of sleep – functions of slow – wave & REM sleep - Disorders of sleep.

**Ingestive behaviour:** Physiological regulatory mechanisms. Drinking – fluid balance – two types of thirst – neural mechanisms. Physiological hunger signals – satiety during the absorption – long-term satiety. Brain mechanisms.

**Reproductive behaviour:** hormonal control of female reproductive cycles – organizational effect of androgens on behaviour – effect of pheromones – human sexual behavior - sexual

orientation. neural control of sexual behavior in males & females. Neural control of maternal and paternal behavior.

## **UNIT V: Hormonal regulations of behavior**

Understanding hormones – target tissues – classification of hormones – regulation of hormone secretions – prostaglandins – the working of hormones – pituitary gland – thyroid gland – parathyroid gland – pineal gland – pancreas – gonad – placenta – thymus – heart – hormonal influence on behaviour pattern.

### **Text book**

1. Khosla M. (2017) *Physiological Psychology: An Introduction*, SAGE/ texts.

### **References**

1. Carlson N. R. (2007). *Foundations of Physiological Psychology*, 6th Edition Published by Dorling Kindersley (India) Pvt.Ltd., licensees of Pearson Education
2. Carlson N. R. (2013) *Physiological of Behavior* 11<sup>th</sup> Edition Pearson India Education Services Pvt. Ltd.
3. Pinel, J. P. (2009). *Biopsychology*. Pearson publication.
4. Kalat. J. W. (1995), *Biological Psychology*. 5th Edition. New York: Brooks/Cole.
5. Francis Leukel (2005). *Introduction to Physiological Psychology*. 3<sup>rd</sup> Edition. CBS Publishers and Distributors, New Delhi.

<b>SEMESTER II</b>			
<b>Core VIII Research Methodology</b>			
<b>Code: 21PPSC24</b>	<b>Hrs/Week:4</b>	<b>Hrs/ Sem: 60</b>	<b>Credit: 4</b>

**Vision:** To impart the knowledge of Research methodology

**Mission:** To sow the seeds of proper research in the minds of the students

**Course Outcomes:**

<b>CO No</b>	<b>Upon completion of this course, the person will be able to</b>	<b>PSO Addressed</b>	<b>CL</b>
CO 1	learn the basic concepts of research methods	1,4	Re
CO 2	gain knowledge about the various methods of doing research in Psychology	1,4,5	Re, Un
CO 3	analyze the various steps in research methodology	4	An
CO 4	create new methods of research designs	4,5	Un, Cr
CO 5	learn the skills of doing research in Psychology	1,5	Un
CO 6	understand and analyze various research methods	1,5	Un, An
CO 7	gain knowledge on the means of improving research skills	4,5	Un, Ev
CO 8	create new research techniques	4	Cr

### **Unit I – Introduction**

Meaning – Objectives – Types – Research methods vs Methodology – Significance of research  
 - Thinking like a researcher – Criteria for good research – Scientific approach to research –  
 Problems encountered by researchers – Ethical issues

### **Unit II – Research design, measurement and scaling**

**Research design:** Meaning – Need – Features – Important concepts related to research design  
 – Types

**Measurement and scaling:** Qualitative and quantitative data – Measurement scales – Central tendency, dispersion – Hypothesis testing - Sources of error in measurement – Techniques of developing measurement tools – Scaling.

### **Unit III - Descriptive and Experimental methods**

**Descriptive methods:** Observation – Definition – Methods – Recording behaviour – Analysis – Survey – Uses – Characteristics – Types – Sampling in survey research – Sampling research designs – Questionnaires

**Experimental methods:** Meaning – Independent group designs - Types – Analysis and interpretation – Establishing external validity – Repeated measures design – Purpose

#### **Unit IV- Analysis and interpretation**

Computer assisted data analysis – Parametric and non parametric measures of analysis – Analysis of variance – Regression analysis - Other multivariate techniques

#### **Unit V – Report writing and communication in Psychology**

**Report writing:** Significance of report writing – Steps – Layout – Types – Oral presentation – Mechanics of writing a research report – Precautions

**Communication:** Internet and research – Guidelines for effective writing

#### **Text books:**

1. Kothari C.R., Garg G., Research methodology – Methods and techniques III Edition (2018) New age International Publishers, London

#### **Reference book:**

1. Shaughnessy J., Zechmeister E., Zechmeister J., *Research methods in Psychology* IX Edition (2012) Mc Graw Hill Publications, New York.
2. Kerlinger, F. N. (2000). *Foundations of behaviour research*, (5THed).New York: Reinhart Publishers.
3. McBurney, D. H. (2001). *Research Methods*.(5thed). US: Wadsworth.
4. Khan, J.A. (2011). *Research Methodology*. New Delhi: APH Publishing
5. Gravetter (2015), *Research Methods for the Behavioral Sciences*, 5th Edition, Wadsworth, 2015.

<b>SEMESTER I</b>			
<b>Core II : Genetics and Evolution</b>			
<b>Course Code: 21PZOC12</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits: 4</b>

### **Objectives:**

- To highlight the importance of genetics and evolutionary significance to the society
- To learn about the genetic recombination of chromosomes, microbial genetics, evolutionary concepts and future evolution of man.

### **Course outcome**

<b>CO. No</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO- 1	examine the chromosomes and genetic recombination and interpret linkage and mapping data	1	Un
CO-2	discuss the theories of crossing over and construction of chromosome map	1	Un
CO-3	infer genetic recombination mechanisms in bacteria and assess the genetic and clinical significance of transposons	2	Un,Ev
CO-4	analyse changes in gene and genotypic changes and evaluate its consequences in populations	6	An, Ev
CO-5	discriminate various human genetic disorders and genetic variations in drug metabolism	4	An
CO-6	provide detailed explanations of neo – Lamarkism, neo – Darwinism, stabilizing and experimental evolution	1 , 6	Un,Cr
CO-7	examine, summarize and integrate central ideas underpinning evolutionary patterns and processes from the molecular to the macro scale	2	Un,Ap,Cr
CO-8	Critically analyse, issues such as speciation mechanisms relating to the formation of species.	2	Un, An



## **Unit I Chromosomes and Genetic Recombination**

Introduction – human karyotype analysis– linkage – comparison of complete and incomplete linkage – Morgan's experiments - theories and molecular mechanism of crossing over – construction of chromosome map – three point test cross (Drosophila), tetrad analysis (Neurospora) - chromosome banding and chromosome painting techniques.

## **Unit II Microbial Genetics**

Recombination in bacteria – conjugation – transformation – transduction – sexduction – transposons – families of transposable elements in bacteria. Yeast Ty elements – Drosophila transposons – modes of transposition – genetic, medical and evolutionary significance.

## **Unit III Population Genetics and Human Genetics**

Gene pool concept – gene and genotype frequencies – Hardy – Weinberg equilibrium – algebraic proof- estimation of equilibrium gene frequencies for complete dominance, co-dominance and multiple alleles. Neurodegenerative diseases – Alzheimer's – Huntington's disease – genes in pedigree - dermatoglyphics – diagnostic features – pharmacogenetics – drug metabolism – genetic variation in the effect of drugs – genetic counselling.

## **Unit IV Evolutionary Concepts**

Neo – Lamarkism, Neo- Darwinism - stabilizing, directional and diversifying selection, experimental evidences - modern concepts of recapitulation theory; genetic and non-genetic variations - origin and evolutionary significance.

## **Unit V Speciation**

Species - modes of speciation – sexual selection and co - evolution- Genetic drift- evolutionary significance - isolating mechanisms and their significance – Simpson's adaptive grid concept – micro, macro, and mega evolution – evolution of man – cultural evolution – future evolution.

## Books for Reference

1. Strickberger M.W. *Genetics*. 3<sup>rd</sup> edition, New York: Maxwell Macmillan International Edition 1985.
2. Gardner, Simmons and Snustad. *Principles of Genetics*, 6<sup>th</sup> edition New York: Prentice Hall. Inc. 1991.
3. Klug W.S. and M.R. Cummings. *Concepts of Genetics*. 6<sup>th</sup> edition New York: Prentice Hall. Inc. 2000.
4. Emmanuel C, Ignacimuthu S. and S. Vincent. *Applied Genetics – Recent Trends and Techniques*. Chennai: JP Publishers 2009.
5. Amita Sarkar. *A Text Book of Human Genetics*. New Delhi: Wisdom Press 2011.
6. Krebs J.E. Goldstein. S. and T. Kilpatrick. *Genes* 10<sup>th</sup> edition. USA: Jones Bartlett Publishers 2011.
7. Ujjwala Deshmukh. *Cytogenetics and Evolution*. New Delhi: Dominant Publishers and Distributors 2005.
8. Gurbacham S. and Miglani. *Essentials of Molecular Genetics*. New Delhi: Narosa Publishing House 2015.
9. Ledyard Stebbins. *Processes of Organic Evolution*. New Delhi: Prentice Hall of India 1970.
10. Ernst Mayr. *Populations, Species and Evolution. An Abridgment of Animal Species and Evolution*. Cambridge: Harvard University press 1970.
11. Dobzhansky, Francis J. Ayala, G. and W. Ledyard Stebbins James. *Valentine Evolution*. Delhi: Surjeet Publications 1973.

## PRACTICALS

**Hours/Week: 2**

**Course Code: 21PZOCR1**

**Credit: 1**

1. Construction of genetic map for a given three point test cross.
2. Preparation of culture medium of *Drosophila*
3. Tracing the stages in the life cycle of *Drosophila*.
4. Observation of common mutants of *Drosophila*
5. Survey of simple Mendelian traits and ABO blood group in the class population and estimation of gene and genotype frequencies based on Hardy – Weinberg law.
6. Demonstration of role of random genetic drift in small populations using simulation (beads)
7. Analysis of dermatoglyphic data (finger print) of the class population.
8. Construction of pedigree
9. Bacterial conjugation (chart).
10. Industrial melanism- Peppered moth

## Books for Reference

1. Michael Breitenback. *Experimental Genetics I – biophysics*. shg. ac /at/ home.htm 1997.
2. William. D. Stansfield. Schaum's Outline Series. *Theory and Problems of Genetics*. Second Edition. USA: McGraw Hill Book Company 1977.

<b>SEMESTER –I</b>			
<b>Core III – Biochemistry</b>			
<b>Course Code: 21PZOC13</b>	<b>Hrs/ Week: 5</b>	<b>Hrs/Semester: 75</b>	<b>Credits: 4</b>

**Unit I                      Atoms and Molecules**

Structure of an atom, chemical bonds (ionic, covalent and hydrogen). Structure and properties of water. Vanderwaals interaction, role of water in life. pH and buffers - Weak acids and alkalies, Henderson and Hasselbalch's equation - Biological buffer system.

**Unit II                      Carbohydrates**

Classification – structure – properties and functions of carbohydrates. Metabolism: glycolysis – TCA cycle – energy budget of glucose oxidation – glycogenolysis – glycogenesis – gluconeogenesis – HMP shunt pathway.

**Unit III                    Protein**

Classification – structure – properties and functions of amino acids – classification – properties and functions of proteins – metabolism of proteins – metabolism of tryptophan – phenylalanine – tyrosine - Inborn errors of metabolism ( Phenylketonuria and Hartnup's disease).

**Unit IV                    Lipid**

Classification – Biological importance of simple lipids (Triglycerides and Wax), compound lipids (phospholipids and glycolipids) and derived lipids (saturated, unsaturated and cholesterol) –  $\beta$  oxidation, ketogenesis – biosynthesis of fatty acids – disorders of fat metabolism (hypercholesterolemia, hyperlipoproteinemia and atherosclerosis). Role of liver in fat metabolism.

**Unit V                    Enzymes and Nucleic acids**

Nomenclature – classification – properties – functions and mechanism of enzyme action and its regulation – coenzyme, isoenzyme. Nucleic acids, chemistry of nucleic acids, structure, biosynthesis and degradation, purine and pyrimidine nucleotides and disorders of their metabolism (Gout, Severe combined immunodeficiency, Orotaciduria and Thymidine phosphorylase deficiency).

**Text Book:**

1. Ambika Shanmugam, *Fundamentals of Biochemistry for Medical Students*, Madras: Navabharat Printers and Traders, 2012.
2. Pankaj Naik, *Biochemistry for Medical Students* New Delhi: 4<sup>th</sup> edition, Health Science Publishers, 2016.
3. Jain J.L, Sunjay Jain, Nitin Jain, *Fundamentals of Biochemistry*, New Delhi: S. Chand & Company, 2007.
4. Styer L.W.H, *Biochemistry*, San Francisco: Freeman & Company, 1995.
5. Murray R.K., Gaaner D.K, Mayer P.A and V.W. Rodwell. *Harper's Biochemistry*, Tokyo: 24<sup>th</sup> edition. Prentice Hall of Japan, Inc, 1996.
6. Rastogi S.C, *Biochemistry*, New Delhi: Second Edition. Tata Mc Graw Hill Publishing Company Ltd., 2003.
7. Satyanarayana U and U. Chakrapani. *Biochemistry*, Haryana and Kolkata : Fourth Edition. Elsevier & Allied. 2014.
8. Edward Staunton West, Wilbert R. Todd, Howard S. Mason, John T. Van. Bruggen, *Biochemistry*, New Delhi: Fourth edition. Oxford and IBH Publishing Co. 1966.
9. Bernard L. Oser, *Hawk's Physiological Chemistry*, New Delhi: 14<sup>th</sup> edition. Tata Mc Graw Hill Publishing Company Ltd. 1965.
10. Chatterjee M.N, *A Textbook of Biochemistry*. New Delhi: Jaypee Brothers, Medical Publishers Pvt Ltd. 2010.
11. Lehninger, A. *Principles of Biochemistry*, New Delhi: CBS Publishers & Distributers, 1993.

SEMESTER II			
Core VIII		Microbiology	
Course Code: 21PZOC24	Hrs/ Week : 4	Hrs / Sem : 60	Credits : 4

### Objective

- To prepare graduate students with thorough knowledge and understanding of the core concepts in the field of Microbiology.
- To equip the students with knowledge about taxonomy, organization, multiplication and infection of microbes and to develop expertise in microbiological techniques.

### Course Outcome :

CO. NO	Upon completion of this course, the students will be able to	PSO addressed	CL
CO- 1	classify microorganisms focusing on the modern trends of Taxonomy	1	Un
CO- 2	prepare media to be utilized in the cultivation of microorganisms	2	Ev
CO-3	understand the structural organization and life cycle of microorganisms	2	Un
CO-4	explain the role of microorganisms in fermentation, medicine and the production of microbial products	2	Ev
CO-5	gain familiarity with the unique role of pathogens in human infectious diseases	2	Un
CO-6	identify the methodologies used in disease treatment and prevention	6	An
CO-7	demonstrate practical skills in the use of technologies and methods common to microbiology	8	Ev
CO-8	apply scientific methods in the design and execution of experiments	8	Ap

## **Unit I Classification**

Classification of microorganism – Five Kingdom concept. Modern trends of bacterial taxonomy - ribosomal RNA and sequencing - construction of phylogenetic tree. General characters of main groups of microorganisms – analysis based on Bergey's Manual of Determinative Bacteriology (biochemical tests).

## **Unit II Cultivation of Microorganisms**

Preparation of culture media – isolation and maintenance of pure culture - cultural and morphological characteristics of bacteria, fungi – microscopic examination of microorganisms - Gram staining - acid fast staining – spore staining - capsular staining – flagellar staining.

## **Unit III Microbes – Structural Organization**

Structural organization of bacteria – structure of *E. coli*, virus – plant virus – Tobacco Mosaic Virus, animal virus – adenovirus - bacteriophage and fungi – yeast, penicillium - life cycle of Actinomycetes and yeast.

## **Unit IV Production of Microbial Products**

Yeast fermentation and its products – production of alcohol, beer and wine. Mixed fermentation product - production of vinegar. Production of antibiotics - penicillin and tetracycline.

## **Unit V Microbial Diseases**

Protozoan diseases - amoebiasis and leishmaniasis. Bacterial diseases- diphtheria, tetanus and gonorrhea. Viral diseases - corona virus, dengue fever, rabies and ebola. Fungal diseases - actinomycosis, aspergillosis, ringworm and candidiasis.

## **Books for Reference**

1. Arti Kapil. *Text Book of Microbiology*. Hyderabad: University press 9<sup>th</sup> Edition. 2016
2. Dubey R .C and D.K. Maheswari. *A Text Book of Microbiology*. New Delhi: S. Chand & Co. 2006
3. Roger Stainer, John Lingraham, Mark I Wheelis and Page R. Painter. *General Microbiology*. London: Mac Millan, Hampshire 1992.

4. Pelzer Chan and Krieg. *Microbiology*. New Delhi: Tata Mc Grow Hill Publishing Company, 2<sup>nd</sup> Edition 1998.
5. Wulf Crueger and Anneliese Crueger. *Biotechnology: A Textbook of Industrial Microbiology*. New Delhi: CBS Publishers and Distributors, 3<sup>rd</sup> Edition. 2016.
6. Presscott Harley and Klein. *Microbiology*. New York: WCB Mc Graw Hill Co. 2005
7. Purohit S.S. *Microbiology – Fundamentals and Application*. India: M/S Saraswathi Publication, 1991
8. Power C.B and K.F. Dagainawala. *General Microbiology*. Vol I & II. Himalaya Publishing House, 1988.
9. Ramesh. *Food Microbiology*. Chennai: MJP Publishers. 2007
10. Casida, J.R. *Industrial Microbiology*. New Delhi: New Age International Pvt. Ltd., 2<sup>nd</sup> Edition 2015
11. Ananthanaryanan, R and J. Panikar. *Text Book of Microbiology*, Chennai Anna Salai : Orient Longman Private Ltd., 160, 7<sup>th</sup> Edition. 2006.

## **PRACTICALS**

**Course Code 21PZOCR4**

**Hrs / Week : 2**

**Credit: 1**

1. Sterilization Techniques
2. Sample handling for microbial studies
3. Preparation of culture media:  
Nutrient broth, Nutrient agar, Potato dextrose agar, Mullen- Hinters agar
4. Counting of viable cells (CFU/ ml) by serial dilution & spread plate or pour plate methods
5. Pure culture techniques - Streaking and spread plate methods.
6. Spore staining
7. Simple biochemical tests of bacteria
  - a. Acid and gas production in glucose broth
  - b. Starch hydrolysis
  - c. Catalase
  - d. Nitrate reduction
8. Dye reduction test in milk

9. Test for antibiotic sensitivity - Kirby Bauer disc diffusion test
10. Isolation of symbiotic nitrogen fixing bacteria from root nodules
11. Observation of algae and fungi

**Books for Reference:**

1. Kannan N. *Laboratory Manual in General Microbiology* Palani: Palani Paramount Publications, 1996.
2. James Cappuccino and Natalie Sherman. *Microbiology: A Laboratory Manual*. Addison –Wesly - Hyman Inc, 1990.
3. Dubey R.C. and D.K. Maheswari. *Practical Microbiology*. New Delhi: S Chand & Company Ltd. 2008.



SEMESTER III			
Core XII		Research Methodology and Biotechniques	
Course Code : 21PZOC34	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

### Objectives

- To make students familiar with various research methods that are obligatory to do quality research in future.
- To equip the students with the knowledge of scientific paper writing
- To prepare the students to utilize the biological techniques in their research

### Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	demonstrate critical thinking and scientific approach in the design and implementation of an experiment.	7	Un, Ap
CO-2	develop skills to communicate scientific ideas in both written and oral formats	7	Ap
CO-3	apply a range of qualitative and quantitative research techniques to the scientific issues.	4	Ap
CO-4	identify a working comprehension of the technical and procedural aspects of laboratory testing, safety and ethical standards of practices	6	Ap
CO-5	list different methodologies to be adopted for conducting research in more appropriate manner.	6	An
CO-6	choose new scientific tools, concepts and theories to understand and solve scientific problems.	6	Ev
CO-7	develop a broad range of laboratory skills to perform experiments for employment prospects.	7	Cr
CO-8	design and conduct independent laboratory or field research that is consistent with the highest standards and practices of research	8	Cr

## **Unit I Research Designing**

Introduction - literature collection – sources - Internet and e-journals - literature citation - experimental design - thesis formatting and typing - manuscript preparation, interpretation and report writing and Plagiarism.

## **Unit II Research Publication & Ethics**

IPR: Patent, Copy right, H-index, I-10 index, Ethical Committee, Laboratory safety measures. Calculation of citation index in SCI/ Scopus/ Google scholar/ ICI.

## **Unit III Microscopy Types**

Principle, construction and applications of Phase contrast – Polarization – Electron microscope – types (SEM, TEM) - fixation and staining techniques for EM (Positive and Negative staining, Metal shadowing and Freeze fracture), fluorescence – atomic force and magnetic force microscope – micrometry.

## **Unit IV Spectroscopic Techniques**

Absorption and emission principles – construction and applications of spectrophotometer – UV - visible spectrophotometer, FTIR, spectrofluorimeter - flame photometer - atomic absorption and emission spectrophotometer, ESR and NMR.

## **Unit V Principles and Applications of Biotechniques**

Centrifuge – types: ultra, cooling and density gradient centrifuge, column chromatography, electrophoresis: SDS-PAGE, isoelectric focusing, GM counter – sample preparation for radioactive counting – biochemical application of radioisotopes - autoradiography.

## **Books for Reference**

1. Palanichamy S. and M. Shanmugavelu. *Research Methods in Biological Sciences*. Palani : Palani Paramount Publication.1997.
2. Gurumani. *Research Methodology for Biological Sciences*. Chennai: M.J.P. Publishers. 2011.

3. Veerakumari. L. *Bioinstrumentation*. Chennai: M.J.P Publishers. 2007.
4. Aparna Mathur. *Laboratory Instrumentation*. New Delhi: Black Prints. 2013.
5. Chinmoy Goswami, Abhijit Paintal and Rabindra Narain. *Hand Book of Bioinstrumentation*. Delhi: South Anarkali. 2011.
6. Debbie Holmes Peter Moody and Diana Dine. *Research Methods for the Biosciences*. U.K. Oxford University Press. 2006.
7. Rabindra Narain. *Practical Immunology*. New Delhi: Wisdom Press. 2012.

## **PRACTICALS**

**Course Code: 21PZOCR6**

**Hrs/ Week : 2**

**Credit : 1**

1. Fractionation of fish liver by density gradient centrifugation
2. Measurement of cell size by micrometry
3. Phase contrast microscopic observation of living cells
4. Estimation of lipids (Bragdon method)
5. Absorption spectra of proteins/ pigments
6. Column chromatographic separation of plant pigments.
7. Checking plagiarism by URKUND (online Demo).
8. Use of different instruments in research methodology (Spotters)
  - a. Electronmicroscope
  - b. Chromatography – HPLC
  - c. SDS-PAGE
  - d. G.M Counter

## **Books for Reference**

1. Gurumani. *Research Methodology for Biological Sciences*. Chennai: M.J.P. Publishers. 2011.
2. Veerakumari. L. *Bioinstrumentation*. Chennai: M.J.P. Publishers. 2007.

<b>SEMESTER I</b>			
<b>Core II</b>		<b>Plant Microbe Interaction</b>	
<b>Course Code: 21PBOC12</b>	<b>Hrs/week: 6</b>	<b>Hrs/Semester: 90</b>	<b>Credits: 4</b>

**Objectives:**

- To provide information on the growth and morphology of microbes
- To familiarize the interaction of plants with microbes
- To understand the basic principles related to plant diseases.

**Course Outcomes**

<b>CO. No</b>	<b>Upon completion of this course, students will be able to:</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	perform the techniques of isolation, characterization and measure the growth of bacteria	4	Re
CO-2	differentiate the mode of action of antibiotics	1	An
CO-3	outline the stages of disease pyramids and disease cycle.	2	Un
CO-4	know about the enzymes involved in plant diseases	1	Re
CO-5	understand the basic principles related to plant diseases.	2	Ap
CO-6	purify, detect and identify the plant viruses.	3	Re
CO-7	understand the general symptoms of bacterial disease, viral diseases and fungal disease	1	Un
CO-8	provide tools to design innovative, sustainable and tailored control methods to prevent plant diseases or to reduce their impacts	6	Cr

SEMESTER I			
Core II		Plant Microbe Interaction	
Course Code: 21PBOC12	Hrs/week: 6	Hrs/Semester: 90	Credits: 4

**UNIT I:** Early development of microbiology, contributions of Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Flemming and Louis Pasteur. Isolation of pure culture and measurement of growth of bacteria. Purification and quantitative assay of plant viruses. Antimicrobial components: mode of action of penicillin, streptomycin and sulfonamides.

**UNIT II:** Introduction: Components of disease (disease pyramid); causes of disease; classification of diseases; stages in the development of disease (disease cycle); Enzymes in plant diseases-pectic enzymes, macerating enzymes and cellulolytic enzymes. Dissemination of plant pathogens, Integrated disease management.

**UNIT III:** Characteristic features of plant pathogenic bacteria, general symptoms of bacterial diseases, Survival and spread of bacterial plant pathogens, control of bacterial disease. Symptoms, morphology of the causal organism, disease cycle and disease management of the following: Angular leaf spot of cotton, Citrus canker and Tundu disease of wheat.

**UNIT IV:** General characteristic of plant pathogenic fungi, survival, dissemination and spread, general symptoms, control of fungal diseases. Symptoms, morphology of the causal organism, disease cycle and disease management of the following: Wilt of cotton, Downy mildew of grapes and Ergot of rye.

**UNIT V:** General characteristic of plant viruses, translocation and distributions of viruses of plants, symptoms caused by plant viruses, Purification, detection and identification of plant viruses, control of plant viruses. Symptoms, morphology of the causal organism, disease cycle and disease management of the following: Bunchy top of banana, leaf curl of papaya and Yellow vein mosaic of bhindi.

**Books for Reference:**

1. Agrios G.N. *Plant Pathology*. London : Academic Press, 1997.
2. Caldwell D.R. *Microbial Physiology and Metabolism*. United states: Wm.C Brown publishers, 20 05.
3. Dubey R.C and Maheshwari D.K. *A text book of microbiology*. New Delhi:

- S.Chand and company,2003.
4. Kumar H. D and Swati Kumar. *Modern concepts of Microbiology*. NewDelhi: Vikas Publications, 2008.
  5. Mehrotra R.S and Agarwal A. *Plant Pathology*. New Delhi: Tata McGrawHill Publishing Company,2003.
  6. Pelczar H. and Reid R. *Microbiology – Concepts and Applications*. New Delhi:Tata Mc Graw Hill IPublishing company Pvt.Ltd., 1998.
  7. Pelzar M. J, Ch a n E.C.S and Noel. R *Microbiology*, New Delhi: TataMc Graw Hill Publishing company Pvt.Ltd., 2010.
  8. Prasad T.V.S. *Soil Microbiology*, New Delhi: Dominant Publishers anddistributors, 2011.
  9. Prescott L.M, Harley J.P and Klein D.A *Microbiology*. London:Mc Graw hill,2002.
  10. Sharma P.D. *Plant Pathology*. NewDelhi: Narosa Publishing House Pvt. Ltd.,2006.

**Practical: Hrs/week: 2**

- Record of brief life history of scientist related to microbiology
- Methods of sterilization of glasswares
- Preparation of media
- Serial dilution technique
- Pure culture technique
- Effect of antibiotics on the growth of bacteria. Determination of MIC
- Micropreparation/ study of infected specimen prescribed in the syllabus
- Angular leaf spot of cotton
- Citrus canker
- Tundu disease of wheat
- Bunchy top of banana
- Leaf curl of papaya
- Yellow vein mosaic of bhindi.
- Wilt of cotton
- Downy mildew of grapes
- Ergot of rye

**Submission -** Record Note Book

**Laboratory Manuals for**

**Reference:**

1. Lakshmanan M, Kunthala Jeyaraman, Jeyaraman and Gnanam, *Laboratoryexperiments in microbiology and molecular biology*, Higginbothams Pvt. Ltd., 1971.
2. Sharma P.D. *Plant Pathology*, NewDelhi: Narosa Publishing House Pvt. Ltd.,2006.

Semester I			
Core III Bioinstrumentation and Research Methods			
Course Code: 21PBOC13	Hrs/week: 5	Hrs/Semester: 75	Credits: 4

#### Objectives:

- To familiarize in collection of data and analysis of data for scientific solution
- To know the basic tools in research and to facilitate the students to undergo basic and application-oriented research
- To infuse the practical knowledge of using various scientific instruments to perform researchwork.
- To motivate the students to do research.
- To make them analyze the biological data.

#### Course Outcomes

CO.No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	know microscope as the basic tool for biological research.	6	Ap
CO-2	acquaint with different tools and techniques essential for research work	6	Cr
CO-3	understand the fundamentals of statistics and statistical analysis	4	Un
CO-4	do statistical analysis and communicate the results of statistical analyses accurately and effectively	4	Ap
CO-5	know and explain the importance of internet in research and gather reference materials	6	Un
CO-6	examine the basic framework of research process and able to learn how to address research problem and what is to be done to solve it.	6	An
CO-7	communicate the research findings to the scientific forums	6	Cr
CO-8	develop an understanding of the ethical dimensions of conducting applied research	7	An



Semester I			
Core III	Bioinstrumentation and Research Methods		
Course Code: 21PBOC13	Hrs/week: 5	Hrs/Semester: 75	Credits: 4

- UNIT I:** Microscopy: Principles, working mechanism and applications of Simple, Compound, Phase- Contrast microscopes, Electron microscopy (SEM). Principles and operations: pH meter, Electrical conductivity meters. Centrifugation: working principle and applications -differential and density gradient centrifugations; types: clinical/ low-speed, high speed, micro and analytical ultracentrifuges.
- UNIT II:** Chromatography: Principles, working mechanism and applications- Paper, Thin Layer, HPTLC, Column, HPLC and GC-MS. Spectrophotometry: Principles, working mechanism and applications -UV- visible, AAS, FTIR, MALDI.
- UNIT III:** Electrophoresis - principles, electrophoretic mobility, factors affecting electrophoresis, isoelectric focusing, types - vertical and horizontal. Agarose and polyacrylamide gel electrophoresis, detection and recovery of electrophorogram, gel documentation systems. Tracer techniques – Autoradiography, XRD.
- UNIT IV:** Biostatistics: Practice of statistical methods in biological research. Descriptive statistics: Measures of Central Tendency - Mean, Median and Mode. Measures of Dispersion- Standard deviation, coefficient of variation and standard error. Simple correlation and linear regression analysis. Inferential Statistics: Tests of statistical significance - Chi-square, t-tests and Analysis of Variance (ANOVA- one way & two-way).
- UNIT V:** Types of research, scientific research: hypothesis, experimentation, theory. Preparation of Research Article – Layout of a Research Paper, review article, online publications, thesis writing, Citation, referencing and bibliography, editorial process and proof-reading symbols. Journals in Botany-predatory, peer-reviewed, online journal, SCI journals, Web of science journals. Impact factor of Journals, Ethical issues related to publishing. Citation, google scholar, i-10, H index. Plagiarism and Self- Plagiarism. Oral presentation of research papers in conference.

#### Books for Reference

1. Gurumani N. *Research Methodology for Biological Sciences*, Chennai: MJP Publishers, 2006.
2. Gurumani N. *Scientific thesis writing and paper presentation*. Chennai: MJP Publishers, 2010.

3. Boyer R F. *Modern Experimental Biochemistry*. America: 3<sup>rd</sup> edn. Prentice HallPubl, 2000.
4. Kothari C.R. *Research Methodology – Methods and techniques*, New Delhi: Newage International (P) Ltd., Publishers, 2004.
5. Veerakumari L. *Bioinstrumentation*, Chennai: M.J.P. Publishers, 2015.
6. Gurumani N. *An Introduction to Biostatistics*, Chennai: 2nd edition M.J.P.Publishers, 2005.
7. Satguru Prasad. *Fundamentals of Biostatistics*, New Delhi:4th edition EmkayPublications, 2003.
8. Veera Bala Rastogi. *Fundamentals of Biostatistics*, Chennai: 2nd edition AneBooks Pvt. Ltd., 2009.

**Practical: Hrs/week: 2**

- Preparation of Molar, Normal, ppm, percentage and buffer solutions.
- Thin layer chromatographic separation of amino acids
- Separation of protein by PAGE
- Separation of DNA by AGE
- Digital photographic display of anatomical samples/ microscopic samples.
- Estimation of Na and K using flame photometer
- Demonstration-AAS, Fluorimeter and FTIR
- Data analysis with statistical package (SPSS& Excel) -  
mean, median, mode, standard deviation, standard error  
student t-test, ANOVA
- Preparation of bibliography using reference tool (Zotero)
- Calculation of citation Index
- Determination of Impact Factor of Author, Article and Journal.

**Books for Reference**

1. Jayaraman J. *Laboratory manual in biochemistry*, New Delhi: Wiley Eastern Ltd., 1985.
2. Palanisamy S and Manoharan M. *Statistical methods for biologists*, Palani: II Edition Palani paramount publishers, 1994.
3. Ponmurugan P and Gangathara Prabhu B. *Biotechniques*. Chennai: MJ Publishers, 2012.

SEMESTER II			
Core VII - Developmental Botany			
Course Code: 21PBOC23	Hrs/week: 5	Hrs/Semester: 75	Credit: 4

### Objectives

- To study the vegetative and reproductive development of seed-bearing plants
- This course is aimed at understanding the structural organization of tissues, organs and their developmental events controlled by environmental cues and genetic factors

### Course Outcome

CO. No	Upon completion of this course ,students will be able to	PSO addressed	CL
CO-1	understand the overview of essential aspects of development, organization and life cycle of seed bearing plants	3	Un
CO-2	know how embryo arises and the nature of signals that guide complex patterns of growth and differentiation in the embryo	4	Un
CO-3	explore and illustrate how the molecular and genetic approaches provide an insight into the mechanism that translate cues into organized pattern growth and development	4	Re, Un
CO-4	understand cell differentiation, organ development and network of gene signals that control developmental sequences	3	Un
CO-5	role of shoot and root apical meristem in vegetative growth and development	3	Re, Un
CO-6	know the biochemical and physiological changes associated with the development of sex organs, fertilization events and fruit development	4	Un, Ap
CO-7	know how the intrinsic programmes of development coupled to external influences such as nutrient levels, energy inputs and environmental signals.	4	Un
CO-8	acquire hands on training experience related to the course.	4	Re

SEMESTER II			
Core VII		Developmental Botany	
Course Code: 21PBOC23	Hrs/week: 5	Hrs/Semester: 75	Credit: 4

- UNIT I: Embryogenesis:** Basic concept of development. Polarity and cell lineages. Principle of determinants in plant embryogenesis – axis and pattern formation – apical, basal and radial; Cell plasticity - Meristem and indeterminate growth; Types of meristem – Root apical meristem (RAM) – quiescent center - development of lateral root and root hair formation - position dependent signaling process- hormonal control and maintenance of RAM; Shoot apical meristem (SAM)- organization and activities of SAM, role of gene and transcription factors; vegetative organization, tissue differentiation, leaf initiation and differentiation, Genetic approaches on SAM.
- UNIT II: Seed germination and Seedling establishment:** Seed structure, seed dormancy- breaking of seed dormancy; Seed germination – phases, mobilization of stored resource, seedling growth – growth curve- response to environmental cues- tropism – gravitropism, phototropism, thigmotropism – role of auxin distribution in tropism; phototropism- photomorphogenesis- shoot differentiation- vascular tissue differentiation; root growth and differentiation – emergence of lateral growth and biochemical and physiological considerations.
- UNIT III: Vegetative growth and organogenesis:** Leaf initiation and determination of phyllotaxy, differentiation of epidermal tissues and appendages, mesophyll tissues; venation pattern, role of hormones; primary root system and shoot system architecture; secondary growth in stem and root- secondary tissue and cambial activity- vascular cambium and cork cambium- abnormal secondary growth.
- UNIT IV: Floral development:** Floral evocation and development of floral parts - Floral meristem, floral organ development – gene control mechanism, homeotic gene control organ identity, competency and determination in floral evocation. Integrating environmental cues – photoperiodism – monitoring day length, circadian rhythm, vernalization- promoting flowering with cold- temperature control; physiological and molecular control of floral organ development and hormone signals in floral evocation –, gender expression in flowers, genetic control of floral symmetry.

**UNIT V: Developmental biology of floral organs:** Anther differentiation – tapetal behavior, microsporogenesis, pollen development and maturation. Male gametogenesis- pollen germination; megasporogenesis – development of female gametophyte- organization of embryo sac- gene regulation on megagametogenesis- pollen pistil interaction self incompatibility – causes – morphological, cyto genetical reasons – fertilization- development of seed and fruit formation.

**Books for Reference:**

1. Leyser O and Day S *Mechanisms in plant development*. France: Black Well Publishing Company, 2009.
2. Howell S.H *Molecular genetics of plant development*. NY: Cambridge University Press, 1998.
3. Taiz L and Zeiger E *Plant Physiology and development*. USA: Sinauer Associates. Sixth Edition. 2010.
4. Ragavan V *Developmental Biology of flowering plants*. NY: Springer. 2000.
5. Ragavan V *Experimental Embryogenesis in Vascular plants*. London: Academic Press Inc., 1976.
6. Shivana K.R and Joshi B.M *The angiosperm pollen structure and function*. Singapore: John Wiley & Sons, 1985.
7. Benjamin H Willier and Jane M Oppenheimer *Foundations of Experimental Embryology*. New Delhi. Prentice of India Private Limited, 1968.

**Practical: Hrs/week: 2**

- Micropreparation of shoot apex/root apex/flower buds/ anther/ ovary/epidermal appendages for microtomy
- Directionality of pollen tube growth: protein extraction and protein gelelectrophoresis
- Pollen viability test
- Pollen germination test
- Hand sectioning of anther and ovary
- Dissecting embryo and endosperm

**Books for Reference**

1. Chawla H.S *Introduction to Plant Biotechnology*. New Delhi:

SEMESTER – II			
Core VIII		Genetics and Bioinformatics	
Course Code:21PBOC24	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

### Objectives:

- To develop an overall understanding on the concepts in genetics and their implications Gain skill on common Bioinformatics tools use in Biology
- To understand Mendel's and T. H. Morgan's theories, on inheritance and their applications
- To practice chromosome mapping, pedigree analysis and basic problems in population genetics
- To comprehend chromosomal aberrations and its implications
- To get trained on Bioinformatics tools used in DNA/RNA/protein sequence analysis
- To get trained on protein structure/visualization and phylogenetic software

### Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	predict the possible outcome in a parental cross of known genes	4	Ap
CO-2	associate the physical basis of heredity and the mode of inheritance of a character	2	Un
CO-3	predict the unknown phenotype and genotype in a partially known pedigree	4	Ap
CO-4	map a gene and measure the distance between two genes	4	Ap
CO-5	understand various chromosomal aberrations and various chromosome banding techniques	1,2	An, Un
CO-6	comprehend the operations in population genetics	2	Un
CO-7	predict gene of unknown sequences, similarity between sequences, protein structure, phylogenetic relationships between large groups using genomic data	1, 4	An, Ap
CO-8	learn barcoding techniques and sequence submission	1,2	An, Un

SEMESTER – II			
Core VIII		Genetics and Bioinformatics	
Course Code: 21PBOC24	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

- UNIT I:** A brief account on Mendelian Principles. Sex linked inheritance. Formulating and testing genetic hypotheses: Chi-square test and probability theory in genetics. Pedigree analysis. Genetic counselling. Chromosome basis of inheritance. Linked genes, recombination and crossovers: Classical experiments in *Drosophila*. Chromosome mapping: two point and three point test cross, gene order and distance calculation. Somatic tests to assigning genes to chromosomes. Genetic recombination and gene mapping in eukaryotes e.g. *Neurospora*.
- UNIT II:** Chemical composition and packaging of eukaryotic chromosomes. Concept of gene. C-Value paradox, Cot-value and its significance. Chromosome structure in eukaryotes: Chemical composition of eukaryotic chromosomes, the three levels of DNA packaging, Ultra structure of centromere and telomere. Repeated nucleotide sequences, satellite DNA. Structural aberrations in chromosomes: Haploidy, Anueploidy, Polyploidy, and their types, cytological study and identification of autopolyploids and allopolyploids, Genetic consequences of ploidy alteration: Evolution of hexaploid wheat. Structural alteration in chromosome: Deletion, Duplication, Inversion & Translocation, hetrozygote. Chromosomal aberreation related syndromes. Chromosome banding: Q-band, G-band, R-band, C-band, *in situ* hybridization: GISH, FISH, Molecular maps.
- UNIT III:** Population genetics: History, Gene frequencies and Genotype frequencies, Gene pool. Systems of Mating: Random mating and Hardy-Weinberg Principle, Application of Hardy-Weinberg principles: Test for Random mating, Test for sex-linked trait, Test for carrier gene frequency, Test for mode of inheritance, Test for multiple gene. Non-random mating, Positive non-random mating, Negative non random mating.
- UNIT IV:** NCBI, DDBJ, EMBL. Submitting sequence: Sesquin. Sequence structure and mapping data bases. Comparing nucleotide and amino acid sequence: BLAST, Multiple sequence alignment: CLUSTALW, CLUSTAL omega. Protein databases: UniProtKB/Swiss-Prot, PIR, PDB, SCOP & CATH, ProDom, PFAM. Protein visualization tools: Swiss PDB Viewer, Pymol. Expasy proteomic tools: AA Compident and Peptide Mass. Motif and patterns PROSITE, BLOCKS, CADD, Introduction to software: JPred, 3DPSSM, Modeller, ITASSER, Procheck.
- UNIT V:** The terminology of phylogenetics- Trees, Root, branches, Node, Leaf, Clade; lineagesorting, orthology, paralogy, xenology; "basal" lineages, crown vs. stem groups, Phylogram vs. cladogram. Multiple sequence alignment & Tree building software - ClustalW, Mega, Phylip, Phylodraw, PhymL, RaxML, Treeview.

### Books for Reference

1. Benjamin Lewin, *Genes VII*. New Jersey: Pearson Prentice Hall, 2004.
2. David Preifelder. *Molecular Biology*. New Delhi : Narosa publishing House, 2006.
3. Dnyansagar, V. R.. *Cytology and Genetics*. Tata Mc Graw – Hill Publishing Company limited, 1986.
4. Robert H. Tamarin.. *Principles of Genetics*. New Delhi : Tata Mc. Graw - Hill publishing company Ltd, 2006.
5. Rastogi S.. C., Mendiratta N., and Rastogi, P. *Bioinformatics: Methods And Applications:(Genomics, Proteomics and Drug Discovery)*. New Delhi: PHI Learning Pvt. Ltd., 2013.
6. Sathyanarayana,U. *Biotechnology*. Kolkatha: Book and Allied (P). Ltd., 2006.
7. Singh B.D. *Genetics*. New Delhi: Kalyani Publishers, 2017.
8. Snustad D.P. and Simmons M. J. *Principles of Genetics*. New Jersey: Wiley Asia Student Edition. Wileyand Sons, Inc., 2012
9. Verma P.S. and Agarwal V.K. *Genetics*. New Delhi: S. Chand and Co., 1991
10. Vijendra Das L. D. *Genetics and plant breeding*. New Delhi: New age International (P) limited Publishers, 2005.

### Practicals: Hrs/Week: 2

- Problems coming under Mendelian pattern of inheritance
- Problems using chi-square, probability theory and pedigree
- Countable slides for the metaphase anaphase spread to be prepared each for mitosis and meiosis,and submit at the end of the semester.
- Karyotyping
- Chromosome structural aberration – Translocation in *Tradescantia spathacea* (Rhoeo)
- General genetic tests for genetic toxicity
- Test for gene mutations in bacteria –Bacterial reverse mutation Test
- Chromosomal aberrations due to the effect of mutagens – EMS/2,4 – D/acridine orange in *Allium cepa*
- Sequence analysis using BLAST
- Multiple sequence alignment using CLUSTAL W and CLUSTALX
- Protein structure prediction – PDB, JPred, Modeller
- Create Phylogenetic tree using minimum three of the tools mentioned in the syllabus

### Books for Reference:

1. Bendre Kumar. *A Text book of Practical Botany, Volume I & II (7<sup>th</sup> Edition)*. Merrut: RastogiPublications, 2014.
2. Proudlock R. *Genetic Toxicology Testing A Laboratory Manual*. USA: Academic Press, CA, 2016.



<b>SEMESTER - III</b>			
<b>Core XI Molecular Biology and Genetic Engineering</b>			
<b>Course Code: 21PBOC33</b>	<b>Hrs/week: 5</b>	<b>Hrs/Semester: 75</b>	<b>Credits: 4</b>

### **Objectives:**

- To furnish broad insight on chemical nature of hereditary material (DNA), organization of chromosome at different phases of cell cycle, basic rules, governing its replication and to examine genes have the code to life.
- To apply the understanding of DNA and adopt molecular techniques to manipulate gene to get the desired output.
- To educate the students in strategizing research methodologies employing genetic engineering techniques.

### **Course Outcomes:**

<b>CO.No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>PSO addressed</b>	<b>CL</b>
CO-1	know the chemistry of genetic material and details of its replication at molecular level	1	Un
CO-2	pronounce how errors during replication are repaired	6	An
CO-3	infer complexity of gene expression in eukaryotes over prokaryotes	2	Un
CO-4	explain gene regulation mechanisms at various levels by which they can learn how it controls growth and development of an organism	4	Cr
CO-5	Understand the principles of genetic engineering and basic steps of gene cloning	2	Un
CO-6	advocate the role of enzymes and vectors responsible for gene manipulation, transformation and genetic engineering	1	Un
CO-7	grasp different types of gene transfer methods employed in gene cloning process	2	Cr
CO-8	practice the advanced techniques in genetic engineering, investigate the different strategies of recombinant DNA technology and resolve the problems encountered	3	Ap

SEMESTER - III			
Core XI Molecular Biology and Genetic Engineering			
Course Code: 21PBOC33	Hrs/week: 5	Hrs/Semester: 75	Credits: 4

- UNIT I: Replication of DNA:** Molecular mechanism of DNA replication in prokaryotes (activation, initiation synthesis of new strands of DNA, termination and helix formation) and eukaryotes (replication of the ends of eukaryotic chromosomes, telomerase enzyme), Enzymology of DNA replication (DNA polymerase enzymes in prokaryotes and eukaryotes and DNA ligase enzymes), replication models (theta replication of DNA, rolling circle model and D-loop model). **DNA repair:** necessity of DNA repair, mistakes in DNA (types), Biochemical mechanism of DNA repair (mismatch repair and repair of thymidine dimers).
- UNIT II: Gene expression:** Definition of gene, types of genes, functions of genes, transcription and processing of RNA in prokaryotes and eukaryotes, genetic code, translation in prokaryotes (initiation, elongation, termination) and eukaryotes (initiation, elongation, termination and polypeptide folding), post translational processing of protein (protein folding).
- UNIT III: Regulation of gene expression:** Gene regulation in prokaryotes: Coordinated gene regulation, strategies of gene regulation, mechanism of gene regulation at transcriptional level induction (*lac* operon – structure, functioning) and repression (*trp* operon – structure). **Gene regulation in eukaryotes:** genome level (presence of multigene families, gene alteration, gene arrangement), transcription level (acetylation of histones, euchromatin remodeling complexes, methylation of nucleotides, control elements, transcription factors, mediators, insulator, regulatory proteins, hormones and chromosome level), post-transcriptional level (post-transcriptional control by choice of splice site, polyproteins, regulation of gene expression by RNA, control on transport of RNA, control at translation of RNA, mRNA degradation control, protein folding level and protein degradation control).
- UNIT IV: Genetic Engineering:** Discovery, denaturation and renaturation of DNA, artificial synthesis of gene, restriction enzymes – types, target sites, DNA cleavage styles (sticky and blunt end style). Biological tools for recombinant DNA technology (enzymes, linkers, foreign DNA and cloning vectors). Vectors – cloning and expression vector, plasmid vectors – types, characteristics (pBR322 and pUC8), bacteriophage vectors (lambda phage and M13 vectors), cosmid vectors (pJB8), phagemid vectors (pBluescript), artificial chromosome vectors (BAC and YAC), shuttle vectors, fosmid vectors.
- UNIT V: Techniques used in Genetic Engineering:** Generation of DNA fragments (DNA cleavage by restriction enzymes, Southern blotting technique, Northern blotting and Western blotting). Artificial synthesis

of gene (Chemical assembly of oligonucleotides, enzymatic assembly of oligonucleotides and complementary DNA synthesis). Joining of foreign DNA fragment to a cloning vector (sticky, blunt end ligation and homopolymer tailing method). Introduction of recombinant DNA into host cell (transformation, transduction, electroporation, liposomes, microinjection and microprojectile). Selection and screening of transformed cells (reporter genes, elimination of non-transformed cells, identification of clones having rDNA, selection, formation and expression of cloned genes). Genetic engineering and human welfare.

### **Books for Reference:**

1. Veer Bala Rastogi. *Principles of Molecular Biology*. India: MEDTECH. 2016.
2. Brown T.A. *Gene cloning and DNA analysis, An Introduction*. Manchester: John Wiley & Sons. 2010.
3. Primrose S.B and Twyman R. *Principles of gene manipulation and genomics*. Wiley. 7<sup>th</sup> edition 2006.
4. Verma P.S. and Agarwal V.K. *Genetic Engineering*. New Delhi: S. Chand & Company. 2010.
5. Benjamin Lewin. *Genes VII*. Burlington: Pearson Prentice Hall. 2004.
6. Channarayappa. *Molecular Biology. Principles and Practices*. India: Universities Press Pvt. Ltd., 2006.
7. Nicholl D.S.T. *An Introduction of genetic engineering*. UK: Cambridge University press. 2001.
8. Robert H. Tamarin. *Principles of Genetics*. New Delhi: Tata Mc. Graw-Hill publishing company Ltd., 2006.
9. Sathyanarayana U. *Biotechnology*. Kolkatha: Book sand Allied (P). Ltd., 2006.
10. Glick B.R, Pasternak J.J and Patten C.L. *Molecular Biotechnology: principles and applications of recombinant DNA*. Washington: ASM Press. 4<sup>th</sup> edition 2010.

### **Practicals**

#### **Hrs/ week - 2**

- Estimation of DNA by diphenylamine method.
- Estimation of RNA by Orcinol method.
- Isolation of bacterial genomic DNA.
- Isolation of genomic DNA from plant tissue.
- Separation of DNA fragments using AGE.

- Digestion of DNA with restriction enzymes.
- Vecscreen software to detect foreign DNA.
- Protein translation using p BLAST.

**Laboratory Manual for Reference:**

1. William D. Stansfield, Jame S. Colome and Raul J. Cano. *Theory and Problems Molecular and cell biology*. Schaum's outline series, 1<sup>st</sup> edition McGraw-Hill. 2019.

SEMESTER IV			
Core XV		Plant Biotechnology	
Course Code: 21PBOC43	Hrs/week: 4	Hrs/Semester: 60	Credits:4

#### Objectives:

- To acquire knowledge on laboratory organization and handling the tools of in-vitro culture of plant that of novel quality
- To understand the role of 21st century science (biotechnology) in increasing productivity of crop plants and to enhance the production of high value metabolites.
- To advance laboratory skill to get employment in biotechnology laboratories and industries.

#### Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	comprehend the basic principal of in-vitro tissue culture and develop skills in methods of tissue culture	3	Re, Un
CO - 2	practice <i>in-vitro</i> tissue culture techniques for getting required plants from explants	4	Un, Ap
CO - 3	expound <i>in-vitro</i> somatic hybridization and formation of somaclonal variation and its commercial application	4	Un
CO - 4	substantiate tissue culture is the viable option for the conservation of endangered plants	4	Re
CO - 5	grasp the techniques of mass cultivation of biofertilizer and defend biofertilizer a boon to sustainable agriculture	3	Un
CO - 6	categories different methods of synthesis of nanoparticles and understand the wide range of application of nanotechnology.	3	Un
CO - 7	describe what is plant molecular farming and highlight that transgenic plants are bioreactor for production of quality protein and other metabolites valuable to medicine and industries	4	Ap
CO - 8	utilize transferable skills obtained through the course for the professional accomplishment	1	Re

SEMESTER IV			
Core XV		Plant Biotechnology	
Course Code: 21PBOC43	Hrs/week: 4	Hrs/Semester: 60	Credits:4

**UNIT I:**      **Biotechnology:** Historical development, scope. **Plant tissue culture:** Laboratory organization, preparation of different media and role of growth hormones in *in-vitro* plant development. Plant regeneration pathway: direct embryogenesis, **organogenesis:** organ culture – nodal culture, internodal culture. **Embryo culture:** embryo rescue, breaking of seed dormancy. Factors affecting regeneration, regulation of regeneration. **Production of haploids:** Anther and pollen culture. **Callus culture.**

**UNIT II:**      **Cell culture:** single cell culture and production of secondary metabolites (Alkaloids) **Somatic embryogenesis:** Introduction, factors affecting embryogenesis. **Protoplast Culture:** Plant protoplast isolation, factors affecting protoplast isolation, Protoplast fusion and production of somatic hybrids, selection of hybrid cells and application of protoplast hybridization. **Somaclonal variation:** Isolation and characterization of variants -molecular basis and induced mutations, applications and limitations. **Micropropagation methods:** Apical meristem culture and production of virus free multiple shoots.

**UNIT III:** **Industrial Biotechnology:** role of microbes, strain development, fermentation – **Types of fermentors:** process optimization and recent development in fermentation technology. **Commercial production:** Biopesticide, bio diesel, SLF, alcohol production, pharmaceutical and cosmetics from higher plants. **Enzyme technology:** Cell immobilization and microbial enzyme production at commercial scale.

**UNIT IV:**      **Phytoremediation:** Microbial degradation of toxic chemicals from soil and water: Plants as a phytoremediating agents. **Biofertilizers:** Mass production of *Rhizobium*, *Azospirillum* and Blue Green Algae (BGA), Vesicular Arbuscular Mycorrhizal Fungi (VAM), Single cell protein (*Scenedesmus*, *Spirulina*, *Saccharomyces*). Algae in bioengineering.

**Nanotechnology** – role of bio sensor in environmental monitoring. Outline of green synthesis of nanoparticles and their characterization.

**UNIT V:**     **Transgenic plants: Transformation for resistance to biotic stress** – pathogens, insects, virus and bacteria. **Transformation for resistance to abiotic stress** – herbicide resistance, resistance to drought. **Transgenic plant and improved quality:** extended self life, fruit ripening and prevention of discoloration of fruits. **Transgenic plant for improved nutrition** – golden rice, improved seed quality. **Transgenes and immune protective drugs** – edible vaccine, plantibody **Regulations in Biotechnology:** Biosafety: definition, requirement, biosafety in relation to transgenic research, biosafety guidelines and implementation. Intellectual property rights: process of patenting of biotechnological products. Farmer's Rights and plant breeder's Rights.

**Books for Reference:**

1. Colin Rattledge and K. Bjorn. *Basic biotechnology*. New York: Cambridge University Press, 2001.
2. Dubey R.C. *Textbook of Biotechnology*. New Delhi: S. Chand & Co. 2005.
3. George E.F. and Sherrington P.D. *Plant propagation by tissue culture*. London: Exegetic Ltd. 1984.
4. Gupta, P.K. *Elements of Biotechnology*. Meerut: Rastogi publication 2000.
5. Kalyan Kumar De. *An Introduction to Plant Tissue Culture*. Calcutta: New Central Book Agency 2004.
6. Kumar, H.D. *Molecular biology and Biotechnology*. New Delhi: Vikas publishers 1993.
7. Mahesh. *Paddy molecular Biotechnology*. New age international, publishers. (p) Ltd. 2008.
8. Mukhopadhyay S.N, Prabhakar Sharma and Rabindra Narain. *A text book of DNA recombinant technology*. New Delhi: Wisdom press, 2011.

9. Ramavat K. G. *Plant Biotechnology*, New Delhi: S. Chand & Co. 2000.
10. Reinort J and Yeoman M. M. *Plant cell and tissue culture*. Delhi: Narosa publishing house 1983.
11. Satyanarayana U. *Biotechnology*. Kolkatta: Books and Allied (P) Ltd. 2006.
12. Singh, B.D. *Biotechnology - Expanding Horizons*. New Delhi: Kalyani Publishers 2005.

### **Practicals:**

**(Hrs. /week - 2)**

- Isolation of Rhizobium
- Isolation of rhizosphere bacteria
- Isolation of phosphate solubilizing microorganism
- Synthesis and characterization of nanoparticles
- Preparation of synthetic seeds
- Isolation of protoplast
- Callus induction
- Embryo culture
- Single cell Isolation
- Isolation of BGA
- Nodal Culture
- Protoplast isolation

### **Set up / pictures / photographs/ demonstration**

- Golden rice
- Edible vaccine
- Fermentor

**Submission** - Record Note Book

### **Laboratory Manual for Reference:**

1. Chawla, HS. *Introduction to Plant Biotechnology*. New Delhi: Oxford & IBH publishing company Pvt. Ltd. 2009.

**Submission:** Record Note Book