File No-7-1/2004-HPU (Acad) Himachal Pradesh University Academic Branch

12 6 JUL 2011 Dated.

All the Principal of Govt /Non Govt Affiliated/Associated with the H P.University Shimla-5 with the request to upload the same from University Website www.hpuniv.nic.in

2. The Controller of Examination, H.P.U., Shimla-5

The D R /A R Exam (UG)/ S.O. Exam (U.G.) I.II. III/Conduct/Secrecy/

Re-evaluation/ Evaluation/ RME H P University Shimla-5

4 Incharge Computer Centre, H.P.U., Shimia-5

Subject

Proceedings of the meeting for switching over from CBCS semester system to Annual system 13 06 2018

Sir/Madam

Please find enclosed a copy of the Proceedings of the meeting of Deans of the Faculties and Chairpersons/ Directors of the Teaching Departments/Institutes for switching over from CBCS semester system to CBCS annual system held on 13-06-2018 for information and necessary action

Yours faithfully (K K Sharma)HAS Registrar

Dated 2 6 131 21

Encls As above Endst. No. even

Copy forwarded for information:-

- 1. Dean of Studies, H.P.University, Shimla-5.
- 2. All the Deans, H.P.University, Shimla-5
- 3. All the Chairmen/ Chairperson/ Director/ of the Teaching Departments, H P University, Shimla-5
- 4. The Web Admin. H P University Shimla-5 to upload the letter alongwith its enclosures

No. EDN-A-Ka(1)-1/2015 Government of Himachal Pradesh Department of Higher Education

From:

To

The Principal Secretary (Higher Education) to the Government of Himachal Pradesh

The Director of Higher Education Himachal Pradesh Shimla – 01

Dated

Shimla-2, the

Eeb 2019

Subject:-

Approval regarding starting of M.Com and PG Classes in Chemistry, Botany, Zoology and MA Pol. Science in Government College Ghumarwin.

Sir,

I am directed refer to your letter No. EDN-H (8) A (1)-69/89-2010(PG) dated 23<sup>rd</sup> April,2018, on the subject cited above and to convey the approval of the Government to start of M.Com and PG Classes in Chemistry, Botany, Zoology and MA Pol. Science as new PG subject in Government College Ghumarwin subject to completion of all codal formalities. Posts of Lab Staff may be filled through rationalization.

You are therefore, requested to take further necessary action in the matter accordingly under intimation to this department.

Yours faithfully, 5734/00

(Navmeet Kapoor) Deputy Secretary (Hr Edn) to the Government of Himachal Pradesh

# SCHEME AND COURSES OF READING FOR MASTER OF COMMERCE (M.COM) UNDER SEMESTER SYSTEM W.E.F 2018-19

# COURSE STRUCTURE

Note: There will be nine(9) questions in all. The first question is compulsory and consist of ten (10) short questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

# M.Com 1<sup>st</sup> Semester

Course Code	Course Title	Ext.	Int.	Total N	Marks	
MC 1.1	Management & Organizational Be	ehaviour		80	20	100
MC 1.2	<b>Business Environment</b>			80	20	100
MC 1.3	Managerial Economics			80	20	100
MC 1.4	Statistical Analysis for Decision N	Iaking		80	20	100
MC 1.5	Taxation Practices and Administra	ation		80	20	100
Industry cum	Educational tour (Compulsory for regular s	students)				
M.Com 2 <sup>st</sup> Se	emester					
MC 2.1	Corporate Financial Accounting			80	20	100
MC 2.2	Financial Management			80	20	100
MC 2.3	Human Resource Management			80	20	100
MC 2.4	Marketing Management			80	20	100
MC 2.5	Financial Institution and Markets			80	20	100
M.Com 3 <sup>rd</sup> Se	emester					
MC 3.1	Computer Application in Business	5		80	20	100
MC 3.2	Advanced Cost Accounting		80	20	100	
MC 3.3	Corporate Legal Framework		80	20	100	
MC 3.4	Strategic Management			80	20	100
MC 3.5	Research Methodology			80	20	100
M.Com <sup>4th</sup> Se	mester					
MC 4.1	Advanced Financial Management			80	20	100
MC 4.2	Security Analysis and Portfolio M	anagemei	nt	80	20	100
MC 4.3	Project Planning and Control		80	20	100	
MC 4.4	Accounting for Managerial Decisi	on	80	20	100	
MC 4.5	E-Commerce		80	20	100	
MC 4.6	Project Report and Viva-voce* Ethics**	/Corporat	te Go	vernance	and	Business

#### MC 1.1 Management & Organizational Behaviour

Max Marks 80

Internal Assessment 20

Note: There will be nine(9) questions in all. The first question is compulsory and will consist of ten (10) short questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of correspondence courses, the paper will be of 100 marks spread as 20 marks of each question including the compulsory question.

## **Course Contents**

#### Unit I

Management Process; Nature, Scope and Functions of Management. Development of Management Thought; Taylor and Scientific Management, Contributions of Henry Fayol, Hawthorne Experiments and Human Relations, Social Systems Contributions Peter F. Drucker, Behavioural Theory, of Scientists and Situational theory. Schools of Management Thought; Empirical Approach, Human Relations Approach, Social Systems Approach, Socio-technical Systems Approach, Decision Theory Approach, Systems Approach and Contingency/ Situational Approach.

#### Unit II

Behaviour in Organization; Nature of Human Behaviour, Individual Differences, Perception, Perceptional Selectivity and Managerial Implications. Motivation; Motivation and Behaviour, Theories of Motivation including Maslow's Hierarchy of Needs Theory, Two-Factor Theory, McClelland's Need Theory, McGregor's X and Y Theory, Immaturity-Maturity Theory, Valence-Expectancy Theory, Alderfer's ERG Theory, Contingency Theory, Carrot-Stick Theory and Motivational Pattern in Indian Industry. Interpersonal and Group Behaviour; Transactional Analysis- Self Awareness, Ego States, Life Scripts, Life Positions, Strokes and Transactions. Group Dynamics; Behaviour in Groups and Formal-Informal Groups.

#### **Unit III**

Controlling Behaviour; Need for Control, Behaviour Implications of Control, Leadership- Theories of Leadership, Leadership Styles, Qualities of Effective Leader and Leadership Styles in Indian Organizations. Communication; Communication Process, Communication Media, Effective Communication and Barriers in Communication. Organizational Climate; Concept, Factors, Impact of Organizational Climate and Participation & Organizational Climate.

#### Unit IV

Organizational change and Development; Objectives of Planned Change, Process of Planned Change, Human Reactions to Change, Resistance to Change, Overcoming Resistance to Change, Change Agents, Organisational Growth and Change Process, Organizational Development, Steps in Organizational Development and Organizational Development Interventions. Conflicts in Organization; Functional and Dysfunctional Aspects of Conflicts, Individual Level Conflicts, Group Conflicts, Inter-group Conflicts, Intra-organizational Conflicts, Inter-organizational Conflicts and Conflict Management. Organizational Effectiveness; Factors in Organizational Effectiveness and Integration of Individual & Organizational Goals for Effectiveness.

#### **References:**

- 1. Organization Theory and Behaviour by L.M. Prasad, Sultan Chand and Sons, 23 Daryaganj, New Delhi-110002. 2. Principles and Practices of Management by by L.M. Prasad, Sultan Chand and Sons, 23 DaryaganjNew Delhi-110002.
- 3. Essentials of Organizational Behavior by Stephen P. Robbins Prentice Hall of India Private Limited, New Delhi-110001.
- 4. Organizational Development- Behavioural Science Interventions for Organization Improvement by Wendell L. French and Cecil H. Dell, Jr. Prentice Hall of India Private Limited, New Delhi-110001.

- 8. Organisational Behaviour Human Behaviour at Work by Johan W. Newstrom and Keith Davis Tata McGraw Hill, New Delhi.
- 9. Organizational Behaviour by Stephen P. Robbins, Prentice Hall New Delhi.
- 10. Organizational Behaviour by Richard M. Steers and J. Stewart Black, Haper Collins College Publishers, New Delhi.
- 11. Understanding Organizations: Organisation Theory and Practice in India by Sukla York Madhukar.
- 12. Organizational Behaviour by Hawa Singh, V.K. Global Publications Private Ltd., New Delhi

<sup>5.</sup> Essentials of Management by Harold Koontz, Cyril O'Donnell and Heinz Weihrich, Tata McGraw Hill, Publishing Company Ltd., New Delhi. Organisational Behaviour and Management by Johan Ivancevich and Micheeol T. Matheson, Business Publication Inc. Taxas.
Organisational Behaviour by Ricky Griffin, W. Houghton Miffin Co., Boston.

## MC 1.2 BUSINESS ENVIRONMENT

Max Marks 80

Internal Assessment 20

**Note:** There will be nine(9) questions in all. The first question is compulsory and will consist of ten (10) short questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of correspondence courses, the paper will be of 100 marks spread as 20 marks of each question including the compulsory question.

# **Course Contents**

# Unit I

Business Environment; Nature and Importance, Interaction Matrix of different Environment Factors, Environmental Scanning, Economic Planning in India, Objectives, Strategies and Problems of Economic Planning, Privatization, Globalization, Disinvestment in Public Sector Units, NITI Ayog,

# Unit-II

Fiscal Policy, Monetary Policy, Industrial Policy, Industrial Licensing Policy, Foreign Trade Policy.

# Unit-III

Industrial Sickness, Development and Protection of Small Scale Industry. The Environment (Protection) Act, Right to Information Act.

# **Unit-IV**

Regulatory framework of WTO, its Basic Principles and Charter, Provisions relating to Preferential Treatment to Developing Countries, Regional Groupings, Anti- dumping Duties and other NTBs.

# **References:**

1. Arya, P P and Tandon, B.B Economic Reforms in India, Deep and Deep Publishers, New Delhi.

- 2. Cherunilam Francis: Business Environment, Himalaya Publishing House, New Delhi.
- 3. Economic survey Various issues, Govt. of India, Ministry of Finance.
- 4. Justin Paul: Business Environment, Tata McGraw Hill, New Delhi.
- 5. Mishra and Puri: Economic Environment of Business, Himalaya Publishing House, New Delhi.
- 6. Rosy Joshi and Sangam Kapoor: Business Environment Kalyani Publishers, New Delhi.
- 7. Saleem Saikh: Business Environment, Himalaya Publishing House, New Delhi.
- 8. Sengupta, N.K Government and Business in India, Vikas Publication, New Delhi.

#### MC 1.3 MANAGERIAL ECONOMICS

Max Marks: 80

#### Internal Assessment: 20

Note: There will be nine(9) questions in all. The first question is compulsory and consist of ten (10) short questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **Course Contents**

#### Unit-I

**OBJECTIVE OF BUSINESS:-**

Objective of a firm in microeconomics: Traditional profit maximization objective ; sales revenue and growth rate maximization objectives. Objectives of business as perceived in business management.

DEMAND ANALYSIS:- Individual and market demand functions ; law of demand; price elasticity of demand ; its meaning and degrees; determinants of price elasticity; concept of cross elasticity. Demand curve facing a firm ; total; marginal and average revenue.

#### Unit-II

COST FUNCTIONS:- Short run cost functions; their nature, shape and interrelationship ; law of variable proportions. Long run cost functions; LRAC and LRMC- their nature and shape; law of returns to scale.

PRICE INPUT- OUTPUT DECISIONS:-The normal and supernormal profits; the distinction between short and long term price output decisions; the profit maximization objective and conditions of firms short and long run equilibrium.

PRICE DETERMINATION UNDER4 DIFFERENT MARKET CONDITIIONS :- Characteristics of different market structures; price determination and firms equilibrium under perfect competition, monopolistic competition and monopoly- short and long run.

## Unit-III

ECONOMIC FORCASTING AND PLANNING:- Need and methods of economic forecasting for national planning. Economic forecasting and planning of business; need and methods.

BUSINESS CYCLES:-Nature and phases of business cycles. Theories of business cycles: Psychological, profit, monetary, innovations, cobweb, samuleson and hicks theories.

## Unit-IV

INFLATION:-Definition, characteristics and types. Explanation of inflation in terms of demand-pull and cost-push factors. Effects of inflation.

MONETARY AND FISCAL POLICIES:- Need for stabilization policies. Monetary policy: meaning, objectives, instruments, transmission mechanism and limitations in operational mechanism, effectiveness and limitation. **References:** 

- 1. T.R Jain , Dr. O.P Khanna V K Publications.
- 2. Alan Hughes (1987). "managerial capitalism," The New Palgrave: A Dictionary of Economics, v. 3, pp. 293–96.
- 3. Edward Lazear (2008). "personnel economics," The New Palgrave Dictionary of Economics. 2nd Edition. Abstract.
- 4. Keith Weigelt (2006). Managerial Economics
- 5. Elmer G. Wiens The Public Firm with Managerial Incentives
- 6. Khan Ahsan (2014). "Managerial Economics and Economic Analysis", 3rd edition, Pakistan.
- 7. Arya Sri."Managerial Economics " :MEFA . (2015).

#### MC 1.4 STATISTICAL ANALYSIS FOR DECISION MAKING

Max Marks: 80

#### Internal Assessment: 20

Note: There will be nine(9) questions in all. The first question is compulsory and consist of ten (10) short questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **Course Contents**

#### Unit-I

Measurements of central tendency, dispersion, skewness and kurtosis.

## Unit-II

Regression analysis and correlation analysis (Two variables only).

Index Numbers: Meaning, construction of index numbers, problem in the construction of index numbers, Price, Quantity and Value Indices.

## Unit-III

Probability Theory:- Probability ,Classical Probability, Relative frequency Probability and Subjective Probability. Addition and multiple theorem of probability and Bay's Theorem. Probability distribution. Binomial distribution. The Poisson distribution and the Normal distribution.

## Unit-IV

Statistical Inferences; Testing of Hypotheses and Estimation, Sampling Distributions and Procedure of Testing Hypotheses

Hypothesis Testing: Large and small sample tests (Z test, T test, F test)

Non Parametric Test: Chi-square, Run test, Sign test, Median test, Rank Correlation test, Kruskal- Wallis Test **References:** 

- 1. Johnson , R.D and Siskin, B.R Quantitative techniques foe business decision . prentice Hall of India, 1984.
- 2. Hien , L.W- Quantitative Approach to managerial decision . Practice Hall of India, 1983.
- 3. Levin, Richard I. and Rubin david S Statistics for management, Prentice Hall of India, 1983.
- 4. Chou- Ya- Lun; Statistical Analysis. Holt, Rinchart and winslon, 1980.
- 5. Fruend , J.E and William. F.J Elementary Business Statistics The Modern Approach , 1982
- 6. Hooda, R.P, Statistical Methods.

#### MC 1.5 TAXATION PRACTICES AND ADMINISTRATION

Max Marks 80

Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **COURSE CONTENTS :**

#### Unit I

Taxation; Concept, meaning and types of Tax. Distinction between Direct Tax and Indirect Tax.

Tax Planning, avoidance and evasions. Income Tax; Meaning, concepts and latest provisions. Basis of Charge, Residential Status.

GST-Concept, types, Slabs of tax, administrative procedure with regard to GST and Mechanism of GST

#### Unit II

Income from Salary, House Property and Profits and Gains from Business or Profession.

#### Unit III

Capital Gain and Income from Other Sources, Aggregation of Income, Set-off and Carry Forward of Losses, Tax deductions or collection at Source. Advance payment of tax.

#### Unit IV

Tax Planning with reference to setting up a new business. Tax Planning with reference to managerial decisions. Tax Administration. Central Board of Direct Tax, its Powers, composition and Role. E-Filing.

#### **References:**

1. Singhania, Vinod K., Direct tax Planning and Management, Taxmann Publication, Delhi.

Gaur and Narang, Corporate Tax Planning, Kalyani Publishers, Ludhiana.

2.Singhania, Vinod K. and Monica Singhania. *Students' Guide to Income Tax, University Edition.* Taxmann Publications Pvt. Ltd., New Delhi.

- 3. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi.
- 4. Gaur and Narang, Income Tax Law and Practice, Kalyani Publishers.
- 5. Mehrotra H.C. and Goyal S.P, Income Tax Law and Accounts, Sahitya Bhawan Publications.
- 6. Spectrum Income Tax Law and Practice.
- 7. Jain Mukta and Jain Rakesh, Direct Tax Laws by V.K. Publications.
- 8. Bangar's Comprehensive Guide to Direct Tax Laws.

#### MC 2.1 CORPORATE FINANCIAL ACCOUNTING

#### Max Marks 80

#### Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **Course Contents:**

#### Unit I

Accounting for issue, forfeiture and re- issue of shares. Accounting for issue and redemption of debentures.

#### Unit II

Final Accounts of Companies. and Insurance Company Accounts.

#### Unit III

Accounting issues related to Amalgamation in the nature of merger and purchase and Reconstruction of Companies. Accounts related to Liquidation Of Companies.

#### Unit IV

Accounting for Holding and Subsidiary Companies. Royalty Account.

#### References

Gupta, R.L: Advance Financial Accounting, S.Chand&Co., New Delhi.

Arulanandum, M.A and Raman, K.S.: Advanced Accountancy, Himalaya publishing House, N.Delhi.

Maheshwaari, S.N: Advanced Accountancy –Vol.II, Vikas Publishing house, New Delhi.

Monga, J.R: Advanced Financial Accounting, Mayoor Paperbacks, Noida

Shukla, M.C. and T.S. Grewal: Advanced Accountancy, Sultan Chand&Co. New Delhi.

Warren, C.S. and P.E fess: Principles of Financial and Managerial Accounting, South-Western, Ohio.

Porwal, L.S., Accounting Theory, Tata McGraw hill, New Delhi.

#### MC 2.2 FINACIAL MANAGEMENT

#### MAX MARKS 80

Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **Course Contents**

#### Unit I

**Financial Management:** Introduction to Financial Management, nature, significance, objectives and Scope of financial management, functions of finance executive in an organizations and recent developments in financial management. The goal of a Firm, Role of Financial Manager.

**Financial Planning and Forecasting:** Need & importance of financial Planning; tools of financial planning, financial Planning process, Drafting a financial plan; Financial forecasting; meaning, benefits and techniques of financial forecasting; Sources of finance.

#### Unit II

Aspects of Corporate Financial Structure; Factors affecting capital structure, Theories of Capital structure, Net Income Approach, Net Operating Income Approach, The MM Approach.

Leverages; Financial, Operating and composite leverages. EBIT-EPS Analysis.

**Cost of Capital:** Significance, computation of cost of capital including cost of debt, cost of equity capital, cost of retained earnings, weighted cost of capital, CAPM, problems in computation of cost of capital.

#### Unit III

Dividend Policy; Origin of the Dividend Policy, theories of dividend policy.

**Capital Budgeting Decisions:** Nature & importance, facts influencing capital expenditure decisions, capital budgeting process, Evaluation criteria and risk analysis, capital expenditure control.

#### Unit IV

**Working Capital Management and Control:** Need, Types & determinations, assessment of working capital requirements; Management of cash, inventories and receivables, Management of financing of working capital. **REFERNCES** 

- 1. Ravi M. Kishore: Financial Management, Taxman Publications Pvt. Ltd. New Delhi.
- 2. Sinha, Pradeep Kumar: Financial Management, Excel Books, New Delhi.
- 3. Van, Horne: Financial Management and Policy, Prentice Hall of India, New Delhi
- 4. Hampton: Financial Decision making, prentice Hall of India, New Delhi.
- 5. Prasanna, Chandra: Financial Management, Tata McGraw Hill, New Delhi.
- 6. Khan, M.Y. and Jain, P.K.: financial Management, Tata McGraw Hill, New Delhi.
- 7. James c. Vanhorne: Financial Management and Policy, Prentice Hall.
- 8. John Hampton: Financial Decision Making, Prentice Hall.
- 9. Prasanna Chandra: Financial Management, Tata McGraw Hill.
- 10. I.M. Pandey: Financial Management, Vikas Publishing House

#### MC 2.3: HUMAN RESOURCE MANAGEMENT

Max Marks: 80

Internal Assessment: 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **Course Contents:**

#### Unit-I

**Concept, Nature, Scope and Objectives of Human Resource Management, HRM:** The challenges-Environmental, Organizational and Individual, Human Resource planning and Job analysis.

**Recruitment:** sources, concept and objectives, **Selection**: concept, Procedure and cost benefit analysis of selection, Induction, career planning, bases of promotion, Transfer, Separations, Outplacement and Outsourcing HR. Emerging trends of HRM in globalized economy and cross cultural environment.

Unit –II

**Human Resource Development**: Training & Development: Concept, Training need assessment, Types of training programmes: on the job, ROI of training, metrics for evaluation of training programme, Performance Appraisal; Objectives, Uses and Methods : Traditional and Modern methods (Assessment and Development Centres, 360 Appraisals), Problems of Performance Appraisal, Legal issues in Performance Appraisal. Classification of Employees and Conceptual differences in Compensation Systems.

#### Unit-III

**Concept of Wages & Salary**, Components of wages, Method of wage Determination, Methods of Wage payment, Wage Differentials, Job Evaluation. **Industrial Relations**: Concept and Approaches to Industrial Relations, Unitary, Pluralistic and Radical Approach, Industrial Relations System, Overview of International HRM: Selection, Compensation, Training & Development, Patriation and Repatriation.

#### Unit-IV

Workers' Participation in Management, Collective Bargaining, Dispute Settlement System including Arbitration, Conciliation and Adjudication.

Employees Compensation: Regulatory provisions, Regulatory provisions for settlement of disputes.

#### **Recommended Books:**

- 1. Human Resource Management, VSP Rao, Excel Books
- 2. Human Resource Management, Durai, Pearson
- 3. Personnel & Human Resource Management, P. Subba Rao, HPH
- 4. HRM Text & Cases, Aswathappa, TMH
- 5. HRM, Snell, Bohlander, Vohra; Cengage
- 6. Managing Human Resources, Gomez, Balkin, Cardy, PHI
- 7. Human Resource Management, Jyoti, Venikates, Oxford
- 8. Human Resource Management, Khanka, S. chand
- 9. HRM a case study approach, Muller Camen, Jaico

#### MC 2.4 MARKETING MANAGEMENT

## MAX MARKS 80

#### Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **COURSE CONTENTS**

## UNIT I

#### The concept, nature, scope and importance of marketing;

Marketing management and its evolution; Marketing environment; Strategic marketing planning; marketing segmentation; Buyer behavior; consumer versus organizational buyers; consumer decision-making process.

# UNIT II

**PRODUCT DECESION**; concept of product, classification of products, new product development, product positioning, product line and product mix, Branding, packaging and labeling. Consumer adoption process. **Pricing Decision**: Factors affecting price determination. Price policies and process.

## UNIT III

**Distribution Channels and physical Distribution Decision:** Nature of distribution channel, function of distribution, middlemen. Channel management decision; Retailing and wholesaling. Logistics of distribution. **UNIT IV** 

**Promotion Decision**: Communication process, promotion mix, advertising, personal selling, publicity and public relations. Marketing organization and control. Social, Ethical and legal Aspects of marketing in India.

#### **References:**

- 1. Kotler, Philip, Marketing, Management; Prentice Hall Of India, New Delhi.
- 2. Stanton, William J. Fundamentals of Modern Marketing; McGraw Hill and Charles futroll. Publishing co. New York.
- 3. Mc caethy, E.jenome and basic marketing; MANAGERIAL Approach Willian D. PERREAULTS JR. Richard Irwin, home woodlle.
- 4. Cundiff and still, fundamental of modern marketing; prentice hall of India, New Delhi.
- 5. Mentza, john T. and marketing today, Haecourt, Braco, David j. schwatz govanavuiel, New York.

#### MC 2.5: FINANCIAL INSTITUTIONS & MARKETS

#### Max Marks 80

#### **Internal Assessment 20**

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### COURSE CONTENTS

#### Unit I

**INTRODUCTORY**: Nature and role of financial system – Financial System and financial markets. An economic analysis of financial system in India. Indian financial system – A critical analysis.

**FINANCIAL MARKETS:** Money and capital markets. Money market Instruments: Call money, treasury bills, certificates of deposits, commercial bills, trade bills, etc. Capital market: Government securities market, Industrial security market, Role of SEBI – and overview; Recent developments National Depository Securities Ltd. (NDSL), Market- Makers.

#### Unit II

**MONEY MARKET INSTITUTIONS:** Central bank: Functions and its role in money creation, Commercial banks; Present structure. Introduction to International and Multinational banking.

**NON- BANKING INSTITUTIONS**: Concept, role of financial institutions, sources of funds, Functions and types of non-banking financial institutions.

#### Unit III

**MUTUAL FUNDS:** The evaluation of mutual funds, regulation of mutual funds (with special reference to SEBI guidelines), Performance evaluation, Design and marketing of mutual funds scheme; Latest mutual fund schemes in India – An overview. Evaluating of mutual funds.

**MERCHANT BANKING:** Concept, function, growth, government policy regarding Merchant banking business and future of merchant banking in India.

#### Unit IV

**Changing Role of Financial Institutions :** Role of banking, financial sector reforms, financial and promotional role of financial institutions, universal banking; concept and consequences.

#### **References:**

Auerbach, Robert D, Money, Banking and Financial Markets; Macmillan Publishing Co; New York and Collier MacMillan Publisher; London.

Avadhani, V.A., Investment and Securities Market in India; Himalaya Publishing House; Bombay...

Khan, M.Y., Indian Financial System - Theory and Practice; Vikas Publishing House; New Delhi.

Mishkin, Frederics, S., The Economics of Money Banking and Financial Markets ; Harper Collins Publisher; New York.

#### MC 3.1 COMPUTER APPLICATIONS IN BUSINESS

# Max Marks 80

#### **Internal Assessment 20**

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

# COURSE CONTENTS

## Unit I

**Modern Information Technology** : Basic idea of Local Area Networks (LAN), Wide Net Works (WAN), E-mail , internet, Multimedia.

Introduction to Windows: Write, Paintbrush, File Manager, Print Manager, Control Panel etc.

## Unit II

**Introduction and working with MS-Word in MS-OFFICE**: Word basics Commands, Formatting ; Text and documents; Sorting, Working with graphics ; Introduction to mail-merge.

**Working with EXCEL** : Excel basics ; formatting, functions, chart feature ; Working with graphics in Excel , Using worksheets as databases.

## Unit III

**Presentation with Power – Point** : Power point basics; Creating presentations the easy way; Working with graphics in Power-Point; Show time;

Introduction to Lotus smart suite for Data Sheet Analysis.

Spreadsheets and their uses in business.

Unit IV

Introduction to Tally: Maintenance of Accounting books along with financial statement analysis.

Statistical Packages Useful in Business: Usage of statistical packages for analysis (as per availability)

#### **References:**

Ron Mansfield, The Compact Guide to Microsoft office; BPB Publication. Dienes, Sheila s. , Microsoft office, Professional for windows 95; Instant Reference; BPB Publication. Peter Norton, Working with IBM-PC

#### MC 3.2 ADVANCED COST ACCOUNTING

Max Marks

80

Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **COURSE CONTENTS :**

UNIT-I

Nature and Scope of Cost Accounting; Introduction, meaning of cost accounting, scope of cost accounting, objectives of cost accounting, advantages of cost accounting, financial accounting v/s. cost accounting, limitations of cost accounting, general principles of cost accounting, cost system-characteristics of an ideal cost system, installations of a cost system

Cost Terms and Purposes; Cost in general, cost objectives, cost system, cost behaviour pattern, variable cost and fixed cost, shut down cost, average cost, total cost, product cost, period cost, inventoriable cost, fringe cost. Classification of cost; Preparation of Statement of Cost, Collection of cost for Tenders or Quotations.

UNIT-II

Inventory Planning, Control and Costing: Techniques of Inventory Control; Level Setting, Economic Order Quantity, Just- in Time Inventory System, ABC Analysis, VED Analysis and Perpetual Inventory System. Methods of Valuing Material Issues.

Accounting for Pay-Roll: Methods of Wage Payment and Incentive Plans.

Overheads Allocation, Apportionment, Re-apportionment and Absorption.

UNIT-III

Reconciliation of Cost and Financial Accounts; Need for Reconciliation, Reasons for disagreement between the profits disclosed by financial accounts and cost accounts.

Standard Costing and Variance Analysis: Meani9ng of Standard Costing, Preliminaries to the cost og Standard cost, Analysis of Material, Labour, Overheads and Sales Variance.

## UNIT-IV

Service or Operating Costing; Transport Costing, Hospital Costing, Hotel Costing and Power House Costing.

Contract Costing; Recording of Cost value and profit of contract.

Process Costing; Features of Process Costing, Application of Process Costing, Elements of Production Cost, Process Losses, Inter-process Profits.

#### **References:**

1. Jawahar Lal, Cost Accounting, Tata McGraw Hill Publishing Co., New Delhi.

2. M. N. Arora, Cost Accounting - Principles and Practice, Vikas Publishing House, New Delhi.

3. D. K. Mittal and Luv Mittal, Cost Accounting, Galgotia Publishing Co., New Delhi.

4. Ravi M. Kishore, Cost Accounting, Taxmann Allied Services Pvt. Ltd. NewDelhi.

5. B.M. Lall Nigam and I.C. Jain, Cost Accounting, Principles, Methods and Techniques, K.L. Malik & Sons Pvt. Ltd., Daryaganj, New Delhi.

6. M.C. Shukla, T.S. Grewal and M P. Gupta, Cost Accounting, Text and Problems, S. Chand & Co. Ltd., New Delhi.

7.S.P. Jain and K. L. Narang, Cost Accounting, Principles and Methods, Kalyani Publishers, Jalandhar.

8. S. N. Maheshwari & S.N. Mittal, Cost Accounting, Theory and Problems Shri Mahabir Book Depot, New Delhi.

#### MC 3.3 CORPORATE LEGAL FRAME WORK

Max Marks 80 Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **Course Contents**

#### Unit I

**Company Law:** Salient Features of Companies, Classification and Formation of Companies, Memorandum and Articles of Association, Doctrine of Indoor Management. Shares, transfer and transmission of shares.

#### Unit-II

Special Provisions under Companies Act 2013 regarding National Company Law Tribunal, Appealate National Company Law Tribunal, Different forms of Companies including OPC, Corporate Social Responsibility, Companies Arrangements and Amalgamation, restructuring and liquidation.

#### Unit-III

Appointment of Directors, Meetings of Directors & Shareholders of Companies, Overview of different modes of winding up of Companies.

#### **Unit-IV**

Restrictive and Unfair Trade Practices, Competition Act 2002, Consumer Protection Act.

#### **References:**

- 1. Business and Corporate Law, Saravanavel and Mohapatra, HPH
- 2. Business Law, N.D Kapoor, New Age.
- 3. Business Law, Gulshan, Excel.
- 4. Legal Aspects of Business, Pathak, TMH

#### M.C. 3.4 Strategic Management

Max Marks	80
Internal Assessment	20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **Course Contents**

UNIT-I

Exploring Strategic Management; strategy and strategic management, Strategic management: awareness and change, E-V-R Congruence,, The strategy process and strategic management in practice.

Strategic Management Framework: Models of Strategic Management, The Strategic Challenge, Strategic success, failure and competency. Strategic Leadership and Decision Making: Visionary leadership and strategy creation, issues in strategic leadership and entrepreneurship.

The Organizational Mission and Objectives: Vision, Mission and Objectives. Social Responsibility of Business and ethics.

UNIT-II

Strategic Success: Financial Analysis, Company Failure predicting company failure, symptoms and causes of company decline. Environmental Awareness and Management, SWOT Analysis. The competitive environment and competitive advantage: competition and the structure and regulation of industry in the United Kingdom, Analysing an industry, competitive advantage, successful competitive strategies.

Competitive advantage through products, processes and service: the organisation 's value chain, The value chain and competitive advantage marketing strategy, Research and development, innovation and new products, speed and competitive advantage operations management, Service ,not-for-profit and small businesses ,supply chain architecture, Service and total quality management . Competitive advantage through people: human resource strategy, managing human resources, management and leadership.

#### UNIT-III

Financial strategy: Financing and competitive advantage. Information, information systems and information technology, The strategy information challenge, information technology and competitive advantage. Planning and creating corporate strategy: Strategy formulation, planning and planning systems, strategic planning techniques. Strategic alternatives and market entry strategies: disinvestment strategies , strategic means, international strategies and selection of strategies.

Issues in strategic growth: diversification and acquisition, acquisition, effective acquisition strategies, joint ventures and strategic alliances. Issues in strategic consolidation and recovery: the feasibility of recovery, retrenchment strategies, turnaround strategies, management buy outs, financing a buy out, management buy ins, managing recession, strategies for declining industries, implementing recovery strategies. UNIT-IV

Strategic evaluation and choice: corporate strategy evaluation, criteria for effective strategies, judgment. Interlude strategy implementation: strategy structure or structure strategy, implementation and change, problems of successful implementation, successful implementation. Issues in organizational structure: structural forms , structure :determinants and design, business process re-engineering. Corporate strategy and corporate management style: styles of corporate management, strategic management at the corporate level, the role of general managers, organizations in the late 1990s.

Issues in strategic resource management: corporate resource planning, functional planning, policies, procedures, plans and budgets, crisis avoidance and management. Issues in strategic change management: issues in the management of change, strategies for implementation and change, power and politics.

## **References:**

- 1. H. Igor Ansoff, Implanting Strategic Management, Prentice Hall 1984.
- 2. C. Roland Christensen, Kenneth R. Andrews, Jospeh L. Bower, Rochard G. Hamermesh, Michael E. Porter, Business Policy: Text and cases, Fifth Edition, Richard D. Irwin ,inc, Homewood , LL Linois, 1982.
- 3. William F. Glueck and Lawrence R. Jauch, Business Policy and Strategic Management, Fourth Ed,McGraw-Hill,1984.
- 4. Management, Seventh Ed., South Western Publishing co. Cincinnati, Dhio, 1976.
- 5. KS Chopra, Business Policy for Indian Industries : Corporate Strategy Formulation, The Times Research Foundation , Pune 1985
- 6. John Grieve Smith, Business Strategy : An introduction Basil Blackwell, Oxford and economist Publications London, 1985.
- 7. S.K Bhattachary and N. Venkataarmin, managing Business Enterprises Strategies, Structures and Systems, Vikas Publishing House New Delhi
- 8. John L Thompson, Strategic Management: Awareness and change, International Thompson press.1997

#### MC 3.5 RESEARCH METHODOLOGY

Max Marks80Internal Assessment20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **Course Contents:**

**Unit I:** Introduction of Research: Meaning, characteristics, objectives, nature, scope, significance, limitations, role of research in decisions making, types, criteria of good research and ethics in research; The research process -- steps in research process; Defining the research problem—problem defining process, consideration in selecting a research problem; Research design—definition, Types, components and significance.

**Unit II:** Data collection and processing: Meaning of data, types of data; secondary data--advantages, disadvantages, criteria for evaluating secondary data, secondary in Indian context; Primary data—meaning, methods of collection of primary data- survey, observation, case study and experiment; Questionnaire—types, guidelines for preparing questionnaire, steps in designing the questionnaire, essential of good questionnaire and difference between schedule and questionnaire; Processing of data—editing, coding, classification, tabulation, and presentation by way of diagrams and graphs.

**Unit III:** Sampling and Attitude measurement: Sampling—meaning of sampling, census Vs sampling; Sampling merits, demerits and suitability of census method; Principles of sampling, merits, demerits, Characteristics of good sampling, key term in sampling, methods of sampling—probability and non-probability, determination of sample size, sampling errors and non-sampling errors: Concept of attitude, measurement and scaling; Types of scales-nominal, ordinal, interval and ratio scales, various types of scaling techniques, reliability and validity of scales.

**Unit IV:** Hypothesis, Data analysis and Report writing: Hypothesis- meaning, characteristic, sources, hypothesis testing procedure, Type-I and Type- II errors, Application of mean, dispersion, skewness, kurtosis, Correlation and regression in research; Application of Z-test, t-test, F-test, Chi-square test and ANOVA; Introduction to SPSS-- data entry and descriptive statistics, Report writing; Significance of Report-Writing; Steps in Report Writing, Layout of the Research Report; Types of Report, Mechanics of Writing a Research Report; Precautions for writing Research Report.

**Books Recommended:** 

Business Research Methods, Cooper, Schindler, TMH Research Methodology, C.R. Kothari, Newage Publication Research Methodology for Management with SPSS, Majhi & Khatua, HPH Management Research Methodology, Krishnaswamy, Sirakumar, Pearson Research Methodology, Zeikmund, Cengage Research Methodology, Paneer Selvam, PHI Research Methodology, Prasanta Sarangi, Taxmann A Text Book of Research Methodology, AKPC Swain, Kalyani Research Methodology, Das, Vrinda Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press. Research Methodology - C.R.Kothari

#### MC 4.1 ADVANCED FINANCIAL MANAGEMENT

Max Marks 80

#### Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question. **Course Contents:** 

#### Unit-I

Financial Management; Scope and objective, Time value of money, Risk and return (including Capital Asset Pricing Model), Valuation of securities – Bonds and Equities. Leverage: Operating, financial & combined leverage, EBIT-EPS analysis.

#### Unit-II

Cost of Capital and Financing Decision: Sources of long-term financing Estimation of components of cost of capital. Methods for Calculating cost of equity capital, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average cost of capital (WACC) and Marginal cost of capital.

Corporate Restructuring: Need and broad areas of corporate restructuring, objectives, techniques of corporate restructuring. Financial Restructuring: Need & steps in financial restructuring, reorganization of capital, buy back of shares-concept necessity and procedure. Financial management of sick units.

#### Unit-III

Mergers & Takeover: Types & objectives, legal and procedural aspect of mergers and takeover process, valuation & financing of mergers & acquisitions, post merger-problems & reorganization, taxation and financial aspects of mergers, takeover Overview of mergers & takeover in India.

The Capital Budgeting Process, Cash flow Estimation, Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Net Terminal Value, Internal Rate of Return (IRR), Profitability Index, Capital budgeting under Risk – Certainty Equivalent Approach and Risk- Adjusted Discount Rate.

#### Unit-IV

Capital structure – Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach). Operating and financial leverage. Determinants of capital structure.

Dividend Decision – Theories for Relevance and irrelevance of dividend decision for corporate valuation. Cash and stock dividends. Dividend policies in practice. Working Capital Decisions: Concepts of working capital, the risk-return trade off, sources of short-term finance, working capital estimation, cash management, receivables management, inventory management and payables management.

#### **References:**

1. Horne, J.C. Van. Financial management and policy. 10th ed. New Delhi Prentice Hall of India.

- 2. Horne, J.C. Van. Fundamentals of Financial Management. 9 th ed. New Delhi Prentice Hall of India.
- 3. Levy H. and M. Sarnat . Principles of Financial Management. Engelwood Cliffs, Prentice hall.
- 4. Johnson, R.W. Financial Management. Boston Allyn and Bacon.
- 5. Joy, O.M. Introduction to Financial Management. Homewood: Irwin.
- 6. Khan and Jain. Financial Management text and problems. 2 nd ed. Tata Mc Graw Hill New Delhi.
- 7. Pandey, I.M. Financial Management. Vikas Publications.
- 8. Bhalla, V.K. Financial Management & Policy. Anmol Publications, Delhi.
- 9. Chandra, P. Financial Management- Theory and Practice. (Tata Mc Graw Hill).
- 10. Rustagi, R.P. Fundamentals of Financial Management. Taxmann Publication Pvt. Ltd.
- 11. Singh, J.K. Financial Management- text and Problems. 2 nd Ed. Dhanpat Rai and Company, Delhi.
- 12. Sharma, G.L. and Y. P.Singh. ed. Contemporary Issues in Finance and Taxation. Academic Foundation Delhi.
- 13. Singh, Surender and Kaur Rajeev. Fundamentals of Financial Management. Book Bank International.

#### MC 4.2 SECURITY ANALYSIS & PORTFOLIO MANAGEMENT

Max Marks 80

Internal Assessment 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **Course Contents**

#### Unit I

**PORTFOLIO ANALYSIS:** Estimating rate of return and standard deviation of portfolio. Effect of combining the securities, Markowitz Risk-return optimisation.

**PORTFOLIO PERFORMANCE EVALUATION:** Measure of return, risk adjusted measures of return, market timing, evaluation criteria and procedures. Investment policies of Individuals, Tax saving schemes in India.

#### Unit II

Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis.

#### Unit III

**SINGLE INDEX MODEL OR MARKET MODEL:** Portfolio total risk, portfolio market risk and unique risk, Simple Sharpe's optimisation solution.

#### Unit IV

**CAPITAL MARKET THEORY:** Capital market line, security market line, risk free lending and borrowings.

**FACTOR MODELS:** Arbitrage pricing theory, two factor and multi- factor models, Principle of arbitrage, arbitrage portfolios.

#### SUGGESTED READINGS:

Fischer, D.E. and Jordan R.J., Security Analysis and Portfolio Management, Prentice Hall, 1983. Reilly, F.K., Investment Analysis & Portfolio Management, Drygen Press, 1985.

#### MC 4.3 PROJECT PLANNING & CONTROL

Max Marks80Internal Assessment20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) shortquestions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### **Course Contents**

#### Unit I

Identification of Investment Opportunities; Project ideas generation and screening,

Phases in Project Management, Project feasibility study, Appraisal Criteria and Process: Methods of appraisal under certainty, uncertainty and risk;

#### Unit II

Market and Demand Analysis: Sources of information- primary and secondary; Demand forecasting and market planning;

Technical Analysis: Materials and inputs; Production technology; Product mix; Plant location and layout; Selection of plant and equipment;

#### Unit III

Financial Analysis: Cost of project and means of financing; Major cost components; Planning capital structure; Financing schemes of financial institutions.

Profitability and Financial Projections: Cost of production; Break-even analysis; Projected balance sheet, profit and loss account and cash flow statement.

#### Unit IV

Social Cost Benefit Analysis: Meaning and methodology; L&M and UNIDO approach; SCBA in India.

Project Review/control- Evaluation of project. PERT/CPM. Problem of time and cost overrun, Project implementation practices in India.

#### REFERENCES

Bryce, MC: Industrial Development, McGraw Hill (Int. Ed), New York.

Chandra, Prasanna: Projects: Planning Analysis, Financing, Implementation, and Review Tata McGraw Hill, New Delhi.

Patel, Bhavesh M, Project Management, Vikas publishing House pvt. Ltd., New Delhi

Chaudhary, S.: Project Management, Tata McGraw Hill, New Delhi.

I.D.B.I: Manual of Industrial Project Analysis in Developing Countries.

O.E.C.D: (i) Manual for Preparation of Industrial Feasibility Studies. (ii) Guide to Practical Project Appraisal.

Pitale, R.L: Project Appraisal Techniques, Oxford and IBH.

Planning Commission: Manual for Preparation of Feasibility Report.

Timothy, D.R. and W.R Sewell: Project Appraisal and Review, Macmillan, India.

Chandra, P., Project Preparation, Appraisal and Implementation,

## MC 4.4 ACCOUNTING FOR MANAGERIAL DECISIONS MAX. MARKS 80 INTERNAL ASSESSMENT 20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

#### COURSE CONTENTS

#### Unit I

**Introduction to Accounting:** Management Accounting as a field of Accounting. The concepts of Management Accounting-objective; Nature and Scope. Financial Accounting, Cost Accounting and Management Accounting Account's position as a member of the management team.

Accounting plan and Responsibility Centres: Meaning and significance of Accounting, Responsibility Centre-Cost centre, profit centres, and investment centres, problem of transfer pricing. Objective and determinants of Responsibility Centres.

#### Unit II

Financial Statement Analysis: Ratio Analysis, Fund Flow and Cash Flow Statements.

#### Unit III

Marginal costing and Break-even analysis: Concept of marginal cost, Practical application of Marginal costing: Marginal costing and Pricing. Cost-Volume-Profit analysis. Break-even analysis: Assumptions and practical application of Break-even-analysis: Decision regarding sales-mix, make or buy and discontinuation of a product line. Marginal costing versus Direct Costing.

## Unit IV

Budget and Budgetary Control: Definition of budget, Essentials of budgetary Control, Kinds of budgets- operating budget, Master Budget Flexible budget, Budgetary control Decision- making for capital expenditure, Zero Base Budgeting and Performance budgeting.

**Reporting to Management:** Objects of Reporting, Reporting needs of different management levels. Types of report, modes of reporting to different levels of management.

## **References:**

Murphy, Managerial Acconting ch. 4, 5 & 6. Man Mohan & Goyal: Principles of Management Acconting ch. 13. Hingorani and others, op. Chit. 11. Welsch, Budgeting, Profit Planning and Control,

#### MC 4.5 E-COMMERCE

Max Marks	80
Internal Assessment	20

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries fifteen (15) marks.

For students of Correspondence courses, the paper will be of 100 marks spread as 20 marks including the compulsory question.

## **Course Contents:**

#### Unit I

Introduction to E-commerce: Meaning of electronic commerce, business applications of e-commerce, comparison with traditional commerce;

Business models in E-commerce – e-shops, e-procurement, e-auctions, value chain integrators, information brokerage, telecommunication, collaboration platforms, etc.; Electronic payment system;

#### Unit II

E-Banking - concept, operations. Online fund transfer - RTGC, ATM, etc.,

Online share market operations.

Online marketing, Web-based advertising - concept, advantages; Types of online

advertisements;

## Unit III

Search engine – as an advertising media, search engine optimisation – concept and techniques; Email marketing; Social Networking and marketing – promotion, opinion formulation, etc.; Viral Marketing, E-retailing-concept, advantages, limitations; CRM and Information Technology, Tools to conducting online research – secondary research, online focus groups, web based surveys, data mining from social networking sites; **Unit IV** 

# Enterprise Resource Planning; Security issues in e-commerce - Online frauds, privacy issues; Cyber laws including Information Technology Act.

#### REFERENCES

Bajaj, Kamlesh K and Debjani Nag: E-Commerce – The Cutting Edge of Business, Tata McGraw Hill (P) Ltd., New Delhi.

Greenstein, Electronic Commerce, Tata McGraw Hill, New Delhi

Leon, Alexis: Fundamental of Information Technology, Vikas Publication House (P) Ltd., New Delhi

Mansfield, Ron: The Compact Guide to Microsoft Office, BPB Publication, Delhi.

Norton, Peter: Introduction to Computer 4/E, Tata McGraw Hill (P) Ltd., New Delhi

Saxena, Sanjay: A First Course in Computer, Vikas Publication House (P) Ltd., New Delhi.

#### MC 4.6 CORPORATE GOVERNANCE AND BUSINESS ETHICS

Max Marks 100

**Note:** There will be nine (9) questions in all. The first question is compulsory and consists of ten (10) short-questions having two (2) marks each. The candidate will be required to attempt one question from each unit and each question carries twenty (20) marks.

#### **Course Contents:**

## Unit I

Corporate governance: Concept, structure and process; Corporate governance: An Evolutionary Process; Improving the efficiency of corporate governance; Corporate governance in India: Issues for consideration. Corporate governance; Globalisation and its position in India.

Financial disclosure, Business Ethics and corporate governance: Corporate disclosure Practises; Transparency and Business Ethics in Corporate Sector; Role of Audit committee in corporate governance.

## Unit II

Board of Directors: Composition of Board of directors & their role; Corporate boards and good governance; Corporate governance in Indian Public enterprises; Corporatization of Agriculture.

Banks, Financial Institutions and Corporate governance: Corporate governance in banks;

Corporate governance: Contemporary issues in banking industry. Corporate governance in mutual funds; Depository system: a step towards effective corporate governance.

## Unit III

## Ethics & Business.

What is Ethics, Nature and scope of Ethics, Facts and value, Ethical subjectivism and Relativism, Moral Development, Ethics and Business, Myth of a moral business.

Decision making: Application of Ethical theories in Business

Economic Justice: Ethical Issues in Functional Areas of Business.

#### Unit IV

**Marketing:** Characteristics of Free and Perfect competitive market, Monopoly oligopoly, Ethics in Advertising (Truth in Advertising).

Finance: Fairness and Efficiency in Financial Market, Insider Trading, Green Mail,

HR: Workers Right and Duties: Work place safety, sexual harassment, whistle blowing.

#### **Corporate Social Responsibility Issues.**

REFERENCES

Robert A. G. Monks, Nell Minow, Corporate Governance, 4th Ed Blackwell.

S K Bhatia, Business Ethics and Corporate Governance, Deep & Deep Publication New Delhi.

Kenneth Kim, John R Nofsinger, Derek J Mohr Prentice Hall; 3 edition (November 11, 2009).

John Colley, Jacqueline Doyle, Wallace Stettinius, George Logan, Corporate Governance.

# M.Sc. Zoology

# **First Semester**

Cours	se No. Title of the Course	<b>Marks :400</b>		
Ι	Biosystematics & Taxonomy	60		
Π	Structure and Functions of Invertebrates	60		
III	Insect diversity & Physiology	60		
IV	Biology of Parasites	60		
Practi	cals I-IV (20 marks each)	80		
Intern	al Assessment (15 Marks each)	60		
Atten	dance (5 Marks Each)	20		
Total		400 Marks		
Secon	nd Semester	Marks: 400		
V	Cell and Molecular Biology (Common Cou	urse)	60	
VI	Biostatistics and Computer Applications (c	common Course)	60	
VII	Comparative Anatomy of Vertebrates		60	
VIII	Developmental Biology		60	
Practi	cal V to VIII (20 marks each)		80	
Intern	al Assessment (15 Marks Each)		60	
Atten	dance (5 Marks Each)		20	
Total			400	
Third	Semester		Mark	s: 400
IX	Cytogenetics & Evolution (Common Cours	se)		60
Х	Immunology and Biotechnology (Commor	n Course)		60
XI	Applied Zoology			60
XII	General Physiology			60

Practical IX to XII (20 marks each)	80
Internal Assessment (15 Marks Each)	60
Attendance (5 Marks Each)	20
Total	400
Fourth Semester	Marks 300
XIII Biochemistry (Common Course)	60
XIV Ecology (Common Course)	60
XV Special Paper	60
Practical XIII to XV (20 marks each)	60
Internal Assessment (15 Marks Each)	45
Attendance (5 Marks Each)	15
Total	300
Grand Total	1500

Special Paper: 1. Molecular and Human Genetics 2. Biochemistry 3. Parasitology 4. Entomology5. Molecular Physiology (A candidate shall be required to opt one specialization)

# M.Sc Zoology

# Semester-I

Course-I

# **Biosystematics and Taxonomy**

# 1. Definition and basic concepts of Biosystematics and taxonomy

- 1.1 Historical resume of systematic
- 1.2 Stages in taxonomy
- 1.3 Importance of taxonomy
- 1.4 Aims and tasks of a taxonomist

# 2. Treads in Biosystematics-concepts of different conventional and newer aspects

- 2.1 Ecotaxomony
- 2.2 Behavioural taxonomy
- 2.3 Cytotaxonomy
- 2.4 Biochemical taxonomy
- 2.5 Numerical taxonomy

# 3. Dimension of speciation and species concept

- 3.1 Typological species concept
- 3.2 Biological species concept
- 3.3 Evolutionary species concept
- 3.4 Polytypic & monotypic species, subspecies, infraspecific groups, super species and other kind of species.

# 4. Concept of zoological classification

- 4.1 Theories of biological classification
- 4.2 Kinds & Component of classification
- 4.3 Phyletic Lineages
- 4.4 Linnaean hierarchy

# 5. Taxonomic collections, methods & data recording

- 5.1 Collecting ways and data collection
- 5.2 Preservation of collected material and curating
- 5.3 Methods of identification and problems encountered in identification
- 5.4 Taxonomic characters and taxonomic keys
- 5.5 Preparation of taxonomic publication and taxonomic paper

# 6. Zoological Nomenclature

- 6.1 International code of Zoological Nomenclature (ICZN)
- 6.2 Operative principles and important rules of nomenclature
- 6.3 Important Latin words & abbreviations and Linnaean Signs

# 7. Conservation of diversity- theory, achievement and future directions

# 8. Evaluation of Biodiversity indices with brief reference to Shannon-Weinner index and dominance index.

# **Suggested Reading Material:**

- 1. M.Kato.The Biology of Biodiversity. Springer.
- 2. E.O. Wilson, biodiversity. Academic Press, Washington.
- 3. G.G. Simpson, Principle of animal taxonomy. Oxford IBH Publishing company.
- 4. E. Mayer. Eleements of Taxonomy. Oxford IBH Publishing company.
- 5. E.O. Wilson. The diversity of Life (The College edition W.W. Northem & Co.
- 6. B.K. Tikadar. Threatened Animal of India, ZSI publication Calcutta
- 7. V.C. Kapoor. Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co.
- 8. J.c. Avise, Molecuular Markers, Natural History and Evolution, Chapman & Hall, New York.

# **Course-II**

# Semester-I

# **Structure and Functions of Invertebrates**

# **1.0 Organisation of Coelom**

- 1.1 Acoelomates
- 1.2 Pseudocoelomates
- 1.3 Coelomates; Protostomia and Deuterostoma.

# 2.0 Locomotion

- 2.1 Flagella and ciliary movement in Protozoa
- 2.2 Hydrostatic movement in Coelenterata, Annelida and Echinodermata

# 3.0 Nutrition and Digestion

- 3.1 Pattens of feeding and digestion in lower matazoa
- 3.2 Filterfeeding in Polychaeta Mollusca and Echinodermata
- 4.0 Respiration
- 4.1 Organs of respiration: Gills, Lungs and trachea
- 4.2 Respiratory pigmrnts
- 4.3 Mechanism of respiration

# 5.0 Excretion

- 5.1 Organs of excretion: coelom, coelomoducts, Nephridia and Malphigian tubules
- 5.2 Mechanism of excretion
- 5.3 Excretion and osmoregulation

# 6.0 Nervous system

- 6.1 Primitive nervous system: Coelenterata and Echinodermata
- 6.2 Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (cephalopoda)
- 6.3 Trends in neural evolution

# 7.0 Invertebrates Larvae

- 7.1 Larval forms of fee living invertebrates
- 7.2 Larval forms of parasites
- 7.3 Strategies and Evolutionary significance of Larval forms

# 8.0 Minor Phyla

- 8.1 Concept and significance
- 8.2 Organization and general characters

# **Suggested Books**

- 1. Hyman, L.H. The ivertebrates. Vol. I protozoa through Ctenophora, McGraw Hill Co., New York.
- 2. Barrington, E.J.W. Invertebrate structure and function. Thomoes Nelson and sons Ltd. London.
- 3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
- 4. Hyman, I. H. the Invertebrates. Vol. 2 Mc Graw Hill. Co., New York.
- 5. Hyman, L.H. The Invertebrates Vol. 8, McGraw Hall. Co., New York. & London.
- 6. Barnes, R.D. Invertebrate Zoology, III edition, W.b. Saunsders Co., Philadelphia
- 7. Russel Hunter, W.D.A biology of higher invertebrates, the Macmillan co. Ltd. London.
- 8. Hyman, L.H. The invertebrates smaller coelomate groups. Vol. V Mc Graw Hill Co. New York.
- 9. Read, C.P. Animal Parasitism. Prentice Hall Inc., New Jersey.
- 10. Sedddgwick, A. a. Student text book of Zoology. Vol. I, II, and III Central book Depot, Allahabad.
- 11. Parker, T.J. Haswell, W.A. Text book of Zoology, Macmillan co., London.

# M.Sc. Zoology Semester-I

**Course-III** 

# **Insect Diversity and Physiology**

- 1. **Insect Diversity:** An introduction to Insect classification including historical development, Basis of Insect classification; Classification of insects upto orders with focus on local examples; Newer trends in Insect taxonomy.
- 2. **Insect Morpohology:** Comparative morphology of head thorax, abdomen and their appendages; functional morphology of mouth parts and genitalia
- 3. **Anatomy and Physiology:** Anatomy and elementary physiology of the following systems of a typical Insect:
  - (i) Integumentaryy system
  - (ii) Digestive System
  - (iii) Exerctory System
  - (iv) Respiratory System
  - (v) Nervous System
  - (vi) Reproductive System
- 4. Receptors and Stridulatory organs
- 5. Insects growth and metamorphosis
- 6. Insect pheromones and Diapause
- 7. Insects as vectors of human diseases
- 8. Insects of commercial Importance and their culture; honeybees, Silkworm and Lac Insect
- 9. Brief idea about chemical and biological control of insect pests
- 10. Insects in the service of Forensic Science

# **Suggested Readings:**

- 1. Chapman, R.F. 1998. The insects structure and Function. Cambridge Univ. Press, Cambridge.
- 2. Daly, H.V. Doyen, J.T. an Ehrlich, P.R. 1988. Introduction to insect Biology and Diversity. McGraw Hill Ltd. London.
- 3. Imms, A.D. 1992. A. General Text book of entomology. Chapman & Hall, London.
- 4. Snodgrass. R.E. 1989 Principles of Insect Morphology. Mc Graw Hill, New York.
- 5. Blum, M.S. 1996. Fundamentals of Insect Physiology John Willey & Sons. New York.
- 6. Tembhare, D.B. 1997. Modern Entomology. Himalaya Publishing House, Mumbai.
- 7. Mani, M.S. 1997. General Entomology Oxford & IBH Publishing Co., New Delhi
- 8. Srivastva, K. P. 1998. A Text Book of Applied Entomology (Vol. I & II) Kalyani Publihshers, New Delhi.

- 9. Nayar, K. R. Anantha krishnan, T.N. and David, B.V. 1998 General and Applied Entomoloty. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- 10. Wigglesworth, V.B. 1992. Principles of Insect Physiology ELBS edition.

# M.Sc. Zoology

# Semester-I

# **Course-IV**

# **Biology of Parasites (General Course)**

- Introduction Origin and Evolution of Parasitism
- Morphology, Life cycle, pathogenicity and prophylaxis of Letshmania sp; Trypanosoma sp; Plasmodium sp; Balantidium sp; Eimeria sp.
- Merphology, life cycle, pathogenicity and prophylaxis of Trematode parasites;
- Fasciola sp.; Fasciolopsis sp; Dicrocoelium sp.; Paragonimus sp.;
- Schistomoma spp.; Fasciolopsis sp; Clonorchis sp; Dicrocoelium sp.; Paragonimus sp.; Schistosoma spp.; Polystoma sp.
- Mcrphology, life cycle, pathogenicity & prophylaxis of cestode parasites; Diphyllobothrium sp; Echinococcus sp; Hymenolepls sp; Dipylidium sp.
- Morphology, life cycle, pathgenicity and prophylaxis of Nematode parasites;
- Ascaris sp.; Trichinella sp.; Enterobius sp.; Stronglyoides sp.; Necator sp.;
- Ancylostomia sp.; Wuchereria sp.
- Morphology and life cycle of Acanthocephalan parasite; Macracanthorhynchus sp.

# Suggested Reading

- 1. Cheng, T.C. General parasitology Academic Press, Inc. (1986)
- 2. Noble, E.R. and Noble, G.A: Parasitology, The biology of Animal parasites Lea and Fabiger
- 3. Andeson, D.R.: Comparative Protozoology, Cambridge Uni. Press.
- 4. Chandler, A.C. and Read, C.P.; Introduction of Parasitology, Willy Eastern,
- 5. Belding, D.A. A text book of Prasitology, Meredith pub. Co.
- 6. Baker, J.R. Parasitic Protozoa, Academic Press
- 7. Grell, K.G. Protozoology, Springer Verlag

# Semester-II

## **Course-V**

# Cell and Molecular Biology (Common Course)

# 1. Structural organization of Plant and animal Cell:

- (i) Cell wall: structure, function and biogenesis
- (ii) Plasma membrane; structure, models, functions, sites for ATPases,ion carriers, channels and pumps
- (iii) Plasmodesmata: structure, role in movement of molecules, camparison with gap junctions.
- (iv) Plant vacuole: Tonoplast membrance, ATPases as storgaeg, organelle
- Structure and fuctions of microbodies: Golgi apparatus, lysosomes, endoplasmic reticul lum
- 2. Chloroplast and mitochondria: Structure, genome organization, gene expression, nucleochloroplastic interactions, biogenesis of mitochondria
- 3. Nucleus: structure, nuclear pores, nucleosome organization, nucleolus
- 4. The cytoskeleton: Organization and role of microtubules and microfilaments, motor movements implications in flagellar and other movements.
- 5. Cell cyle and apoptosis: Control mechanisms, role of cyclins, cyclin-dependent kinases, cytokinesis and cell plate formation, mechanisms of programmed cell death
- 6. Gene expression:
- (i) DNA structure; A, B, and Z forms; replication, damage and repair
- (ii) Transcription, promoters and transcription factors, splicing, mRNA transport, rRNA biosynthesis, differences in propkaryotes and eukaryotes
- (iii) Translation; structure of ribosome, mechanism of translation initation, elongation and termination, structure and role of tRNA
- 7. Regulation of gene expression in prokaryotes and eukaryotes
- 8. Protein sorting: Targeting of proteins to organelles

# **Suggested Readings:**

Lewin, B. 2000. Genes VII Oxford University, Press, New York

Alberts, B. Bray, D., Lewis, J. Raff, M., Roberts, K. and Watson, J.D. 1999, Molecular biology of the cell. Garland Publishing, Inc. New York.

Wolfe, S.L. 1993, Gruissem, W. and Jones, R.L. 2000, Biochemistry and molecular biology of plants, American society of plant physiologists, Maryland, USA

Frifelder, D. Molecular Biology. John and Bartlett Publishers, inc., Boston, USA

# **Course VI: Biostatistics and Computer Applications: (Common Course)**

- 1. Brief description and tabulation of data and its graphical representation.
- 2. Measures of central tendency and dispersion: mean, median, range, standard deviation and variance. Correlation and simple linear regression.
- 3. Sampling: Sampling Techniques, sampling errors, framing Hypothesis, level of significance, tests of significance (F & t test), chi-square test
- 4. Introduction of digital computers: Organization; law-level and high –level languages, binary number system.
- 5. Flow charts and programming techniques.
- 6. Introduction to programming in Q basic.
- 7. Introduction to data structures and database concepts; introduction to internet and its applications.
- 8. Introduction to MS OFFICE software, covering word processing, spreadsheets and presentation software
- 9. Computer Oriented statistical techniques.
- 10. Frequency table of single discrete variable, computation of mean, variance and standard deviation, t-test correlation coefficient.
- 11. Bio-informatics.
# M.Sc. Zoology

# **SEMESTER-II**

**Course-VII** 

# **Comparative Anatomy of Vertebrates**

#### 1.0 Origin of Chordata and Vertebrate Morphology

1.1 Concept of Protochordata

- 1.2 Definition, scope and relations to other discipline
- 1.3 Importance of the study of vertebrate morphology

# 2.0 Origin and Classification of Vertebrates

# **3.0 Vertebrate Integument and its Derivatives**

- 3.1 Development, general structure and functions of skin and its derivatives
- 3.2 Glangs scales, horns, claws, nails, hoofs, feathers and hairs

# 4.0 Digestive System

- 4.1 General structure & Functions of Digestive System
- 4.2 Comparative anatomy of alimentary canal in vertebrates

#### 5.0 Circulatory System

- 5.1 Blood
- 5.2 Evolution of heart
- 5.3 Evolution of aortic arches

#### 6.0 Respiratory System

- 6.1 Characters of respiratory tissue
- 6.2 Internal and external respiratory tissue
- 6.3 Comparative account of respiratory organs

#### 7.0 Skeletal System

- 7.1 Form function, body size and skeletal elements of the body
- 7.2 Comparative account of jaw suspesnsorium & vertebral column
- 7.3 Limbs and girdles

# 8.0 Evolution of Urinogemital system in vertebrate series

#### 9.0 Sense organs

- 9.1 Simple receptors
- 9.2 Organs of olfaction and taste
- 9.3 Lateral line system
- 9.4 Elecroception

#### **10.0** Nervous system:

- 10.1 Comparative anatomy of the brain in relation to its functions
- 10.2 Comparative anatomy of spinal cord
- 10.3 Nerves-Cranial, Peripheral and autonomous nervous systems

# 11.0 General Topics

- 11.1 Origin of birds
- 11.2 Migration of birds and fishes
- 11.3 Extinct reptiles
- 11.4 Evolutionary Histories, of Horse, Camel, elephant and man.

# Suggested books:

- 1. Alexandar, P.M. The ctorol ddata Cambridge University Press London
- 2. Bamington, E.J.W. The biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
- 3. Boume, G.H. The structure and functiosn of nervous tissue. Academic Press, New York and London.
- 4. Center, G.S. Structuer and habit in vertebrate evolution-Sedgwick and Jackson, London.
- 5. Kent, G.c. Compatative anatomy of vertibrates
- 6. Monielli, A.r. the chordates. Casmbridge university Press, London.
- 7. Smith, H.S. Evolution of chordate structure. Hold Rinehart and Winstoin Inc. New York.
- 8. Waters, H.E. and Sayles, L.D. biology of vertebrates. Mac Millan & Co., New York.
- 9. Weichert, C.K. and Preesch, W. Elements of chordate anatomy, 4<sup>th</sup> Edn. Mc. Graw Hall Book Co., New York.
- 10. Montagna, W. Comparative anatomy, Jophn Wiley and Sons Inc.

# M.Sc Zoology

# Semester –II

#### **Course: VIII**

#### **Developmental Biology**

- 1. Introduction development Biology
- 1.1. Scope, Science of developmental biology and its applications
- 1.2. Developmental patterns in metazoan.
- 2.0 Germ Cell
  - 2.1 Germ cell migration in amphibian, birds and mammals.
  - 2.2 Differentiation of germ cells into sperm or egg.
- 3.0 Spermatogensis
- 3.1 A detailed study of the process in mammal, Gene expression during sperm development.
- 4.0 Oogenesls
- 4.1 Oogenic meiosis
- 4.2 Maturation of oocyte in amphibian
- 4.3 Role of progesterone in oogenesis
- 4.4. Gene transcription in oocye
- 4.5 Vitellogenesis
- 5.0 Fertilization
- 5.1 Contact recognition between sperm and egg
- 5.2 Acrosomal reaction
- 5.3 Gemeta bindings and fusion (roleof egg membranes)
- 5.4 Activatinof egg.
- 6.0 Creation of Multicellularity
- 6.1 Cleavage characteristics

6.2 Patterns of cleavage (Radial holoblastic, bilateral holoblastic, spiral holoblastic, Rotational holoblastic and meroblastic)

- 6.3 Casulation in amphibian (Frog and chick)
- 6.4 Concept of fate maps (Chick, frog)
- 7.0 Organizers and induction
- 7.1 Primary embryonic induction
- 7.2 Regional specificity of induction
- 7.3 Molecular mechanism of primary embryonic induction
- 7.4 Molecular nature of organizers (I to VI)
- 8.0 Early vertebrate development
- 8.1 Neuralation and development of ectoderm
- 8.2 Organization of mesoderm and endoderm
- 9.0 Differentition
- 9.1 Cell commitment and differentiation
- 9.2 Chemical basis of differentiation
- 10.0 Organogenesis
- 10.1 Development of redumentary organs in amphibian and mammal
- 10.2 Cellular interactions during the development of limb, brain, eye, heart and liver
- 11.0 Placenta
- 11.1 Development of placenta, different types
- 11.2. Placental normones and their functions/ importance
- 12.0 Multiple ovulation and Embryo transfer technology
- 12.1 Supovulation
- In-vitro fertilization
- 12.3. In Vitro oocyte maturation

# 12.4 Cryopreservation

12.5 Embryo transfer technology

# **Books Recommended:**

- 1. Reproduction I animals by Austen and short
- 2. Molecular Biology of Development by Scott. F. Gilbert
- 3. Human Reproduction by R. G. Edwards
- 4. Introduction to Embryology by Balisnsky
- 5. Molecular Biology of Fertilization byy Schatten and Schatten.

# M.Sc Botany/Zoology

# Semester-III

# **Course-IX**

# **Cytogenetics & Evolution (Common Course)**

- 1. Chromosome Organization:
- 1.1.Structuer of chromosomes, DNA packaging and DNA replication
- 1.2. Metaphase chromosomes, centromere, kinetochore, telomere and its importance
- 1.3. Heterochromatin and euchromatin
- 1.4.Chromosome banding
- 1.5.Polytene and lampbgrush chromosomes
- 2. Sex chromosomes, sex determination and dosage compensation in Drosophila and human
- 3. Mendelian and non-Mendelian Inheritance:
  - 3.1 Mendelian inheritance and its modification
  - 3.2 Maternal effect
  - 3.3 Epigenetic inheritance
  - 3.4 Extranuclear inheritance
- 4. Veriationin cbromosome structure and number
- 5. Brief description of gene expression:
- 5.1 Genetic code
- 5.2 Transcription and translation
- 5.3 Regulation of gene expression
- 6. Gene mutation and DNA repair:
- 6.1 Consequences of mutations
- 6.2 Occurrence and causes of gene mutation
- 6.3 DNA repair
- 7. Quantitative genetics:
- 7.1 Quantitative traits
- 7.2 Polygenic inheritance
- 7.3 Heritability
- 8. Population genetics and evolution
- 8.1 Genes in populations
- 8.2 The Hardy-Weinberg Equilibrium
- 8.3 Factors that change allele frequencies in populations :a) Mutations, b) Migration, c) Natural selection, d) Random genetic draft and e) Genetic load.
- 9. Origin and evolution of species
- 9.1 Biological species concept
- 9.2 Anagenesis and cladogensis
- 9.3 Allopatric, parapatric and sympatric speciation

- 9.4 Gradualism and pubctuated equilibrium
- 9.5 Neo-Darwinism
- 9.6 The shifting-balance Theory of Evolution
- 10. Molecular evolution:
- 10.1 Experimental approaches used to compare species at molecular leave
- 10.2 Phylogenetic trees
- 10.3 Molecular drive-a cohesivie mode of species evolution
- 10.4 Neutral theory of molecular evolution

# **Suggested Readings:**

- 1. Gardner, E.J.; Simmon, M.J. and Snustad, D.P. Principles of Genetics, John wiley & Sons, inc. NY
- 2. Weaver, R.F. and Hedrick, P.W. Genetics. Wm C. Brown Publishers.
- 3. Brown, T.a. Genetics- A Molecular, Approach, Chapman & Hall.
- 4. Mitra, S. Genetics-A Blueprint of life, Tata McGraw Hill
- 5. Dobzhansky, Th. Genetics and Origin of Species. Columbia University Press.
- 6. Dobzhansky, Th; Ayala, F.J.; Stebbins, G.L. and Valentine, J.M. Evolution, Surjeet Publihsers, Delhi.
- 7. Futuyama, D.J. Evolutinary Biology, Suinuaer Associations. INC Publishers. Dunderand.
- 8. King, M. Species, Evolution The role of chromosomal change. The Cambridge University Press, Cambridge.
- 9. Merrel, D.J. Evolution and Genetics Holt. Rinchart and Winston, Inc.
- 10. Strikberger, M.W. Evolution Jones and Barlett Publishers. Boston London.

#### Semester-III

# Course-X: Immunology and Biotechnology: (Common Course) Immunology:

# **Introduction to immunology**

Innate and acquired immunity, characteristics of immune response, humoral and cellular immunity benefits and damaging effects of immunology.

Cell and tissues of immune system:

Cells of immune system, primary and secondary loymphoid organs.

Antigens:

Immunogenes, major cleasses of antigens, physical and chemical properties of antigens.

Immunoglobulins:

Structure and functions of immunoglobulins, classes and subclasses of human immunoglobulins, polymorphism, primary and secondary immune response.

Complement system:

Complement proteins, pathways of complement activation

Antien-antibody reactions:

Precipitation, agglntination immune fluorescence, radio immunoassay

ELIS A, immunobleting.

Monogleral antibodies:

Hybridoma, isolation and characterization of monoclonal antibodies

Hypersensitivity

Anaphylaxis, antibody-mediated cytotoxic and immune complex reactions, delayed-type hypersensitivity

Biotechnology:

Biotechnology: scope significance, nicrobes and microbial systems and their improvement for biotechnological use.

Principles and techniques of plant and animal cell culture.

Principles and applicatiosn of DNA recombinant technology to agricultural and human diseases. Aims, strategies for development of transgenics (with suitable examples), intellectual property rights, possible econolgical risks and ethical concerns. Construction of genomic/c DNA libraries, PCR and DNA finger printing.

Fermentation technology, design, process , scale up and down stream processing, production of antibiotics, boverages, enzymes, Ethanol and methane from biomass; bioremediantion, biopesticides and biosensors, single cell protein.

# **Suggested Reading:**

- 1. Immunology by Janis Kuby
- 2. Immunology by J.P. Bellanti.
- 3. Fundamentals of Immunology by W.E. Paul
- 4. Essential Immunology by J.M. Roitt
- 5. Immunology by E.S. Golub
- 6. Immunology by E. Benjamini, R. Coico and G. Sunshine
- 7. Walker, J.M. and Gungold, E.B. (eds) Molecular biology and Biotechnology, Royal Society of Chemistry, Cambridge, 1990.
- 8. Maniaties. T.N. Fritsch, E.F. and Sembroook, t. Molecular Cloning. A Laboratory Mannual, cold spring Herber, New York. 1990
- 9. Domain, A.L. and Solomon, N.A. (eds), Mannual of Industrial, Microbiology and Biotechnology, American society of microbiology Washington, 1986.
- 10. Prtimrose, S.B. Molecular Biotechnology (second Edition), Blackwell Scientific Publications, Oxford, 1991.
- Kumar H.D. A text book on Biotechnology, affiliated East West Press Pvt. Ltd., New Delhi, 1993.

# Applied Zoology

# 1. Sericulture

Silkworm and its strains, rearing of silkworms, sericulture and its components, silk reeling Pests, and diseases of silkmoth. Byproducts of sericulture, Non-mulberry sericulture-Tassar, Muga and Ericulture: Sericulture industry in India.

# 2. Apiculture:

The honeybees; Apicultural practices: Have products, Bee pasturage, apiculture and crop pollination; Beekeeping and pesticides; Enemies and diseases of honeybees.Beekeeping industry in India and its future.

# 3. Pest Control

Principles and practices of pest control. Methods of pest control-Chemical Biological, Microbial, Integrated control. Corganochlorine, Insecticides, Organisphosophorus insecticides, Carbamates, Acaricides, Nematicides, Rodenticides, Molluscicides and Botanical pesticides. Pheromonal and Hormonal control. Chemosterilants and genetic control.

# 4. Crop Pests and their Management

Biology and control of following insect pests of agricultural importance: Termites, Rice weevils, castor hairy caterpillar, codling moth, mango mealy bug, Cotton white fly, citrus psylla and cabbage Caterpillar. Biology and control of some important Phytoparastic nematodes: Anguina, Xiphinema sp Meloidogyne sp & Heterodera sp.

# 5. Medical Zoology

Systematics, biology and control of following medically important organisms. Trichomonas, Trichuris, Onchocerca, Cyclops, sarcoptes, Dermacentor, Phlebotmus, Glossina, Blowfly, Gadfly.

Mode of transmissionand brief epidemonolgy of some important diseases. Cholera, Typhus, small pox, plague, Malaria, Dengue fever, Filariasis & AIDS

# 6. Vaccination: Immunization; different types of vaccines; Current status of malarial vaccine.

7. Wild Life Management

Objective of wild life conservation and conservation strategies; Extinction of wild species meaning and cause; Wile life protection in India and classification of threatened species, protected wild animals, protected areas and their management in India Endangered fauna and special projects for endangered species.

# 8. Pisciculture

Monocultuer and composite culture Fresh water, & marine fisheries, induced breeding & its technique in pisciculture; Haps & ponds for fish culture and their management; Fish enemies and their control; fish diseases and their control; Importance of fish culture and fishing gears

# 9. Metabolic and Muscular disorders

Metabolic disorder with regard to major food stuffs absorption

Types of myopathies (congenital, metabolic, endocrine, toxic and inflammatory) Painful muscle syndromes (mechanical, chemical syndromes, ischaemia, focal muscle pain, diffuse Shulam's synorme cramps, contracture, myotonia). Principle of management and drug treatment.

# Suggested Books

- 1. Jhingran, V.G. 1995. Fish and Fisheries of India, Hindustan Publ. Corp., New Delhi.
- 2. Lagler, K.F. Bardach, J.E. Miller, R.R. and Pasina, D.R. M. 1987. Inohthology John Wiley and Sons, New York.
- 3. Deshmann, R. F. 1992. Wild life biology. Wiley Eastern Publisher, New Delhi.
- 4. Sharia, V.B. 1995. Wildlife in India. Natral Publisher, Dehradun.
- 5. Verman, L.R. 19990 Beekeeping in integrated mountain development. Oxford & IBH Publ. Co., New Delhi.
- 6. Stine, K.E and Brown, T. M. 1996. Principles of Toxicology. Lewis Publishers London.
- 7. Atwal, A. S. 2000, Essentials. Of beekeeping & Pollination. Kalyani Publ. New Delhi.
- 8. Hassal, A.K. 1990. The Biochemistry and uses of Pesticides EELBS Editions
- 9. Atwal, A.S. and Dhaliwal G.S. 1997. Agriculture pests of South Asia and their management. Kalyani Publishers New Delhi.
- 10. Aruga, H. 1998. Principles of S ericulture. Oxford & IBH Publishing Co. New Delhi.
- 11. Harper, Physiological Chemistry
- 12. Karpati, G. Jones. D.H. and Griggs, R. c. Disorders of voluntary muscle, 7<sup>th</sup> edition. Cambridge Univ. Press.

#### Semester-III

#### **Course-XII**

#### **General Physiology**

- 1. Nutrition and digestion
- 1.1. Digestion and absorption of proteins, fats and carbohydrates
- 1.2. Vitamins, minerals and their role
- 1.3.Coordination and control of digestion
- 2. Body fluids
- 2.1 Structure and functions of bloods vessels
- 2.2 Pressure, blood flow, resistance and interrelationship
- 2.3 Vascular distensibility and vascular compliance
- 2.4 Different types of body fluids, their importance and regulation
  - 3. Respiration
- 3.1 Transport of O2 and CO2
- 3.2 Distribution and physiology of respiratory pigments
- 3.3. Carbon monoxide poisoning
- 3.4 Buffer systems (Bicarbonate buffer system, phosphate buffer system, Protein buffer system
- 3.5 Respiratory regulation of acid base balance
- 3.6 Respiratory Quotient
- 4.0 Recreation
- 4.1 Functional anatomy of mammalian kidney and its renal unit
- 4.2. Ultrafilteration, absorption and secretion mechanisms in urine formation
- 4.3 Role of antidiuretic hormone and aldosterone
- 4.4. Kidney in acid base balance
- 5.0 Muscle System
- 5.1 Ultrastructure of a skeletal muscle
- 5.2 Differences between skeletal, cardiao and smooth muscle

- 5.3 Mechanism of contraction of skeletal muscle
- 5.4 Biochemistry of actomyosin ATPase reaction
- 6. Endocrine System
- 6.1 Structural and functional organization of pituitary gland
- 6.2 Hormones secreted by thyroid, parathyroid, adrenal gland, pancreas and their functions.
- 6.3 Feedback inhibition
- 6.4 Hormonal regulation of mineral and electrolye concentration
- 6.5 Hormones and metabolism
- 7.0 Reproductive physiology
- 7.1 Histophysiology of mammalian gonads (Testis, Ovary)
- 7.2 Hormones secreted by gonads
- 8. Receptor Physiology
- 8.1 Mechanoreception
- 8.2 Photoreception
- 8.3 Phonoreception
- 8.4 Chemoreception
- 8.5 Equilibrium reception
- 9. Environmental Physiology
- 9.1 Basic concept of stress and strain
- 9.2 Adaptation, acclimation and acclimatization
- 9.3 Physiological adaptation to osmotic and ionic stress
- 9.4 Adaptation to high altitude and deep diving

#### **Suggested Books**

1. Ruegg, J.C., Calcium in muscle activation, Springer Verlag Berlin Heidelberg, New York.

- 2. Hoar, W.S. General and comparative physiology, Prentice, Hall Inc./England Wood cliffs, New Jersey.
- 3. Guyton, A.C. and Hall, J.E.; Text book of medical physiology, 10<sup>th</sup> Ed, Saunders, Harcourt, India.
- 4. Heilmeyer, L.M.G. Cellular regulation of protein phosphorylation, springer-verlag, Berlian Heidelberg, New York.
- 5. Prosser, C.L. and Brown, F.A. comparative Animal Physiology 2<sup>nd</sup> Ed. W.B. Sunders, Philadelplina.
- 6. Karpati, G., Jones, D.H. and Griggs. R.C. Disorders of Voluntary Muscle, 7<sup>th</sup> Edn, Cambridge University Press.
- 7. Turner, C.D. General Endocrinology, 4<sup>th</sup> Ed. W.B. Saunders, Philadelphia London.
- 8. Prosser, C.L., Comparative Animal Physiology, W.B. Saunders, Toppen Publication.

# **IV Semester**

# **Course XIII**

# **Biochemistry (Common Course)**

- 1. A review of laws of thermodynamics, redox potentials
- 2. Carbohydrate-classification, occurrence, structure and function of monosaccharides, oligosachharides.
- 3. Lipids-classification, occurrence structure and importance of acyl lipids and phosphates, biosynthesis of fatty acids, B-oxidation and role of polyunsaturated fatty acids.
- 4. Outlines of Nitrogen fixation, symbiotic and non-symbiotic
- 5. Amino acids, peptides and proteins. Occurrence, structure and function of amino acids, stereoisomers synthesis of amino acids by reductive amination, GS-GOGAT system transmination classification of proteins according to solubility, structure and function of proteins. Conjugate proteins, lectins and their importance, protein synthesis, transcription, translation degradation and protein folding.
- 6. Protein-ligand, protein protein, nucleic acid protein and nucleic acid-ligand interactions, Enzymes-classification, mode of action . Enzyme kineties ()Michaelis Menten Constant), Enzyme inhibition. Coenzymes, cofactors, Ribozymes.
- 7. Nucleic acid bases-their structure structure, and function of DNA, genetic code, different kinds of RNA and their origin. Role in protein, synthesis and in revers transcription DNA polymorphism
- 8. Biosyt nthesis and functions of secondary metabolites phenolics, flabonids, terpenoids.
- 9. Alkalods and steroids, suberins
- 10. Importance of Acetyl Co. A and Shikimic acid in intermediary metabolism
- 11. Chemical foundations of biology e.g. pH acids, bases, fubbbers, weak bonds, free energy, resonance, isomerisation etc.

# **Suggested Readings:**

- 1. Zubay, G. 1988, biochemistry (2<sup>nd</sup> ed), Macmillan Publ. House N.Y.
- 2. Mahler, H.R. and codes F.H. 1971. Biological chemistry, Harper International.
- 3. Lehinger. A.L. 1978, Biochemistry Kalyani Publishers, Ludhiana
- Goodwin T.W.a dn Meriar L.E.I. 1989 Introductory plant Biochemistry pergamon Press VY.
- 5. Conn, E.E. and Shimpap, P.K. 1976. Outlines of Biochemistry Wiley Eastern
- 6. Styer, Biochemistry.
- 7. Freifelder Molecular Biochemistry.

# M.Sc. Botany/Zoology

#### Semester-IV

# **Course-XIV**

#### **Ecology (Common Course)**

- 1. Climate, Soil and Vegetation patterns and organization: Life zones, major biomes, vegetation, soil types, concepts of community, ecological succession.
- 2. Ecosystem organization: Structure and Functions, primary production, energy dynamics, litter fall and decomposition, global biogeochemical cycles, mineral cycles in terrestrial and aquatic ecosystems.
- 3. Population growth and dynamics: Models of population growth (Stochastic and time lag), Reproduction strategies, mating preference spacing systems r and k selection, case studies in population dynamics.
- 4. Predation: Predator-Prey interaction, Host parasite interaction, Role of predation in nature.
- 5. Competition and Mutualism: Types and theories of competition, commensalism and mutualism, Plant-Pollinator and animal-animal interactions, Niche theory.
- 6. Biological diversity: concepts and levels, role of biodiversity in ecosystem functions and stability, speciation and ----- categories of threat, distribution and global patterns, Terrestial biodiversity hot spots.
- 7. Environmental pollution: types, Sources effects on plant and animal ecosystems Greenhouse gases, Ozone layer and ozone hole, consequences of climatic changes.
- 8. Ecological management: concepts, sustainable development, sustainability indicators, degraded ecosystems and their regeneration with special reference to waste lands, forests and aquatic ecosystems.

#### Suggested Reading

- 1. Begon and Mortimer: Population Ecology
- 2. Horace and Quick: Population Ecology
- 3. Elseth, G.D.: Population Biology
- 4. Thomas C.E. Population Biology
- 5. Krebs C.J.: Ecological Methodology
- 6. Slanden & Bang: Biology of Populations
- 7. Hillary S.E. Ecology 2000
- Merrit Emlern J. An evolutionary approach Brewer Principles of Ecollgy Price P.W: Slobodchikoff and Gand W.S.: A new Ecology Odum: Fundamentals of Ecology H.D. Kumar –General Ecology 1997, J.Merritt Emlen: Ecology -1973.

# M.Sc. Zoology (IV Semester)

#### **Molecular and Human Genetics**

Course-XV)

# **Special Paper**

#### **Molecular Genetics**

- 1. Basic of genetic analysis:
- 1.1 Terminology
- 1.2 Mutants and revertants
- 1.3 Uses of mutants
- 1.4 Genetic analysis of mutants
- 1.5 Site directed mutagenesis
- 2. Genome analysis:
- 2.1 Cytogenetic mapping
- 2.2 Genetic linkage mapping using molecular markers
- 2.3 Physical mapping
- 3. Recombination and transposition at molecular level:
- 3.1 Sister chromatid exchanges and homologous recombination
- 3.2 Site specific recombination
- 3.3 Transposition
- 4. Computer analysis of genetic sequences:
- 4.1 General concepts in sequence analysis
- 4.2 Identification of functional sequences
- 4.3 Homology
- 4.4 Structure prediction
- 5. Recombination DNA and genetic engineering:
- 5.1 Gene cloning
- 5.2 Detection of genes and gene products
- 5.3 Analysis of alteration of DNA sequences
- 5.4 Uses of microganisms in biotochology
- 5.5 New methods for genetically manipulating plants and animals
- 5.6 Applications of transgenic plants and animals
- 5.7 Gene therapy
- 5.8 DNA fingerprinting

#### HUMAN GENETICS

- 6. Human population genetics:
- 6.1 Polymorphic nature of human proteins

- 6.2 Biology of human races
- 6.3 Mutation and human diversity
- 6.4 Determination of mutation rates
- 7. Prenatal diagnosis and genetic counseling:
- 7.1 Prenatal diagnosis of birth defects
- 7.2 Uses of amniocentesis
- 7.3 Ultrasonography
- 7.4 Prenatal diagnosis by DNA analysis
- 7.5 Chorion-villi sampling
- 7.6 Genetic counseling
- 8. Human immunogenetics:
- 8.1 Immunological reactions
- 8.2 Immunoglobin genes and structure of immunoglobins
- 8.3 Generation of antibody diversity
- 8.4 Human leucocyte antigens
- 8.5 Treatment of autoimmune diseases
- 8.6 Allergy and applied immunology
- 8.7 Blood and antigens
- 8.8 Transplantation antigens
- 9. Genetic basis of cancer:
- 9.1 Transformed cells
- 9.2 Oncogenes
- 9.3 Carcinogens
- 9.4 Teratoma and teratocarcinomas
- 9.5 Cancer therapy

# **Suggested Reading:**

- 1. Atherly, A.G. Girton, J.R. and Mc Donald, J.F., The Science of Genetics. College, Publishing, Harcourt Brace College, Publishers. NY.
- 2. Watson, J.D.; Hopkins; N.H.; Roberts, J.W.; Steitz, J.A. and Weiner, A.M. Biology of Genes, The Benjamin/Cummings Publishing Company Inc. Tokya
- 3. Griffiths, A.J.F., Gelbart, W.M.; Miller, J.H.; Lewontin, R.C. and Modern Genetic Analysis. W.H. Freeman and Company, New York.
- 4. Brooker, R.J. Genetics: Analysis and Principles. Benjamin/Cumming, Longman Inc.
- 5. Manage, E.J. and manage, A.P. Basic Human Genetics. Sinauer, Associates, Inc.
- 6. Hartl, Daniel L. Human genetics. Harper and Row
- 7. Rothwell, N.V. Human Genetics. Prentice-Hall.
- 8. Winchester, A.M. heredity, Evolution and Humankind. West Publishing Company.

Course-XV

# Semester-IV

# **Biochemistry (Special Paper)**

# THERMODYNAMICS

1.1 Application of the first and second law of thermodynamics in understanding energies in the living cells.

# CARBOHYDRATES

- 2.1 Chemistry of animon sugars and sialic acids. Structure and function of glycoprotein, Proteoglycans, mucopolysaccharides, bacterial cell sugar compounds and storage polysaccharides.
- 2.2. Intermediatiary metabolism, multiple enzyme systems and experimental approaches to the study of metabolism.
- 2.3 Glycolysis Kerb cycle, anaplerotic and amphibolic nature of Kreb cyle, Regulation of Glyoxalate pathway.
- 2.4 Glycolysis, Gycogenolysis and their regulation
- 2.5 Pentose phosphate pathway and its regulation.
- 2.6. Gluconeogenesis, Gucogenesis, Glycogenesis, and synthesis of oligosaccharides, and Mucopolysaccharides.

# LIPIDS:

- 3.1 General structure and functions of acylglycerols, phosphoglycerides, Sphingolipides, waxes. steroids and prostaglandin
- 3.2 Lipid micelles structure of vitamins ADK, steroids and their derivatives
- 3.3 Formaiotn of Ketone bodies and their regulation
- 3.4 Biosynthesis of triacylglycerols, Phosphoglycerides, sphingomyelin, prostaglandin's glycolipids and steroids

# PROTEINS

4.1 Regulation of amino acid biosynthesis

- 4.2 Protein splicing and folding
- 4.3 Post-transnational modification and protein targeting

# ENZYMES

5.1 Nomenclature of enzymes

5.2 Assay of enzymes, various methods employed in enzyme assays, enzyme activity specific activity and turn over number for enzymes

- 5.3 Enzyme catalytic efficiency
- 5.4 Graphical methods for determination of Km. and Vmax. Types of enzyme inhibition.

# NUCLEIC ACIDS

- 6.1 Degradation and synthesis of purine and pyrimidine nucleotides and their regulation
- 6.2 Salvage pathway for purine
- 6.3 Proteins-nucleic acid interaction
- 6.4 Post-transcriptional modification
- 6.5 Onogenes

# NUTRITION

- 7.1 Scope and methodology of nutrition as science, energy metabolism
- 7.2 Food energy carbohydrates, fat proteins, individual nutrients, vitamins and minerals with special reference to:
- 7.2.1 Distribution in body and biochemical role
- 7.2.2 Amount in ordinary food
- 7.2.3 Digestion, absorption, storage and utilization
- 7.2.4 Requirements and recommended allowances
- 7.2.5 Effect of deficiency and excess
- 7.3 Formulation of balanced diet and nutritional adaptation

#### **Suggested Books**

- 1. Zubay, G. 1988. Biochemistry, Macmillion publication
- 2. Strayer, L, Biochemistry (Freeman)
- 3. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M.Raff et.al. (Garland publication New York).
- 4. T.E. Creighton. Peroteins: Structure and molecular properties. W.H. Freeman, New York.

5. Davidson, S. et.al. 1975. Human Nutrition and Dietetius.

# M.Sc Zoology

#### **Course-XV**

#### Semester-IV

# PARASITOLOGY (Special Course)

#### 1. Parasitic Protozoa

- i) Locomotion
- ii) Nutrition
- iii) Economic importance of Parasitic Protozoa
- 2. Trematodes
  - i) Ultrastructure of Tegument
  - ii) Cercaria of Digenea
  - iii) Life Cycles in Digenea
- 3. Cestodes
  - i) Ultrastructure of Tegumnt
  - ii) Adhesive organs
  - iii) Larval forms and variations in life cycles
- 4. Nematodes
  - i) Ultrastructure of Tegument
  - ii) Comparative anatomy of Digestive systems
  - iii) Protein, Lipid and Carbohydrate metabolism in Nematodes
  - iv) Infective stages and variations in life cycles
- 5. Parasite Transmission
  - i) Mechanism for location, Circadian rhythm, penetration into host
  - ii) Chemotherapy of commonly used anthelminthic
  - iii) Nutrition in helminthes, uptake and digestion

#### **Suggested Reading**

- 1. Cheng, T.C. General Parasitology Academic Press, Inc. (1986)
- 2. Noble E.R. and Noble, G.A. Parasitology, The biology of Animal parasites Lea and Fabigor.
- 3. Arderson D.R. comparative Protozology, Cambridge Uni. Press.
- 4. Chandler. A.C. and Read, C.P: Introduction of Parasitological, Willy, Eastern.
- 5. Belding, D.A. A text book of Parasitological, Meredith Publ. Co.

- 6. Bager, J.R. Parasitic Protozoa, Academic Press.
- 7. Grell. K.G. Protozoology, Springer Verlag.
- 8. Maggenti A:" General Nematology, Springer Verlag.
- 9. Erasumus D.A: The biology of Treamatodes, Edward Arnold (Publc) Ltd.
- 10. Dawes Ben: The Trematodes, Cambridge University Press
- 11. Wardle R.A. & Mc Leod J.A: The Zoology of Tapeworms, Hafner Publs. Co.,
- 12. Cox F" E.G. Moder Parasitology- A Text book of Parasitology, Blackwell Scientific Publ.
- 13. Chappel L.H.: Physiology of Parasites, Blakie
- 14. Croll N.A. & Mathews B.F: Biology of Nematodes, Blakie
- 15. Lee D. C. 7 Atkinson J.J: Physiology of Nematodes, The Macmillan Press Ltd.
- 16. Smyth J.D. & Mcmannus D.P: The Physiology and Biochemistry of Cestodes.

# M.Sc. Zoology

# Semester-IV

Course –XV

# **Entomology (Special Paper)**

# 1. Agricultural Entomology

Biology and control of following insect pests of Agricultural importance: Sanjose scale, Woolly apple aphid, Rice stem borer, Maize, borer, Diamond back moth, Mustard aphid, Mangohoppers, Melon fruit fly, Potato cutworm, Potato, tubermoth, Sugarcan borers, Pink boll worm fo cotton, Cotton Jassid, Citrus caterpillar, rice weevil, Khapra beetls, Lesser grain borer, Angoumois grain moth, Locusts.

# 2. Insect Control and Toxicology

Basic principles and types of insect control: cultural ,physical, mechanical, biological and chemical control. Mode of action of insecticides: inorganic insecticides; botanical pesticides and synthetic organic insecticides. Physiology of insecticidal resistance. Insecticides and environmental pollution.

Newer methods of insect control including genetic methods. Uses of chemosterilants, radiations, hormones and pheromones in insect control. Principles and practices of integrated pest management Microbial control.

# **3.** Medical Entomology

Insects as vectors of human diseases. Mode of transmission and epidemiology of major vector borne diseases-malaria, yellow fever, encephalitis, kalazar, plague, typhus, leishmaniasis, filiariasis. Control of vectors.

#### 4. Isnect Sociobiology

Basic attributes of social life, social organization in honeybee, wasp, termite and ant. Kinds of societies among bees; social significance of the nest; caste determination in bees; Foraging and orientation; Defense mechanisms in bees

Species of honeybees, their general characteristics and economic importance; Honey plant resources; Bee Genetics, Dances and languages of honeybees Foraging behavior of bees in relation to pollination, Honeybee pests and diseases. Bee products: their composition and uses.

# 5. Insect Ecology

Abiotic and biotic factors of environment concerning distribution and abundance of insects. Current theories to explain insect number. Ecology of pest control. Insect mimicry. Entomophagous insects.

#### **Suggested Readings:**

- 1. Atwal, A.S. and Dhaliwal, G.S. 1997. Agriculture pests of South Asia and their management Kalyani Publishers, New Delhi.
- 2. Pedigo, L.P. 1996. Entomology and Pest Management. Prentice Hall of India, New Delhi.
- 3. Clarke, L.R. Geier, P.U, Hughes, R.D. and Morris, S.R.F. 1982 The Ecology of Insect population-in theory and practice. ELBS edition
- 4. Michener, C.D. 1981. The social behavior of the bees. The Belknap Press of Harvard Univ. Cambrige.
- 5. Verma, , L.R. 1990. Beekeeping in integrated mountain development Oxford & IBH Publ. Co., New Delhi.
- 6. Wilson, E.O. 1981. The Insect Societies. Harvard Univ. Press, Cambridge.
- 7. Hassall, A.K. 1990. The biochemistry and uses of pesticides ELBS edition
- 8. Hill, D.S. 1993. Agricultural insect pests of tropics and their control. Cambridge uni. Press. Cambridge.
- 9. Stine K.E and Brown. T.M. 1996. Principles of Toxicology, Lewis Publishers, London.
- 10. Atwal, A.S. 2000, Essentials of beekeeping & Pollination Kalyani Publ. New Delhi.

#### M.Sc. Zoology

#### Semester-IV

Course-XV

#### Molecular Physiology (Special Paper)

- 1. Digestive System
- 1.1.Metabolism of carbohydrates, lipids and proteins
- 1.2. Nutritional disorders
- 1.3.Neural and hormonal control of Gastrointestinal movements.
- 2.0 Respiratory system
- 2.1 Neural regulation of respiration
- 2.2 Humeral regulation of respiration
- 3.0 Blood Vascular System
- 3.1 Intrinsic, nervous and humeral regulation of circulation
- 3.3. Cardicac cycle
- 3.4 Conduction system in heart
- 3.5 Control of excitation and conduction in heart
- 4.0 Excrction:
- 4.1 Conter-current mechanism (Formation of concentrated and dilute urine)
- 4.2 Secretion, Reaborption of different electrolytes, ions, molecules
- 4.3 Renin-Angiotensin system
- 5.0 Muscular System
- 5.1 Ultrastr5ucture of smooth muscle cell
- 5.2 Mechanism and regulation of vascular, smooth muscle contraction
- 5.3 An introductory idea of "latch" and "Catch"
- 5.4. Diversity of slow and fast muscles
- 6. Nervous System:

- 6.1 Reflex mechanism
- 6.2 Types of reflexes
- 6.3 Functional compartmentalization of brain and hierarchy of control
- 7.0 Endocrine System
- 7.1 Hormones, their nature and mechanism of action
- 7.2 Hormone receptors and signal transduction
- 7.3 Biosynthesis of adrenal and thyroid hormones
- 8.0 Reproductive Physiology
- 8.1 Hormonal regulation of spermatogenesis, and oogenesis
- 8.2 Mammalian reproductive cycles
- 8.3 Implantation
- 8.4 Partuirition
- 8.5 Lactation
- 9.0 High Altitude and deep sea Physiology:
- 9.1 Effect of low O2 at high altitude
- 9.2 Acclimatization to low O2
- 9.3 Angular acceleratory forces and their effects
- 9.4 Artificial climate, and weightlessness
- 9.5 Nitrogen narcosis and oxygen toxicity.

#### **Suggested Books**

- 1. Guegg, J.C.: Calcium in muscle activation, Springer Verlag Berlin Heidelberg, New York.
- 2. Hoar, W.S.: General and comparative physiology, Prentice, Hall, Inc./England Wood cliffs, New Jersey.
- 3. Guyton, A.C. and Hall, J.E.: Text book of medical physiology, 10<sup>th</sup> Ed., Saunders, Harcourt, India.
- 4. Heilmeyer, L.M.G. Cellular regulation of protein phosphorylation, Springer-Verlag, Berlin Heidelberg, New York.

- 5. Prosser, C.L. and Brown, F.A.: Comparative Animal Physiology, 2<sup>nd</sup> Ed. W.B. Saunders, Philadelplina.
- 6. Karpati, G., Jones, D.H. and Griggs, R.C.: Disorders of Voluntary Muscle, 7<sup>th</sup> Edn, Cambridge University Press.
- 7. Turner, C.D.: General Endocrinology, 4<sup>th</sup> Ed. W.B. Saunders, Philadelphia London.

# Annexure- 1

# HIMACHAL PRADESH UNIVERSITY

# Courses of Study and Syllabi for M. Sc. Physics (Effective from the session 2009 onwards)

Max. Marks
80+ 20 I.A.
80+ 20 I.A.
80+ 20 I.A
80+ 20 I.A.
80+ 20 I.A
80+ 20 I.A

# Semester-IV

Course- PHY	MS-401 Electronics –II	80+ 20 I.A.
Course- PHY	MS-402 Elective Papers one of the following	80+ 20 I.A.
i)	PHYMS-402 (a) Advanced High Energy Physics	80+ 20 I.A
ii)	PHYMS-402 (b) Nuclear & Particle Astrophysics	80+ 20 I.A
iii)	PHYMS-402 (c) Advanced Quantum Mechanics	80+ 20 I.A.
Course- PHY	MS-403 Elective Papers one of the following	80+ 20 I.A
i)	PHYMS-403 (a) Nano Physics	80+ 20 I.A
ii)	PHYMS-403 (b) Mesoscopic Physics	80+ 20 I.A
iii)	PHYMS-403 (c) Advanced Computational Physics	80+ 20 I.A
Course- PHYMS-404 Elective Papers one of the following		80+ 20 I.A.
i)	PHYMS-404 (a) Advanced Nuclear Physics	80+ 20 I.A.
ii)	PHYMS-404 (b) Nuclear Technology	80+ 20 I.A.
iii)	PHYMS-404 (c) Opto – Electronics	80+ 20 I.A

Course- PHYMS-405 Project

100 `

# **SEMESTER-I**

Course Code	PHYN	IS-101	No. of hour per semester	52
Name of the course	Mathematical Physics			
Duration of the Course	One Semester (13 Weeks)			
Lectures to be Delivered	39 ( 13	<b>39 ( 13 X 3)</b>		
Tutorial	13 (13 X 1)			
Semester End Examination	Total Maximu	Total Maximum Marks = 100		
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section A

#### **Complex Variables**:

Analyticity of the function of a complex variable, Cauchy integral theorem and formula. Expansion of an analytic function; Taylor and Laurent series. Residue theorem, contour integration, Jordan Lemma. Applications in evaluation of definite integrals. Dispersion relation, saddle point method.

#### **Vector Spaces**:

Vector Spaces and Matrices; linear independence, Bases; dimensionality; inner product; linear transformations. Matrices; Inverse; Orthogonal and Unitary matrices; Independent elements of a matrix; Eigen-values and eigen-vectors; Diagonalization; Complete orthonormal set of functions.

#### Section **B**

#### **Special and Orthogonal Functions:**

Partial differential equations, separation of variable technique in Cartesian, Spherical, Cylindrical Coordinates. Special functions related to these equations (Laguerre, Bessel's, Legendre and Hermite) and their applications to boundary value problems, Sturm-Liouville theory and orthonormal eigen-functions. Beta and Gamma functions. Fourier and Laplace transforms and their properties. Applications of Laplace Transforms to solve differential equations.

# Section C

#### **Green's Function**:

Non homogeneous boundary value problems and Green's functions in one dimension. Eigen-function expansion of Green's function. Fourier transform method of constructing the Green's function, Green's function in 3-dimensions, application to scattering problem

# **Group Theory**:

Postulates, multiplication tables, subgroup, direct product group, isomorphism and homomorphism. Representation of a group, Schur's Lemma and orthogonality theorem (Statement only), reducible and irreducible representation. Permutation group C42 group (group of the symmetry of a square), Lie group, Lie algebra, orthogonal groups and unitary group.

#### **Books Recommended:**

- 1. G. Arfken: Mathematical Methods for Physicist 4<sup>th</sup> edition (Academic Press).
- 2. J. Mathews and R. L. Walker: Mathematical Methods of Physics (I. B. House Pvt.Ltd.).
- 3. C. Harper: Introduction to Mathematical Physics (Prentice Hall of India).
- 4. A. W. Joshi: Vectors & Tensors (Wiley Eastern Limited).
- 5. A. W. Joshi: Elements of Group Theory (Wiley Eastern).
- 6. Riley, Hobson & Bence: Mathematical Methods for Physics and Engineering (Cambridge University Press)
- *NOTE:* In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-102	No. of hour per semester	52
Name of the course	Classical Mechanics			
Duration of the Course	One Semester (13 Weeks)			
Lectures to be Delivered	<b>39</b> ( <b>13 X 3</b> )			
Tutorial	13 (13 X 1)			
Semester End Examination	Total Maximum Marks = 100		Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

#### Section A

#### Variational Principles and Lagrangian Formulation of Mechanics:

D'Alembert's Principle and Lagrange's equations. Constraints and generalized coordinates. Calculus of variations, Hamilton's principle and derivation of Lagrange's equation from it. Extension to non-holonomic and non-conservative systems. Symmetry properties of space and time and the corresponding theorems (with reference to cyclic coordinates). Simple applications of Lagrangian formulation for a single particle and a systems of particles. Lagrangian formulation of relativistic mechanics.

#### **Central Force Problem**:

Equations of motion and first integrals. Equivalent one dimensional problem and classification of orbits. The virial theorem. Differential equation for a orbit with a general power law potential. **Applications**: Kepler problem; scattering in c.m. and lab-coordinates.

#### Section **B**

#### Kinematics and Dynamics of Rigid Bodies:

Generalized coordinates of a rigid body, orthogonal transformations and the transformation matrix. The Euler's angles and Euler's theorem on motion of rigid bodies, infinitesimal rotations, motion in a rotating frame of reference, Coriolis force on (i) air flow on the surface of earth (ii) projectile motion (iii)atomic nuclei. Angular momentum

and Kinetic energy of motion about a point. Moment of inertia tensor, the principle axis transformation. Euler's equation of motion.

**Applications**: Torque free motion of a rigid body. Heavy symmetric top with one point fixed.

# Hamilton-Jacobi Theory:

The Hamilton-Jacobi equation for (i) Hamilton's principle function, and (ii) Characteristics function. Separation of variables in Hamilton-Jacobi equation. Action angle variables. **Applications:** Harmonic oscillator with Hamilton-Jacobi and action angle variable methods. Kepler's problem with action angle variable method. The transition from discrete to continuous system.

#### Section C

# Hamiltonian Formulation of Mechanics:

Legendre's transformations and Hamilton's equations of motion. Derivation of Hamilton's equations from variational principle. The principle of least action. Canonical transformations; Poisson's and Lagrangian brackets, their invariance under a canonical transformation, equations of motion in the Poisson's bracket notation; infinitesimal canonical transformations, constants of motion and symmetry properties.

**Applications**: Hamiltonian formulation of (i) harmonic oscillator and (ii) relativistic mechanics. Examples of canonical transformations, with reference to harmonic oscillator. Example of Poisson bracket, (i) harmonic oscillator; (ii) angular momentum.

**Lagrangian and Hamiltonian Formulations for continuous systems and fields:** Transition from discrete to continuous system, Lagrangian formulation for continuous systems stress- energy tensor and conservation theorems. Hamiltonian formulation others theorems.

#### **Books Recommended**

- H. Goldstein, Classical Mechanics 2<sup>nd</sup> ed. (Indian Student Edition, Addison-Wesley/ Narosa).
- 2. J. B. Marion, Classical Mechanics (Academic Press).
- 3. L. D. Landau and E. M. Lifshitz, Mechanics 3<sup>rd</sup> ed. (Pergamon).
- 4. R. G. Takwale & P. S. Puranik, Introduction to Classical Mechanics (Tata McGraw Hill)
- 5. Kiran C. Gupta, Classical Mechanics of Particles and Rigid Bodies (Wiley Eastern).
- 6. N. C. Rana and P. S. Joag, Classical mechanics (TMH).
- *NOTE:* In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C

Course Code	PHYN	<b>IS-103</b>	No. of hour per semester	52
Name of the course	Electronics –I			
Duration of the Course	One Semester (13 Weeks)			
Lectures to be Delivered	<b>39 ( 13 X 3)</b>			
Tutorial	13 (13 X 1)			
Semester End Examination	Total Maximum Marks = 100		Pass Marks	
	Theory	MM 80	32	
	Internal	MM 15	06	
	Assessment			
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

#### Section A:

**Sequential Logic:** Flip-Flop: Al-Bit memory-The RS Flip-Flop, JK- Flip-Flop, JK- master slave-Flip-Flop, T Flip-Flop, D- Flip-Flop-Shift Registers, Synchronous and Asynchronous Counter, Cascade Counters, A/D and D/A Converters.

**Microprocessors:** Introduction to microcomputers – input/output- interfacing devices 8085 CPU – Architecture- BUS timings- Demultiplexing the address bus generating control signals- Instruction Set – Addressing Modes- Illustrative Programmes – Writing Assembly Language Programmes, Looping, Counting and Indexing – Counters and Timing Delays- Stack and Subroutine.

#### Section B:

**Operational amplifiers**: Differential amplifiers-circuit configuration-Dual Input, Balanced Output, Differential Amplifier-DC analysis-AC analysis, Inverting and Non-Inverting Inputs, CMRR-constant current bias level translator. Block diagram of typical Op-amp-analysis, Open loop configuration, Inverting and Non-Inverting Amplifiers, Op-Amp with negative feedback-voltage series feedback –effect of feedback on closed loop gain, Input Resistance, Output Resistance Bandwidth and Output Offset Voltage, Voltage Follower, Practical Op-Amp Input Offset voltage-Input Bias Current-Input Offset current, Total Output Offset Voltage, CMRR frequency response, DC and AC Amplifiers, Summing, Scaling and Averaging Amplifiers, Instrumentation Amplifiers, Integrator and Differentiator.

# Section C:

**Microwave Devices**: Klystron amplifiers, Velocity Modulation, Basic principle of two Cavity Klystron, Reflex klystron, Traveling Wave Tubes (TWT), Transferred Electron Devices (Gunn Diode), Tunnel Diode, IMPATT Diode, TRAPATT Diode.

**Microwave Communications:** Advantages and Disadvantages of Microwave Transmission, Loss in free space, Propagation of microwaves, Atmospheric effects on propagation, Fresnel zone problem, Ground reflection, Fading sources, Detectors, Components, Antennas used in MW Communication Systems.

#### **Books Recommended**

- 1. Microwaves by K.L. Gupta, Wiley Eastern Ltd. New Delhi, 1983.
- 2. Digital Principle and Application by, A. P. Malvino and Donald P. Leach, TMH, New Delhi 1993.
- 3. Electronic communication system by G. Kennedy and B. Davis, TMH, New Delhi 1993.
- 4. Semiconductor Devices by S. M. Sze JWS, 1995
- 5. Op-amp and Linear Integrated Circuit by Ramakanth A. Gayakwad, sss PHI, second edition, 1991.
- 6. Microprocessor Architecture, programming and Applications with 8085/8086 by Ramesh S. Gaonkar, Wiley Eastern Let. 1987 (for unit v)
- NOTE:- In all, ten questions will be set. Question No.1will cover the entire syllabus and will be short answer type. The remaining 9 questions will be three each from section A, B and C. Students will attempt 5 questions in all including Q No.1 (Compulsory) and at least one from each section.
| Course Code              | PHYN                             | 1S-104        | No. of hour per<br>semester | 52 |
|--------------------------|----------------------------------|---------------|-----------------------------|----|
| Name of the course       | Computational Methods in Physics |               |                             |    |
| Duration of the Course   | Oı                               | ne Semester   | (13 Weeks)                  |    |
| Lectures to be Delivered | 39 ( 13                          | 3 X 3)        |                             |    |
| Tutorial                 | 13 (1                            | 3 X 1)        |                             |    |
| Semester End Examination | Total Maximu                     | m Marks = 100 | Pass Marks                  |    |
|                          | Theory                           | MM 80         | 32                          |    |
|                          | Internal<br>Assessment           | MM 15         | 06                          |    |
|                          | Attendance                       | MM 5          |                             |    |

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

**Basics:** Computer arithmetic, machine precision, types of errors, subtractive cancellation, multiplicative error, errors and their estimation, flowcharting and algorithms, error propagation, errors in algorithms. Computer languages (Procedural and object oriented), Brief recapitulation of FORTRAN, C, C++, operating systems (proprietary and open source), shells, editors and programs, modular and top-down programming, Simulation and computation (examples: radioactive decay, area of a pond, value of pi)

**Root Finding:** Solutions of non-linear equations by plotting method, bisection method, false position method, Newton Raphson method, secant method, order of convergence in different methods. Application: developing an algorithm to find bond angle of a diatomic molecule using a modeled interaction potential.

**Monte Carlo Methods:** True random numbers, pseudorandom numbers, generators for pseudorandom numbers,. Tests for pseudo random number generators. Monte carlo method: Applications: Random walk, Radioactive decay simulation, area of an irregular plane, value of pi, multidimensional integration, variance reduction, importance sampling, non uniform randomness, von-neumann rejection.

**Differentiation:** Forward Difference, Central Difference, unstable nature of differentiation. Differentiation of interpolating polynomials.

# Section **B**

**Integration:** numerical integration using trapezoidal rule, Simpson's Method, Romberg integration, Newton-Cote's formulae, Gaussian quadrature; weight function and its use in dealing with singularity in the integrand. Application: Semi-classical quantization of molecular vibrations.

**Interpolation and extrapolation**: Lagrange's interpolation using polynomials, difference tables, Cubic-spline method, least square method of fitting data, linear and polynomial regression. Application: Charge on Millikan's oil drop data and estimation of charge on an electron.

**Simultaneous Algebraic Equations**: Various matrix operations, direct and iterative methods for solving simultaneous algebraic equations, Gauss elimination method, pivoting, refinement, Gauss Seidel method

**Eigenvectors and eigenvalues**: homogeneous equations, characteristic equation. Method and secant method. Order of convergence in different Power method, Jacobi, Given's and Householder's methods. Applications: Electric Circuit Network problem, secular equation for dispersion relations, electronic structure of many body problems, brief overview.

# Section C

**Ordinary differential equations (Initial value problems):** Euler, Taylor series and Second order Runge-Kutta method (derivation), Fourth order Runge- Kutta method (without derivation) Predictor- Corrector method. Numerov method, shooting method. Applications: Non-linear oscillators, schrodinger equation for particle in a box,

**Partial Differential Equations (Boundary value problems):** Elliptic, parabolic and hyperbolic equations and corresponding difference equations for each type.Applications: solution of Laoplaces equation, Poission Equation, and heat equation

**Non- linear Dynamics:** Non-linear growth, logistic map, properties of non-linear maps, fixed points, period doubling, attractors, bifurcation diagrams, generating random numbers from logistic maps, Figenbaum constant. A chaotic pendulum, limit cycle and mode coupling, phase space orbits, chaotic and random motion in phase space, bifurcation diagram of a pendulum.

# **Books Recommended**

- 1. Rubin Landau, M Paez: Computational Physics (John Wiley)
- 2. Tao Pang: Computational Physics (Cambridge University Press)
- 3. V. Rajaraman: Computer Oriented Numerical Methods (PHI).
- 4. E Balagurusamy: Numerical Methods (Tata Mcgraw Hill).

- 5. S. E. Koonin: Computational Physics (Addison Wesley).
- 6. Vetterming, Teukolsky, Press and Flannery: Art of Computing, Numerical Recipes (in C, C++, Fortran) (Cambridge University Press)
- *NOTE*:- In all, ten questions will be set. Question No.1will cover the entire syllabus and will be short answer type. The remaining 9 questions will be three each from section A, B and C. Students will attempt 5 questions in all including Q No.1 (Compulsory) and at least one from each section

Course Code	PHYN	<b>AS-105</b>	No. of hour per semester	180
Name of the course		Labor	atory	
Duration of the Course	O	ne Semester	(13 Weeks)	
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

# **Course V: LABORATORY**

**Note:** Students are expected to do as many experiments as possible but not less than 10 experiments out of the following list doing 3 experiments from each of the sections A, B and C. Internal assessment for the laboratory course will be based on a seminar, number of experiments performed and checked after thorough viva based on the each experiment conducted by the concerned teacher/s during the semester and attendance. Marks will be posted in the copy and on the index of the copy. A record of the same will be kept in the laboratory also.

# Section A

- 1. Kelvin double bridge: determination of low resistance.
- 2. Anderson bridge: determination of self-inductance.
- 3. Scherring bridge: determination of capacitance.
- 4. Study of integrating and differentiating circuits.
- 5. Study of clipping and clamping circuits.
- 6. Study of CRO.
- 7. Study of characteristics of semi-conductor devices (UJT, FET).
- 8. Study of regulated power supply.
- 9. Study of thyratron characteristics.

# Section **B**

- 10. e/m of electron by helical method.
- 11. Plank's constant by photocell.
- 12. Millikan's oil drop experiment.
- 13. Cauchy's Constant.
- 14. Verification of Fresnel's amplitude relations.
- 15. Ultrasonic wave velocity in liquids by ultrasonic diffraction.

- 16. Constant Deviation Spectrometer
- 17. Determination of wavelength and difference in wavelengths of sodium lines, and thickness of mica sheet using Michelson Interferometer.

# Section C

#### Computer based experiments using BASIC/ FORTRAN/C/C++:

- 18. Statistical and error analysis of (a) given data (b) error estimation in computation.
- 19. (a) Roots of a quadratic/ cubic equation (b) summation of a series.
- 20. Numerical differentiation and integration of simple functions.
- 21. Operations on a matrix (a) inversion (b) diagonalisation (3x3 matrix) (c) solution of simultaneous equations.
- 22. Plotting and interpolation of a function.
- 23. Finding the value of Pi using monte carlo method

# M. Sc. PHYSICS (1st SEMESTER): LABORATRORY/ PRACTICAL COURSE

- 1. Design of a Regulated Power Supply
- 2. Design of a Common Emitter Transistor Amplifier
- 3. Experiment on Bias Stability
- 4. Negative Feedback (Voltage series/shut and current series/shunt)
- 5. Astable , Mono-stable and Bi-stable multivibrator.
- 6. Characteristics and application of Silicon Controlled Rectifier.
- 7. Testing goodness of fit of Poisson distribution to cosmic ray bursts by chi-square test.
- 8. Determination of Half Life of 'In'
- 9. Determination of range of Beta-rays from Ra and Cs.
- 10. X-ray diffraction by Telexometer.
- 11. Determination of lonization potential of Lithium.
- 12. Determination of e/m of electron by Normal Zeeman Effect using Febry-Perot Etalon.
- 13. Determination of Dissociation Energy of Iodine (I) Molecule by photographing the absorption bands of Iodine in the visible region .
  - (a) Measurement of wavelength of He-Ne Laser Light using ruler.
  - (b) Measurement of thickness of thin wire with laser.

# M. Sc. Physics (1<sup>st</sup> Semester): Tutorial: Laboratory/ Practical Course

# This is only a suggestive list, the faculty concerned can add more topics as per the need of the students

- 1. Network Analysis-Thevemin and Nortan's equivalent circuits.
- 2. Basics of p-n junction: Diffusion current, Drift current, Junction width, forward and Reverse Biasing; Significance of Fermi level in stabilizing the junction.
- 3. Zener diode: Characteristics and voltage regulation.
- 4. Transistor biasing and stability
- 5. Wein's bridge and phase shift.
- 6. Solving Boolean expressions.

- 7. Mechanism and production of electrical pulse through absorption of nuclear radiation in medium.
- Bead time efficiency, counting techniques, energy resolution.
  Lattice extinctions in X-ray diffraction.
  Atomic scattering power and geometrical structure factor.

Course Code	PHYN	1S-106	No. of hour per semester	52	
Name of the course	COMPUTER Centre bas	COMPUTER APPLICATIONS IN PHYSICS (Nodal Centre based course)			
	Additional	Additional Optional Course I			
Duration of the Course	O	ne Semester	(13 Weeks)		
Lectures to be Delivered	39 ( 13	3 X 3)			
Tutorial	13 (1	3 X 1)			
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks		
	Theory	MM 80	32		
	Internal Assessment	MM 15	06		
	Attendance	MM 5			

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section A

# Essentials of operating Systems and Linux Usage:

Operating systems; DOS, Windows and Linux. Introduction to file manipulation, print, view compiling, debugging, executing, Job control, search and Miscellaneous commands in the three operating systems, Usage of text editors (edit, vi and EMACS). Problem solving; flow charts and algorithms, writing the code, testing the code. Compiling and execution

# Section **B**

# Programming language (FORTRAN 90/95):

Evolution of FORTRAN. Elements of Fortran 90 (source form, Expressions and Assignment, comments, statement ordering, intrinsic types (object classes), literal constants, implicit typing, numerical and logical declerations, character decleration, symbolic constants, scalar initialization, scalar expressions, scalar assignments, intrinsic numeric expressions, intrinsic logical operations, character operations, operation precedence), Control Constructs (if, cycle, exit, select case, indexed loops, Intrinsics and Basic I/O, Intrinsic Procedures (classes, functions, subroutines), functions (type conversion, mathematical, numeric, character, Pointers and Derived Types, Modules and Object-based Programming, Arrays (conformance, element ordering, syntax, sections, I/O, constructors, initializing) **Applications I**:

Programming Exercises on Root finding, interpolation and extrapolation, least square fitting, Polynomial equation fitting, differentiation and integration, solution of ordinary differential

equations (Initial value problem, at least ten problems).

# Section C

# **Applications II (Software Packages):**

Word processing for scientific usage. Electronic spreadsheets to model simple physical problems and graphical presentation, EXCEL, LATEX, Computer-Computer Interactions, Electronic mail, FTP, Remote Login Telnet, DOS Windows to Unix transfers.

# Programming exercises (at least ten)

# References

- 1. M. Metcalf and J. Reid, Fortran 90/95 Explained, Oxford, 1996
- 2. Computer oriented numerical methods, V. Rajaraman (Prentice Hall of India)
- 3. A Scientists and Engineers Guide to Workstations and Computers, R.H. Landau, P.J. Fink (John Wiley and Sons).
- 4. Red Hat Linux 7.2, Christopher Negus, IDG Books India (P) Ltd.

# **Computer applications**: Exercises (suggested) on Additional Optional Course- I **Excercises to be done using Fortran 90/95**

- 1. Manipulation of natural numbers (like lcm, hcf, prime
- 2. , sorting, conversion of decimal to binary numbers, Fibonacci sequence etc),
- 3. Evaluation of statistical quantities (mean, SD, correlation)
- 4. Summation of series
- 5. Matrix manipulation (add, multiply)
- 6. Finding root of a non-linear equation using bisection method and Newton raphson method
- 7. Interpolation and extrapolation Least square fitting
- 8. Differentiation (solution of equation of motion) Integration (area under a curve)

# Excercises to be done using Excel &VBA

- 1. Choose a set of 10 values and find standard deviation, mean, variance, moments etc. of at least 25 data points
- 2. To guess the roots of a non-linear equation by conditiobnal formatting
- 3. Simulating radioactive decay using taylor expansion
- 4. Plotting Special Mathematical functions using spreadsheets
- 5. Using spreadsheets for matrix operations such as addition, multiplication and finding the determinant
- 6. Create a spreadsheet to simulate projectile motion
- 7. solving poisson equation and laplace's equations by setting a spreadsheet.

**NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

# **SEMESTER II**

Course Code	PHYN	<b>IS-201</b>	No. of hour per semester	52
Name of the course		Quantum M	echanics - I	
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

# Matrix formulation of Quantum Mechanics:

Matrix Algebra: Matrix addition and multiplication, Nul unit and Constant Matrices, Trace, Determinant and Inverse of a Matrix, Hermitian and unitary Matrices, Transformation and diagonelization of Matrics, Function of Matricies and matrices of infinite rank.Vector representation of states, transformation of Hamiltonian with unitary matrix, representation of an operator, Hilbert space. Dirac bra and ket notation, projection operators, Schrodinger, Heisenberg and interaction pictures. Relationship between Poisson brackets and commutation relations. Matrix theory of Harmonic oscillator.

# Section B

# Symmetry in Quantum Mechanics:

Unitary operators for space and time translations. Symmetry and degeneracy. Rotation and angular momentum; Commutation relations, eigenvalue spectrum, angular momentum matrices of J<sub>+</sub>, J<sub>-</sub>, J<sub>z</sub>, J<sup>2</sup>. Concept of spin, Pauli spin matrices. Addition of angular momenta, Clebsch-Gordon coefficients and their properties, recurssion relations. Matrix elements for rotated state, irreducible tensor operator, Wigner-Eckart theorem. Rotation matrices and

group aspects. Space inversion and time reversal: parity operator and anti-linear operator. Dynamical symmetry of harmonic oscillator.

**Applications**: non-relativistic Hamiltonian for an electron with spin included. C. G. coefficients of addition for j = 1/2, 1/2; 1/2, 1; 1, 1.

# Section C

# **Approximation Methods for Bound State:**

Time independent perturbation theory for non-degenerate and degenerate systems upto second order perturbation. Application to a harmonic oscillator, first order Stark effect in hydrogen atom, Zeeman effect without electron spin. Variation principle, application to ground state of helium atom, electron interaction energy and extension of variational principle to excited states. WKB approximation: energy levels of a potential well, quantization rules. Time-dependent perturbation theory; transition probability (Fermi Golden Rule), application to constant perturbation and harmonic perturbation. Semi-classical treatment of radiation. Einstein coefficients; radiative transitions.

# Books Recommended

- 1. L. I. Schiff, Quantum Mechanics (McGraw Hill).
- 2. Eugan Merzbacher, Quantum Mechanics Johan Wiley & Sons Inc.
- 3. P. M. Mathews and K. Venkatesan, A Text-Book of Quantum Mechanics (TMH)
- 4. C. Cohen-Tannoudji, Bernard Diu, Franck Loloe, Quantum Mechanics Vols-I&II (John Wiley).
- 5. J. J. Sakurai, Modern Quantum Mechanics (Addison-Wesley).
- 6. A. K. Ghatakh and S. Lokanathan, Quantum Mechanics 3<sup>rd</sup> ed. (MacMillan).
- *NOTE:-* In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-202	No. of hour per semester	52
Name of the course		Condensed M	atter Physics	
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (13	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

# Lattice Vibrations:

Genesis of elastic constants, elastic waves and velocities of waves in cubic crystals, experimental determination.

Dispersion relation of mono-atomic and diatomic chains, frequency distribution function, Van-Hove singularities. Quantization of lattice modes, high temperature and low temperature specific heat of lattice. Inelastic scattering of neutrons by phonons and conservation laws. A harmonic crystal interaction, thermal expansion and Gruneissen parameter. Thermal conductivity; lattice thermal conductivity, Umklapp process.

# Free Electron gas:

Free electron gas in three dimensions, idea of periodic boundary conditions and density of states, concept of Fermi surface. Heat capacity of electron gas and its application in metals. Electrical and thermal conductivity of metals. Mathiessen's rule and experimental view point. Motion of free electrons in magnetic field and Hall effect. Boltzmann equation; electrical and thermal conductivity of metals and insulators, thermoelectric effects, Hall effect. Magneto resistance and phonon drag.

# Section B

# **Energy Band Theory:**

Bloch theorem, electron in periodic potential and square well potential. Empty lattice approximation, concept of effective mass. Distinction between metals, insulators and semiconductors. Semiconductor: band gap, equation of motion, Zone schemes, construction of Fermi surfaces, electron hole and open orbits; Calculation of energy bands; tight binding method, Wigner-Seitz method, pseudo-potentials(qualitative only). Law of mass action in semiconductors, impurity conductivity and impurity states. Thermo-electric effect. Study and construction of Fermi surfaces by cyclotron resonance and de-Hass van Alphen effect.

# Superconductivity:

Experimental survey, occurrence, Meissner effect, heat capacity, energy gap, microwave and infrared properties, isotope effect. Theoretical survey; Thermodynamics, London equation, coherence length, BCS theory (qualitative only), BCS ground state. Flux quantization in a superconducting ring, duration of persistent currents. Type II superconductors, vortex state, estimation of  $H_{c1}$  and  $H_{c2}$ . Josephson tunneling, dc and a. c. Josephson effect, Macroscopic quantum interference.

# Section C

# **Dielectric and Ferroelectric Properties**:

Polarization, macroscopic electric field, depolarization field, local electric field at an atom, Lorentz field, field of dipoles inside cavity. Dielectric constant and polarizability Claussius - Mosseti relation. Polarizability (electronic, ionic, dipolar). Classical theory of electronic polarizability, Ferro electric crystals and their classification. Polarization catastrophe, Landau theory of phase transition. Piezo- electricity, anti- ferro electricity, ferro- electric domains, ferro-electricity.

Dielectric function of the electron gas, plasma optics and transparency of alkali metals, plasma oscillation in metals (plasmons).

# Non-Crystalline Solids:

Diffraction pattern, amorphous materials, radial distribution function Glasses, viscosity and hopping rate. Amorphous ferro-magnets and semiconductors. Low energy excitation in amorphous solids, heat capacity and thermal conductivity.

## **Point defects**:

Lattice vacancies, diffusion, color centres. Surface and interface physics; crystallography, electronic structure and surface states. Dislocation; shear strength of single crystals, slip, edge ;and screw dislocations. Burgers vector. Dislocation density, crystal growth, strength of alloys, Hume Rothery rules, phase diagrams.

# **Books Recommended**

- 1. C. Kittel: Introduction to Solid State Physics, VI Edition, (John Wiley and Sons).
- 2. N. W. Ashcroft and N. D. Mermin: Solid State Physics (H. R. W. International edition).
- 3. C. A. Wert and R. M. Thomson: Physics of Solids (McGraw Hill)
- *NOTE:-* In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-203	No. of hour per semester	52
Name of the course		Statistical	l Physics	
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1.	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

**The Fundamental Principles of Statistical Physics**: Statistical Distributions, Statistical independence, Loiuville's theorem, The significance of energy, The statistical matrix, Statistical distribution in quantum statistics, entropy, the law of increase of entropy.

**Thermodynamic Quantities:** Temperature, Macroscopic motion, Adiabatic processes, Pressure, Work and quantity of heat, The heat function, The free energy and the thermodynamic potential , Relations between the derivatives of thermodynamic quantities, The thermodynamic scale of temperature, The joule- Thomason process, Maximum work, Maximum work done by a body in an external medium, thermodynamic inequalities, Le Chatelier's principle, Nernst's theorem, The dependence of the thermodynamic quantities on the number of particles, Equilibrium of a body in an external field, Rotating bodies, Thermodynamic relation in the relativistic region.

# Section **B**

**The GIBBS Distribution**: The Gibbs Distribution, The Maxwellian Distribution, The probability distribution for an oscillator, The free energy in the Gibbs distribution, Thermodynamic perturbation theory, Expansion in powers of h, the Gibbs distribution for rotating bodies, the Gibbs distribution for a variable number of particles, The derivation of the thermodynamic relations from the Gibbs distribution.

**Ideal Gases**: The Boltzmann distribution, The Boltzmann distribution in classical statistics, Molecular collisions, Ideal gases not in equilibrium, The free energy of an ideal Boltzmann gas, The equation of state of an ideal gas, Ideal gases with constant specific heat, The law of equipartition, Monatomic ideal gases, The effect of the electronic angular momentum.

**Non- Ddeal Gases:** Deviations of gases from the ideal state, Expansion in powers of the density, Van der Waals formula, relationship of the virial coefficient and the scattering amplitude, Thermodynamic quantities for a classical plasma, The method of correlation functions, Thermodynamic quantities for a degenerate plasma. The method of correlation function, thermodynamic quantities of a degenerate plasma.

# Section C

**The Fermi And Bose Distributions** : The Fermi distribution, The Bose Distribution, , Fermi and Bose gases not in equilibrium, Fermi and Bose gases of elementary particles, A degenerate electron gas, The specific heat of a degenerate electron gas, Magnetism of an electron gas, Weak fields, and strong fields, A relativistic degenerate electron gas, A degenerate Bose gas, Black body radiation.

**Properties of Matter at Very High Density**: The equation of state of matter at high density, Equilibrium of bodies of large mass, the energy of a gravitating body, Equilibrium of a neutron sphere.

# **Books Recommended:**

- 1. L. D. Landau and I. M. Lifshitz: Statistical Physics Third Edition (Part I) (Pergamon).
- 2. R. K. Pathria, Statistical Physics (Pergamon).
- 3. David Chandler: Introduction to Modern Statistical Mechanics (Oxford University Press).
- 4. R. P. Feynmann: Statistical Mechanics (Addison Wesley).
- 5. F. Mandl, Statistical Physics (Wiley).
- 6. C. Kitlle, Elementary Statistical Physics (John Willey & Sons)
- **NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	<b>1S-204</b>	No. of hour per semester	52
Name of the course		Electrod	ynamics	
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

# **Relativistic Electrodynamics**:

Space time continuum and four vectors. Light cone. Idea of causal events. Lorentz transformation as orthogonal transformations in 4-dimensions. Four vector formulation of electrodynamics. Electromagnetic field tensor and its invariants. Invariance of Maxwell equations under Lorentz transformations and covariant formulation of Maxwell equations. Lagrangian for the electromagnetic field. Equation of motion of a charged particle in an electromagnetic field.

# Section B

# **Charged Particle dynamics**:

Non-relativistic motion in uniform constant fields, non-relativistic motion of a charged particle in a slowly varying magnetic field, adiabatic invariance of flux through an orbit, magnetic mirror. Relativistic motion of a charged particle.

# **Classical Radiation Theory**

Lienard-Wiechert potential, Field of a charge in arbitrary motion, Field produced by a charge in uniform motion, Radiated power from an accelerated charge at low velocities, Larmor's power formula, Radiation from a Charged Particle with collinear velocity and acceleration, radiation from a Charged Particle in circular motion; cyclotron and synchrotron radiation, Bremsstrahlung. Cerenkov radiation. Radiation reaction (damping) and width of spectral line. Abraham-Lorenz model of an electron and self force.

# Section C

# Scattering, Absorption and Dispersion:

Scattering of electromagnetic waves by a free electron and by bound electrons (Thomson scattering and Raleigh scattering), absorption of radiation by a bound electron, electromagnetic theory of dispersion, dispersion in dense media. Causality and dispersion relations: Kramer-Kronig relations.

#### **Plasma Physics**

Elementary concepts: Derivation of moment Equations from Bolzmann equation, Plasma Osicillations, Debye Shielding, Plasma parameter, Magnetoplasma, Plasma confinement. Hydrodynamical Description of Plasma: Fundamental equations. Hydromagnetic waves: Magnetosonic and Alfven waves. Wave Phenomena in Magnetoplasma: Polarization, phase velocity, Group velocity, cut-offs, resonance for Electromagnetic wave propagating parallel and perpendicular to the Magnetic field.

#### **Books Recommended**

- 1. S. P. Puri, Classical Electrodynamics (TMH).
- 2. J. B. Marion and M. A. Heald, Classical Electromagnetic Radiation, 2<sup>nd</sup> Ed. (Academic Press).
- 3. J. D. Jackson, Classical Electrodynamics 3<sup>rd</sup>. (Wiley Eastern).
- 4. L. D. Landau and E. M. Lifshitz, The Classical theory of Fields (Pergamon Press).
- 5. B. G. Levich, Theoretical Physics Vol. I & II (NH).
- **NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-205	No. of hour per semester	180
Name of the course		Labor	atory	
Duration of the Course	O	ne Semester	(13 Weeks)	
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

# Course X: LABORATORY

**Note:** Students are expected to do as many experiments as possible but not less than 10 experiments out of the following list doing 3 experiments from each of the sections A, B and C. Internal assessment for the laboratory course will be based on a seminar, number of experiments performed and checked after thorough viva based on the each experiment conducted by the concerned teacher/s during the semester and attendance. Marks will be posted in the copy and on the index of the copy. A record of the same will be kept in the laboratory also.

# General

- 1. Susceptibility of a given salt by Quincke's method.
- 2. B-H curve of a given material and to determine its parameters.
- 3. Band gap of a semiconductor by Four Probe Method.
- 4. Ultrasonic wave velocity in liquids by interferometer method.
- 5. Stefan's constant.
- 6. Susceptibility by Gouy's method.
- 7. Solar cell characteristics.
- 8. Dielectric constant of a liquid by dipole meter.
- 9. Ionization potential of mercury/ neon.
- 10. Wave velocity and attenuation in solids by pulse method.
- 11. Determination of specific heat of graphic at different temperatures.
- 12. Study of variation of modulus of rigidity and internal friction of a specimen rod with temperature.
- 13. Study of tunnel diode and Zener diode.
- 14. Study of frequency response of amplifiers.
- 15. Study of Oscillator circuits

# Computer based experiments

- 16. Semi classical quantization of molecular vibration.
- 17. Scattering by a central potential.
- 18. Solution of ordinary differential equation and application to order and Chaos in two dimensional motion.
- 19. Structure of white dwarf stars.

- 20. Particle motion in infinitely deep square well potential.
- 21. Scattering states in step potential and tunneling effect.
- 22. Study of ising model using monte carlo method

# M.Sc. PHYSICS (2<sup>nd</sup> SEMESTER): LABORATORY / PRACTICAL COURSE

- 1. Experiment on FET and MOSFET characterization and application as an amplifier.
- 2. Experiment on Uni-Junction Transistor and its applications.
- 3. Digital I: Basic Logic Gates, TTL, NAND and NOR
- 4. Digital II : combinational Logic
- 5. Flip-Flops.
- 6. Operational Amplifier (741).
- 7. Differential Amplifier.
- 8. Measurement of resistivity of a semiconductor by four probe method at different temperatures and Determination of band gap.
- 9. Determination of Lande's factor of DPPH using Electron Spin Resonance (ESR) spectrometer.
- 10. Measurement of Hall coefficient of given semicoundutor: Identification of type of semiconductor and estimation of charge carrier concentration.
- 11. To study the fluorescence spectrum of DCM dye and to determine the quantum yield of fluorescence maxima and full width at half maxima for this dye using monochromator.
- 12. To study Faraday effect using He-Ne-Laser.

# M.Sc. Physics (2<sup>nd</sup> Semester): Tutorial : Laboratory / Practical Course This is only a suggestive list, the faculty concerned can add more topics as per the need of the students

- 1. Effect of capacitance and load resistance on output of an amplifier.
- 2. Integrated circuit timer familiarization.
- 3. Op-amp differentiator.
- 4. Multiplexers and Demultiplexers.
- 5. Registors and Counters
- 6. Radiation level and activity measurement.
- 7. Shielding, mass absorption coefficient.
- 8. Coincidence circuits, counters, timers.
- 9. Coherence and it's relevance in diffraction.
- 10. Identification of charge type by Hall voltage measurement.
- 11. How does four probe method solve the problem of contact resistance?

Course Code	PHYN	1S-206	No. of hour per semester	52
Name of the course	COMPUTE (Nodal Cent	R APPLICA	TIONS IN PHYSIC rse)	S
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section A

# **Recent trends**:

Multimedia and its applications. Essentials of a web page, HTML and its features Essentials of parallel computation and features of parallel programming.

# Section B

# **Object Oriented Programming** (C++):

**OOP fundamentals:** objects, classes, encapsiulation, abstraction, inheritance, polymorphism, reusability, overloading.

# **Structure of a C++ program:**

Variables, data types, identifiers, declaration of variables, scope of variables, initialization of variables, strings as non-numerical variables, constants. Operators. Basic input/otput functions. Control structure: if and else, for , while, do while, break, continue, goto, exit, switch. Functions, scope of variable in a function, void, argument passing (by value, by refrence) overloaded functions), void, inline function, recursivity, declaring functions. Arrays: initializing arrays, multidimensional arrays, arrays as parameters, character sequences: null terminated character sequences. Pointers: refrence operator (&), de-refrence operator (\*), declaring variables of pointer types, pointers and arrays, pointer initialization, pointer arithmetic, pointers to pointers, void pointers, null pointers, pointers and

functionsData structures, pointers to structures, nesting structures, other darta types (typedef, unions, enumerations

**Classes, function templates and preprocessor directives:** Classes, constructors and destructors, overloading constructors, deconstructors, overloading constructor, default constructor, pointers to classes, classes defined with stuct and union. Overloading operator, keyword this, static numbers Friendship function, friend classes, inheritance between classes, multiple inheritance. Polymorphism, pointers to base class, virtual number, abstract base classes, Function templates, class templates, template specialization, name space alia, std, exceptions. Type casting. Preprocessor directives

# Section C

# **Applications III**:

Initial value and boundary value problems (2-dim), Matrix operations, inversion, eigen functions and Eigen values. Monte Carlo method: Basic strategy, generating random numbers, evaluation of two and three dimensional integrals.

# Programming exercises (at least ten).

# References:

- 1. Let Us C, Kanetkar.
- 2. Let Us C++ Kanetkar
- 3. The ANSI C Programming Language, Keringhan and Ritchie, Prentice Hall of India Ltd.
- 4. C by Example, Noel Kalicharan, Cambridge University Press.
- 5. Computer Oriented Numerical methods, V. Rajaraman
- 6. Elements of Parallel processing, V Rajaraman
- 7. Computational Physics: An Introduction, R.C. Verma, P.K. Ahluwalia, K.C. Sharma, New Age International Limited.
- *NOTE:-* In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No.1 (compulsory) and selecting at least one question from each section A, B and C.

**Computer applications**: Exercises (suggested) on COURSE II to be implemented in Nodal Center for Computer Applications

Developing following basic programs in C++

- 1. Inversion of matrix
- 2. Diagonalization, eigenvalue and eigen functions
- 3. Solution of oscillator (undamped and damped )problem
- 4. Motion of a projectile
- 5. Initial value problems Boundary value problems (2 and 3-dim)
- 6. MC method: generation of random numbers
- 7. Evaluation of two dimensional integral
- 8. Evaluation of three dimensional integrals.

- 9. Write a program to study the electromagnetic oscillations in an LCR circuit using Runge Kutta Method
- 10. To study phase trajectory of a chaotic pendulum
- 11. Use Monte Carlo method to study nuclear radioactivity and modifying it to include the case of an unstable daughter nuclei.
- 12. To study the motion of a satellite around earth under central force field.

# Note on COURSE I, II on Computer Applications in Physics

- 1. Both these courses are pre-requisite to the main course.
- 2. Admission to these courses be made at the time of admission to M.Sc.
- 3. Exemption is allowed only to those students who have the requisite background.
- 4. Students in these courses be examined at the end of the year
- 5. These courses must be cleared by the students, marks scored in these will not be counted towards division.

# **SEMESTER III**

Course Code	PHYN	<b>IS-301</b>	No. of hour per semester	52
Name of the course		Quantum Me	echanics - II	
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

# Scattering Theory:

General considerations; kinematics, wave mechanical picture, scattering amplitude, differential and total cross-section. Green's function for scattering. Partial wave analysis: asymptotic behaviour of partial waves, phase shifts, scattering amplitude in terms of phase shifts, cross-sections, Optical theorem. Phase shifts and its relation to potential, effective range theory. Application to low energy scattering; resonant scattering, Breit-Wigner formula for one level and two levels, non-resonant scattering. s-wave and p-wave resonances. Exactly soluble problems; Square-well, Hard sphere, coulomb potential. Born approximation; its validity, Born series.

# Section B

#### **Identical Particles**:

The Schrodinger equation for a system consisting of identical particles, symmetric and antisymmetric wave functions, elementary theory of the ground state of two electron atoms; ortho-and para-helium. Spin and statistics connection, permutation symmetry and Young tableaux. Scattering of identical particles.

# **Relativistic Klein- Gordon Equation:**

Generalization of the Schrodinger equation; Klein-Gordon equation, plane wave solutions, charge and current densities, interaction with electromagnetic fields, Hydrogen-like atom (to show it does not yield physical spectrum), non-relativistic limit. Extension of Klein-Gordon equation to spin 1 particles.

# Section C

# **Relativistic Dirac Equation:**

Dirac Equation; relativistic Hamiltonian, probability density, expectation values, Dirac gamma matrices, and their properties, non-relativistic limit of Dirac equation. Covariance of Dirac equation and bilinear covariance, plane wave solution, energy spectrum of hydrogen atom, electron spin and magnetic moment, negative energy sea, hole interpretation and the concept of positron. Spin-orbit coupling, hyperfine structure of hydrogen atom.

**Quantization of wave fields**: The procedure for quantization of wave fields, quantization of non-relativistic Schrod-inger equation, second quantization, N-representation creation and annihilation operators.

# **Books Recommended**

- 1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics (TMH)
- 2. A. S. Davydov, Quantum Mechanics (Pergamon).
- 3. L. I. Schiff, Quantum Mechanics (McGraw Hill).
- 4. J. D. Bjorken and S. D. Drell, Relativistic Quantum Mechanics (McGraw Hill).
- 5. J. J. Sakurai, Advanced Quantum Mechanics (Addison Wesley).
- *NOTE:-* In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-302	No. of hour per semester	52
Name of the course	Material Science			
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1.	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section A

# Magnetic Properties:

Langevin theory of diamagnetism, quantum theory of para-magnetism (rare earth, Hund's rule, Iron group ions). Crystal field splitting and quenching of orbital angular momentum. Cooling by adiabatic demagnetization of a paramagnetic salt. Nuclear demagnetization. Paramagnetic susceptibility of conduction electrons.

Ferro and anti ferromagnetic order and molecular field theory. Exchange interaction, classical derivation of spin wave dispersion relations in ferro, anti-ferromagnetic systems and thermodynamic properties.

Ferromagnetic domain, anisotropy energy and Block wall. Coercive force and hysteresis, magnetic bubble domains.

Nuclear magnetic resonance and relaxation times. Ferro and anti-ferromagnetic resonance. Principle of Maser action, three level maser, Ruby laser. Semiconductor junction lasers.

# Section B

# Phase Diagrams and Phase Transformation

Definitions and Basic concepts: solubility limit, phase, microstructure, phase equilibria, onecomponent phase diagrams, Binary phase diagrams: binary isomorphous systems, interpretation of phase diagrams, development of microstructure in isomorphous alloys and their mechanical properties, binary eutectic systems and development of microstructure in eutectic alloys, equilibrium diagrams having intermediate phases, eutectoid and peritectic reactions, congruent phase transformations, ceramic and ternary phase diagram, the Gibbs phase rule, Phase transformations: basic concepts, the kinetics of phase transformations, metastable versus equilibrium states, isothermal and continuous cooling transformation diagrams and tempered martensite

# Section C

# **Materials Characterization Techniques**

Principles of X-ray Photometery Spectroscope (XPS) and Anger electron Spectroscopy (AES), Instrumentation, Routine limits of XPS, Applications of XPS & AES.

Scanning Tunneling Microscopy (STM): Working principle, Instrumentation, Modes of operation

Atomic Force Microscopy (AFM): Introduction, Working Principle Instrumentation Modes of operation Difference between STM and AFM

X-ray Characteristics and Generation, lattice planes and Braggs law, Powder diffraction, Transmission Electron Microscopy (TEM) : Basic of TEM, Reciprocal Lattice, Specimen Preparation Bright Field and Dark Field Images Electron energy Loss Spectroscopy. Scanning Electron Microscopy: Introduction,: Infrared (IR) spectroscopy, Ultraviolet (UV) and visible spectroscopy. Mössbauer Spectroscopy Basic theory, experimental set up and Mössbauer parameters.

# **Books Recommended**

- 1. C. Kittel: Introduction to Solid State Physics 6<sup>th</sup> Edition (Wiley). A,
- 2. W. Ashcroft and N. D. Mermin: Solid State Physics (H. R. W. International Edition, 1976).
- 3. C. A. Wert and R. M. Thomson: Physics of Solids (McGraw Hill).
- 4. William D. Callister, Jr.: Callister's Materials science and Engineering, Wiley India (P) Ltd.
- 5. S. Somiya et al. : Hand Book of Advanced Ceramics Vol. I & II
- 6. Sam Zhang, Lin Li and Ashok kumar: Materials Characterization Techniques
- **NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	AS-303	No. of hour per semester	52
Name of the course	Nuclear Physics			
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section: A

**Nuclear Masses and Nucleon-Nucleon Interaction:** Analysis of nuclear masses, nuclear mass formula, stability of nuclei, beta decay and double beta decay. Properties of nuclear states: quantum numbers, angular momentum. Parity. Isotopic spin (isobaric spin, isospin), deuteron problem.

**Nucleon-Nucleon Interaction**: Exchange forces and tensor forces, Meson theory of nuclear forces, Nucleon-Nucleon scattering, Spin dependences of nuclear forces, Effective range theory, Symmetry and nuclear force, Isospin invariance and operator general form of the nuclear potential, Yukawa theory of nuclear interaction.

# Section: B

**Nuclear Structure**: The Nuclear Shell, Shell Model Potential and Magic Numbers, Spin-Orbit couplings, Valence Nucleons and Ground State Spin of Nuclei, collective structure of Odd-A nuclei, The Nuclear Collective Model: Nuclear Collective Vibrations, Nuclear Collective Rotation, Single-particle motion in a deformed potential

# Section: C

**Nuclear Reaction:** Types of nuclear reactions, wave function and scattered waves, differential cross-sections, coupled equations and scattered potential, Partial waves, total differential cross-sections and Optical theorem. Optical Potential- average interaction potential for nucleons, energy dependence of potential, Compound nucleus formation

and direct reactions, Compound resonances, Berit-Wigner formula, Inverse reactions(Reciprocity Theorem).

# **Reference books**:

- 1 B.L. Cohen, Concepts of Nuclear Physics, (TMH).
- 2 K.S. Krane, Introductory Nuclear Physics (John Wiley & Sons).
- 3 S.S.M. Wong, Introductory Nuclear Physics (Printice Hall of India)
- 4 R.R. Roy and B.P. Nigam, Nuclear Physics (New Age International, 2000).
- **NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-304	No. of hour per semester	52	
Name of the course	High Energy Physics				
Duration of the Course	One Semester (13 Weeks)				
Lectures to be Delivered	<b>39 ( 13 X 3)</b>				
Tutorial	13 (13 X 1)				
Semester End Examination	Total Maximum Marks = 100		Pass Marks		
	Theory	MM 80	32		
	Internal Assessment	MM 15	06		
	Attendance	MM 5			

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section : A

Kinematics of Scattering Interaction Picture, Scattering Matrix, Two and Three body phase space, Space- time symmetries, Invariance Principles, Parity, Intrinsic party, Party constraints on the S- Matrix for Hadronic Reactions, Time – Reversal Invariance, Principle of Detailed Balance, Nucleon – Nuclean Scattering Amplitudes, Unitarity constraints Internal symmetries, Selection Rules and Globally conserved Quantum Numbers, Isospin, , Charge Conjugation, G- parity, CP and CPT Invariance.

# Section: B

Unitary Groups, Isospin and SU (2), SU (3), Particle Representation' SU (3), U-spin, V-spin Irreducible Representations of SU (3), Applications of Flavor SU(3), Mass Splitting in Flavor SU (3), Quark Model, Gell- Mann Okubo Mass Formula

# Section: C

Weak Interactions, Classification of weak Interactions; Leptonic Semi- Leptonic and Non- Leptonic Decay, Tau- Theta Puzzle, Parity Violation in Weak Decays Selection Rules:  $\Delta S = \Delta Q$  rule for Semileptonic Decays,  $\Delta I = \frac{1}{2}$  rule for hadronic decays, Universality of Weak Interactions, Fermi Theory of weak interactions, Intermediate Vector – Boson Hypothesis, Helicity of Neutrino, Two Component Theory of Neutrino, KoKo Mixing and CP Violation, KoKo Regeneration.

#### **Text and reference Books:**

- 1. A Modern Introduction to Particle Physics, Riazuddin and Fayyazudi.
- 2. Particle Physics, S. Gasiorowkz
- 3. Particle Physics : An Introduction, M. Leon (Academic Press).
- 4. Unitary Symmetry P. Carruthers.
- 5. Nuclear and Particle Physics W.E. Burcham and M. Jobes (Addision Wisely)
- **NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYN	1S-305	No. of hour per semester	180		
Name of the course	Laboratory					
Duration of the Course	One Semester (13 Weeks)					
Semester End Examination	Total Maximum Marks = 100		Pass Marks			
	Theory	MM 80	32			
	Internal Assessment	MM 15	06			
	Attendance	MM 5				

# Course XV Laboratory

**Note:** Students are expected to do as many experiments as possible but not less than 10 experiments out of the following list doing 3 experiments from each of the sections A, B and C. Internal assessment for the laboratory course will be based on a seminar, number of experiments performed and checked after thorough viva based on the each experiment conducted by the concerned teacher/s during the semester and attendance. Marks will be posted in the copy and on the index of the copy. A record of the same will be kept in the laboratory also.

# Section A

- 1. Michelson Interferometer and thickness of mica sheet
- 2. Fabry-Perot Interferometer.
- 3. G. M. Counter (a) characteristics (b) dead time (c) statistical distribution of counting rate.
- 4. End point energy of beta spectrum.
- 5. Proportional counter and low energy gamma ray measurements.
- 6. Hall effect.
- 7. Lecher wire: dielectric constant of a solid and a liquid.
- 8. Magneto resistance.
- 9. Determination of specific heat of solids (metals and alloys).
- 10. Fourier analysis of a complex signal.
- 11. Simulation of lattice dynamics of a mono-atomic and diatomic lattice.
- 12. Determining the laser beam characteristics (power distribution, beam spot size, divergence of laser beam, depth of field, beam waist, quality of laser beam, spatial coherence of beam)
- 13. Fraunhoffer diffraction (single slit, double slit, circular aperture)
- 14. Determining thickness of a thin wire by diffraction using laser beam
- 15. Measure the wave length of laser light with transmission grating.
- 16. Measurement of thread angle, pitch and diameter of screw using laser beam
- 17. Study reflection, laws of reflection, internal reflection, critical angle, index of refraction of glass, index of refraction of prism, multiple internal reflection in glass and interference

# Section B

- 12. Characteristics of lumped transmission line.
- 13. Modulation and demodulation: A.M. and F.M.
- 14. Designing and study of OPAMP: characteristic and parameter measurements.
- 15. OPAMP as (a) an active filter and frequency response (b)basic mathematical operations using OPAMP.
- 16. Study of multi vibrators (a) a stable (b) bi-stable (c) mono-stable.

17. Study of polarization using laser beam (measurement of state of polarization of light wave, measurement of brewster's angle of glassplate, verification of Maul's law

- 18. To study magneto-optic rotation and magneto optic modulation.
- 19. To create hologram of a given object

# Section C

# (Computer based experiments)

- 17. Boundary value and eigen-value problems.
  - (a) stationary solution of one dimensional Schrodinger equation
  - (b) atomic structure in HF approximation.
- 18. Special functions and Gaussian quadrature:(a) partial wave solution of quantum scattering (b) Born and eikonal approximation in quantum scattering.
- 19. Plotting of radial eigen function of harmonic oscillator.
- 20 Fast fourier transforms of some simple functions.
- 21. Simulation of an order disorder phase transition for a three states potts model

# UGC M.SC. Physics (III Semester): Laboratory/Practical Course

# (a) CONDENSED MATTER PHYSICS

- 1. Measurement of lattice parameters and indexing of powder photographs.
- 2. Interpretation of transmission laue photographs.
- 3. Determination of orientation of a crystal by back reflection Laue method.
- 4. Rotation/oscillation photographs and their interpretation.
- 5. To study the modulus of rigidity and internal friction in metals as a function of temrature.
- 6. To measure the cleavage step height of crystal by Multiple Fizeaue fringes.
- 7. To obtain Multiple beam Fringers of Equal Chromatic order. To determine crystal step height and study birefringence.
- 8. To determine magnetoresistance of a Bismuth crystal as a function of magnetic field.
- 9. To study hysterisis in the electrical Polarization of a TGS crystal and measure the Curie temperature.
- 10. To measure the dislocation density of a crystal by etching.

# (a I) CONDENSED MATTER PHYSICS

- 1. Study of X-ray diffraction from liquid, amorphous materials.
- 2. Determination of dislocation density by Reflection X-ray topography.
- 3. To take Buerger Precession photograph of a crystal and index the reflections.

- 4. To measure the superconductivity transition temperature and transition width of high-temperature superconductors.
- 5. To determine the optical constants of a metal by reflection of light.
- 6. Model evaluation of dispersion curves of one-dimensional lattice.

# (b1) ELECTRONICS

- 1. Pulse Amplitude Modulation/Demodulation
- 2. Pulse position/Pulse Width Modulation/Demodulation
- 3. FSK Modulation Demodulation using Timer/PLL
- 4. Microwave characterization and Measurement
- 5. PLL Circuits and applications
- 6. Fibre Optics communication
- 7. Design of Active filters
- 8. BCD to Seven Segment display
- 9. A/D and D/A conversion
- 10. Experiments using various types of memory elements
- 11. Addition, Subtraction, Multiplication & Division using 8085/8086
- 12. Wave form generation and storage oscilloscope
- 13. Frequency, Voltage, Temperature measurements
- 14. Motor Speed control., Temperature control using 8086.
- 15. Trouble shooting using signature analyzer.
- 16. Assemble language programming on PC.
- 17. Experiments based on computer Aided Design.

Setting up of new experiments will form tutorial for this laboratory course.

# (CI) NUCLEAR AND PARTICLE PHYSICS

- 1. To determine the operating voltage, slope of the plateau and dead time of a G.M. counter.
- 2. Feathers' analysis using G.M. Counter.
- 3. To determine the operating voltage if a –photomultiplier tube and to find the photopeak efficiency of a Nal (Tl) crystal of given dimensions for gamma rays of different energies.
- 4. To determine the energy resolution of a Nal(Tl) detector and to show that it is independent of the again of the amplifier.
- 5. To calibrate a gamma ray spectrometer and to determine the energy of given gamma ray source.
- 6. To determine the mass attenuation coefficient of gamma rays in a given medium.
- 7. To study the Compton scattering using gamma rays of suitable energy.
- 8. To study the various modes in a multichannel analyzer and to calculate the energy resolution, energy of gamma ray.
- 9. To determine the beta ray spectrum of Cs-137 source ad to calculate the binding energy of k- Shell electron of Cs-137.
- 10. To study the Rutherfold scattering using aluminum as scatterer and Am-241 as a source.
- 11. To measure the efficiency and energy resolution of a HPGe detector.
- 12. Alpha spectroscopy with surface barrier detector Energy analysis of an unknown gamma source.
- 13. Determination of the range and energy of alpha particles using spark counter.

- 14. The proportional counter and low energy X-ray measurements.
- 15. X-ray fluorescence with a proportional counter.
- 16. Neutorn activation analysis.
- 17. Gamma gamma coincidence studies.
- 18. Identification of particles by visual range in nuclear emulsion.
- 19. Construction and testing of a single channel analyzer circuit.
- 20. Decoding and display of the outputs from the IC 7490.
- 21. To observe Mossbauer effect in a nonmagnetic and a magnetic environment and to deduce nuclear magnetic moments.

# **Text and Reference Books**

S.S.Kapoor and V.,S. Ramamurthy, nuclear Radiation Detectors, Wiley Eastern Ltd, new Delhi, 1986.

R.M. Singru, Introduction to Experimental nuclear Physics, John Wiley & Sons 1974. Alpha, Beta and gamma Ray Spectroscopy, K. Siegbah, North – Holland, Amsterdam, 1965. W.H. Tait, Radiation Detection, Butterworths, London, 1980.

K. Sriram and Y.R.Waghmare, Introduction to Nuclear Science and Technology, A.M. Wheeler, 1991.

Nicholson, nuclear Insturmentation.

# (e) NUCLEAR AND PARTICLE PHYSICS

- 1. Mounting a Scintillation Crystal to a Photomultiplier Tube.
- 2. Pulse Cable making
- 3. Pulse Shaping with an RC Circuit and to Display with an Oscilloscope.
- 4. Training in the Usage of oscilloscope and Electronic Meters Sensitivity and Resolutin Study.
- 5. Usage of Radiation Monitors.
- 6. Setting up the Gamma Ray spectrometer
- 7. Photoelectric Effect, Compton Effect, Pair Production and Back Scattering
- 8. Discriminators
- 9. Pulse height as a Function of Applied Voltage for Gas Counters
- 10. Proportional Counter Characteristics
- 11. Scintillation Process in Intrinsic and Extrinsic Inorganic Crystals and Organic Crystals
- 12. Signal Formation in Solid State Devices
- 13. Neutron Activation Analysis

# **SEMESTER IV**

Course Code	PHYN	<b>IS-401</b>	No. of hour per semester	52	
Name of the course	Electronics –II				
Duration of the Course	One Semester (13 Weeks)				
Lectures to be Delivered	39 ( 13	<b>3</b> X 3)			
Tutorial	13 (1	3 X 1)			
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks		
	Theory	MM 80	32		
	Internal Assessment	MM 15	06		
	Attendance	MM 5			

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A:

Analog and Digital System: Analog Computation, Active Filters, Comparators, Logarithmic and Anti–Logarithmic Amplifiers, Sample and Hold Amplifiers, Waveform Generators, Square and Triangular Wave Generators, Pulse Generators. Read only Memory (ROM) and Applications, Random Access Memory (RAM) and applications, Digital to Analog Converters, Ladder and weighted type Analog to Digital Converters, Counter type, Successive Approximation and Dual Slope Converters, Application of Digital to Analog converter (DACs) and Analog to Digital Converter (ADCs)

# Section B:

# **Digital Communications**

**Pulse-Modulation Systems**: Sampling Theorem, Low-Pass and Band-Pass signals, PAM, Channel BW for a PAM Signal, Flat-top sampling, Signal recovery through Holding, Quantization of Signals, Quantization, Differential PCM, Delta Modulation, Adaptive Delta Modulation Continuously Variable Slope Delta Modulator (CVSD).

**Digital Modulation Techniques:** Binary Phase-Shift Keying (BPSK), Differential Phase-Shift Keying (DPSK), Quadrature Phase-Shift Keying (QPSK), Phase-Shift Keying (PSK), Quadrature Amplitude Shift Keying (QASK), Binary frequency Shift Keying (BFSK), Frequency Shift Keying (FSK), Minimum Shift Keying (MSK).

# Section C:

**Fabrication of Integrated Devices**: Thin Films Deposition Techniques: Vacuum Pump and Gauges-Pumping Speed throughout, Effective Conductance Control, Chemical Vapor Deposition (CVD), MOCVD, PEMOCVD (Plasma Enhanced Chemical Vapor Deposition), Physical Vapor Deposition: Thermal Evaporation, Molecular Beam Epitaxy (MBE), Sputtering, Laser Ablation, Chemical Solution Techniques: Sol gel, Hybrid, Metal Organic. Lithography, Etching and Micro-machining Silicon, Fabrication of Integrated Circuits and Integrated Micro-Electro-Mechanical Systems (MEMS).

# **Text and References Books**

- 1. Microelectronics by Jacob Millman, Megraw-Hill International Book Co.New Delhi, 1990.
- 2. Taub and Schilling, Princiles of Communication Systems, Second Edition, TMH, 1994.
- 3. Thin Films Phenomenon by K.L. Chopra
- 4. The material Science of Thin films, Milton S. Ohring.
- 5. Deposition Techniques for films and coating R.F. Bunshah (Noyes Publications).
- **NOTE:-** In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.
| Course Code              | PHYMS                  | S-402(a)      | No. of hour per<br>semester | 52 |
|--------------------------|------------------------|---------------|-----------------------------|----|
| Name of the course       | Advanced H             | ligh Energy   | Physics                     |    |
| Duration of the Course   | O                      | ne Semester   | (13 Weeks)                  |    |
| Lectures to be Delivered | 39 ( 13                | 3 X 3)        |                             |    |
| Tutorial                 | 13 (1.                 | 3 X 1)        |                             |    |
| Semester End Examination | Total Maximu           | m Marks = 100 | Pass Marks                  |    |
|                          | Theory                 | MM 80         | 32                          |    |
|                          | Internal<br>Assessment | MM 15         | 06                          |    |
|                          | Attendance             | MM 5          |                             |    |

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

### Section: A

Symmetries and Conservation Laws, Noether's theorem, U(1) gauge invariance baryon and Lepton Number Conservation Global and Local Gauge Invariance, Spontaneous Breaking of Global gauge invariance, Goldstone Bosons, Higgs Mechanism, Generalized Local gauge invariance, Ablian and Non Abelian gauge invariance.

### Section : B

Weinberg- Salam Theory of Electroweak Unification, the matter fields, the gauge fields, The gauging of SU (2) X U (I), the Vector Bosons, the fermion sector, Helicity States, Fermion Masses, Fermion Assignments in the electroweak model, Spontaneous Symmetry Break down, Fermion Mass Generation, the Color gauge theory of Strong interactions.

### Section : C

SU (5) Grand Unified Theory, the generators of SU (5), The Choice of fermoin representations Spontaneous Breaking of SU (5) Symmetry Fermion Masses and Mixing Angles, the Classic Predictions of SU(5) Grand Unified Theory Quark-lepton Mass Relations in SU(5).

### **Text and Reference Books:**

- 2. Modern Elementary Particles Physics, G.L.Kane (Addison Wesley).
- 3. Gauge Theories of Strong, Weak and Electromagnetic Interactions C. Quigg ( Addison-Wesley)
- 4. Grand Unified Theories Graham Ross (Addison Wesley)
- 5. Gauge theory of Elementary Particles Physics, P.P. Cheng and Ling Fong Li.
- 6. Gauge Field Theories, Paul H. Frampton (Addison Wesley)
- 7. Gauge Field theories J. Leite Lopes, Pergamon Press.
- NOTE:- In all, 10 questions will be set. Question No.1will cover the entire syllabus and will be of objective/ short answer type. The remaining 9 questions will be set taking three questions each from Sections A, B and C. The student will attempt 5 questions in all, including question No. 1 (compulsory) and selecting at least one question from each section A, B and C.

Course Code	PHYMS	5-402 (b)	No. of hour per semester	52
Name of the course	Nuclear & Particle Astrophysics			
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section: A

The observational basis of Nuclear Astrophysics, The importance of the four fundamental interactions, A Brief Description of the Observed Universe, The Origin of the Universe: The Hadron Era, the Lepton Era, The Radiation Era; the Stellar Era: Stellar Evolution: the Hertzsprung- Russel Diagram, Evolution of Stars: The Chemical Composition of the Observable Universe, Techniques for Abundance Determination: The Direct and Indirect Methods; The Abundances of Elements in the Universe, The main Sequence Stars.

# Section: B

Thermonuclear and Nuclear Reactions in Stellar Interiors; Nuclear Reactions: Generalities; Nuclear Reaction Rates; Hydrogen burning: The Proton Proton chain or PPI Chain, the Proton chains with a He Catalyst or PP II and PP III Chains; The CNO Cycle, Helium burning, Hydrostatic C,O and Si Burning Explosive Nucleosynthesis in stars, Supernovae: the Fe Photodisintegration Mechanism, the C Detonation Mechanism, The Neutrino Transport Mechanism, Deceleration of the Central Pulsar, The Helium Flashes, the Novae Outbursts Explosions of Supermassive Stars, The Explosive Nucleosynthesis Explosive Burning in H and he burning Zones, Explosive Nucleosynthesis in C,O and Si burning Zones, Formation of the heavy Elements, Abundances of the Heavy Elements- Processes of Neutron Capture, Neutron Capture Reactions. The S-process, The p- process: Weak Interaction Mechanism Spallation Reactions, thermonuclear Reactions.

# Section : C

Nucleosynthesis of Light Elements, the Abundances of Light Elements, the Spattation Reaction, Production of Li, Be, B by the galactic Cosmic Rays, Light Element Production in Stellar interiors and Supernovae explosions Big Bang Nucleosynthesis; the Basic Assumptions, the Standard Model of the Universe, The Cosmdogical principle and the expansion of the Universe, thermal Equilibrium, The Radiation Era , Freeze out, Cosmological Limits on Neutrino Mass, Primordial Nucleosynthesis, Helium Production, Bounds on the number of light neutrinos, Cosmological Bounds on Heavy Neutrinos, baryon Asymmetry of the Universe, The Baryon Number generation, the Cosmological Constant, The Inflationary Universe.

Recommended Books

- 1. An Introduction to Nuclear Astrophysics, Jean Audouze and Sylvte Vaudair.
- 2. The Early Universe, E.W. Kolb and M.S. Turner (Addision Wesley)
- 3. An Introduction to Modern Stellar Astrophysics D.A. Ostlie and B.W. Carroll, Addision Wesley (2007)
- **NOTE:**-In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	5-402 (C)	No. of hour per semester	52
Name of the course	Advanced Quantum Mechanics			
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (13 X 1)			
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

### Section A

**Quantization of fields**: Quantization of neutral and complex scalar fields, U (1) gauge invariance Quantization of Dirac field covariant anticommutation relations, Quantization of electromagnetic field. Interaction Lagrangion for the fields, QED lagrangian.

# Section B

**Scattering Matrix and Feynman Rules**: The S-Matrix reduction of S- Matrix chronological product, Wicks theorem Furry's theorem Covariant perturbation theory interaction lagrangian for QED, Feynman Diagrams and Feynman rules for QED in configuration and momentum space, Electron- Positron scattering, Coulomb scattering of Electrons, electron – positron annihilation, Compton scattering.

### Section C

**Renormalization of QED**: Self energy correction, vacuum polarization and vertex correction, classification of Divergences, Renormalization of mass and charge, wave function renormalization .

### **Reference :**

- 1. Theory of photons and electrons, J.M. Jauch and E.Rohrlich
- 2. Relativistic Quantum field, J.D. Bjorkern amd S.D.Drett.
- 3. Quantum electrodynamics, A.I. Akhiezer and Berestetskl
- NOTE:-In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	5-403 (a)	No. of hour per semester	52
Name of the course	Nano Physics			
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximum Marks = 100		Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

### Section : A

### **Bulk Nanostructured Materials**

**Solid Disordered Nanostructures**: Methods of synthesis, Failure Mechanism of Conventional Grain-Sized Materials, Mechanical Properties, Nanostructured Multilayers, Electrical Properties, Other properties, Metal Nanocluster Composite Glasses, Porous Silicon

**Nanostructure Crystals**: Natural Nanocrystals, Computational Prediction of Cluster Lattices, Arrays of Nanoperticles in Zeolities, Crystals of Metal Nanoparticles, Nanoparticle Lattices in Colloidal Suspensions, Photonic Crystals

### Section : B

### Nanostructures Ferromagnetism

Basic of ferromagnetism, Effect of Bulk nanostructuring of Magnetic properties, Dynamics of nanomagnets, Nanopore Containment of magnetic particles, Nanocarbon ferromagnets, Giant and colossal Magnetoresistance, Ferrofluids

### Quantum Wells, Wires, and Dots

Introduction, Preparation of Quantum Nanostructures, Size and Dimensionality effects: size effect, conduction electrons and dimensionality, F`ermi gas and Density of States, Potential wells. Partial confinement, properties dependent and desntiy of states.

## Synthesis of Nnaomaterials-I (physical methods)

Introduction, Mechanical methods, methods based on evaporation, sputter deposition, chemical vapour deposition, electric arc deposition, ion beam techniques (ion implanataion), Molecular beam epitaxy (MBE)

### Section : C

### Synthesis of Nnaomaterials-I (Chemical methods)

Introduction, Colloids and Collids in solutions, Growth of Nanoparticles, Synthesis of Metal Nanoparticles by Collodal Route, Synthesis of semiconductor nanoparticles by colloidal route, Langmuir-Blodgett (L-B) methods, microemulsions, sol-gel method

### Some special nanomaterials

Introduction, Carbon nano tubes, ordered porous materials using micelles as tempelates, self assembled nanomaterials, core sell particles.

## **Text and Reference Books**

1 NANOTECHNOLOGY: PRINCIPLES AND PRACTICES (Sulabha K. Kulkarni, Capital publishing company)

2.INTRODUCTION TO NANOTECHNOLOGY (Charles P. Poole, Jr. Frank J. Owens: Wiley INDIA)

3. Nanostructured Materials (Jackie Y. Ying: Academic Press)

**NOTE:**- In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5 questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	S-403 (b)	No. of hour per semester	52
Name of the course	Mesoscopic Physics			
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section: A

Preliminary concepts: Two dimensional electron gas, effective mass, density of states, characteristic lengths, low and high field magneto resistance, transverse modes, drift velocity, fermi velocity

Conductance from transmission: Resistance of ballistic galvanometer, Landauer Formula, Launder buticker formalism

Transmission function, S-matrix and green's functions, tight binding model, self energy, relation to other formalisms, feynman paths

# Section: B

Quantum hall effect, origin of zero resistance, effect of back scattering Brief remarks on fractional quantum hall effect.

Localization and fluctuations: localization length, weak localization, effect of magnetic field, cundctance fluctuations, diagrammatic perturbation theory

Double barrier tunneling: coherent resonat tunneling, effect of scattering, single electron tunneling

# Section: C

Optical analogies: Electrons and phonons: conceptual similarities, linear optics, non-linear optics, coherent sources

Non-equilibrium green function formalism: correlation and scattering functions, self energy and green's function, kinetic equation, calculating the self energy, solution procedure, current

flow and energy exchange, relation to Landauer Butticker formalism, relation to Boltzmann formalism, strongly interacting systems, resonant tunneling with phonon scattering.

## **References**:

- 1. Introduction to Mesoscopic Physics, Y Imry, Oxford University Press (2001)
- 2. Electronic Transport in Mesoscopic Systems, Supriya Dutta, Cambridge University Press
- 3. Quantum Transport: Atom to Transistor, Supriya Dutta, Cambridge University press.

**NOTE:**- In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5 questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	-403 ( C )	No. of hour per semester	52
Name of the course	Advanced Computational Physics			
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	<b>MM 5</b>		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section A

Concepts of deterministic and stochastic simulation methods, limitations of simulational physics, percolation, percolation threshold, cluster labeling, critical exponents, fractal dimension, regular fractals and self similarity, fractal growth processes. One particle system moving in a spring potential.

### Monte Carlo Method (Stochastic Methods)

Random walk on one, two and three dimensional lattices, self-avoiding walk, microcanonical ensemble monte carlo method (Case Study: one dimensional ideal gas, Ising Model, heat flow), Canonical ensemble monte carlo method (Metropolis method, classical ideal gas, ising model, hard rods), isothermal-isobaric ensemble monte carlo method, grandcanonical ensemble monte carlo method

### Section B

### **Molecular Dynamics (Deterministic Methods)**

Molecular Dynamics as deterministic simulation, integration schemes (euler, predictor corrector, verlet), calculating thermodynamic quantities, organization of simulation, microcannonical ensemble molecular dynamics (case study: monoatomic particle system interacting via lennard jones potential), canonical ensemble molecular dynamics (case study: isokinetic simulation of a system of monoatomic particle system using lennard jones potential), isothermic-isobaric ensemble molecular dynamics (case study: simulation of a

system of monoatomic particle system using lennard jones potential at constant temperature and constant pressure). Brief discussion of Anderson scheme and Nose scheme.

# Section C

# Symbolic Computing:

Symbolic Computing Systems, Basic symbolic mathematics, computer calculus, Linear systems, Non-linear systems, Differential equations, Computer graphics, Dynamics of a flying sphere. Basics of Mathematica: numerical computations, algebraic computations, calculus, graphics, Procedural programming

**High Performance Computing**: The basic concept, High performance computing systems Parallelism and Parallel computing, Data parallel programming, Distributed computing and message passing, Some current applications.

## Computing Hardware Basics: Memory and CPU

Components: Memory Hierarchy, The Central Processing unit

**CPU Design:** RISC, CPU Design; Vector Processing, Virtual Memory, Programming for virtual memory, Programming for Data Cache.

# **Recommended Books:**

- 1. Computer Simulation Methods, Heermann, Springer Verlag (Good for N-body methods and Monte Carlo approach).
- 2. Computational Physics, S.E. Koonin, Addison Wesley (New York)
- 3. Computational Physics, T Pang, Cambridge University Press
- 4. Computational Physics, R.H. Landau, M J Paez, John Wiley & Sons.
- 5. Computer Simulation Methods in Theoretical Physics, DW Heermann, Springer Verlag
- 6. The Art of Molecular Dynamics Simulation, D.C. Rapaport, 2<sup>nd</sup> Edition, Cambridge University Press.
- 7. Understanding Molecular Simulations, Frankel and Smit, 2<sup>nd</sup> edition, Elsevier
- 8. An Introduction to Computer Simulation Methods, Applications to Physical Systems, 2nd/3rd Edition, Harvey Gould and Jan Tobochnik.
- 9. Monte Carlo methods in statistical physics & The Monte Carlo method in condensed matter physics, K.Binder, Springer, 1986/1992.
- 10. Solid State Physics, N.W.Ashcroft & N.D Mermin.
- **11.** A First Course in Scientific Computing: Symbolic, Graphic, and Numeric Modeling Using Maple, Java, Mathematica, and Fortran90, R H. Landau, Princeton University Press.
- 12. An Introduction to Computer Simulation, Woolfson and Pert, Oxford
- 13. Computational Physics, Thijssen, Cambridge (Advanced and quite specialised)
- 14. Computational Techniques in Physics, MacKeown & Newman, Adam Hilger

- 15. Numerical Recipes in FORTRAN, 2nd Edition, Press et al. Cambridge (An advanced text for reference).
- 16. H. GOULD and J. TOBOCHNIK ``An Introduction to Computer Simulation Methods: Application to Physical Systems, Parts 1 and 2 " or the single volume 2nd edition
- 17. W. H. PRESS, B. P. FLANNERY, S. A. TEUKOLSKY and W. T. VETTERLING, ``Numerical Recipes", Cambridge University Press, 1986 (1st or 2nd editions, Fortran, C or C++ only).
- 18. Mathematica, S Wolfram, Addison Wesley Pub Co.
- *NOTE*:- In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	S-404 (a)	No. of hour per semester	52
Name of the course	Advanced Nuclear Physics			
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (13 X 1)			
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{th}$  week and the second at the closing of the semester i.e.  $14^{th}$  week

# Section: A

**Angular Momentum Theory:** Angular momentum coupling: coupling of two angular momenta, coupling of three angular momenta, coupling of four angular momenta Racah coefficients. Tensors and reduced matrix elements of irreducible operators, Product of tensor operators. Application: Spherical harmonics between orbital angular momentum states, Spin operator between spin states, Angular momentum J between momentum states, Matrix elements element of compounded states and Matrix elements between angular momentum coupled state.

*Nuclear Decays*: Decay widths and lifetimes. Alpha Decay: General Properties and theory of alpha decay, Barrier penetration of alpha decay, alpha decay spectroscopy Spontaneous fission decay Beta Decay: General Properties, Neutrinos and Antineutrinos, the Fermi theory of beta decay, Angular momentum and selection rules of beta decay, electron capture, beta spectroscopy. Gamma decay, reduced transition probabilities for gamma decay, Weisskopf units for gamma decay.

# Section: B

The Fermi gas model, The one body potential General properties, The harmonic oscillator potential separation of instrinsic and centre-of-mass motion, the kinetic energy and the harmonic oscillator. Conserved quantum numbers, angular momentum, parity and isospin, Quantum number for the two nucleon system, two proton or two neutron, and proton and neutron.

*The Hartree Fock Approximation* Properties of single Slater determinants, Derivation of the Hartree-Fock equations, examples of single particle energies, Results with Skyrme Hamiltonian: Binding energy, single particle energies, Rms charge radii and charge densities.

# Section: C

*The Shell Model:* Ground state spin of nuclei, Static electromagnetic moments of nuclei, Electromagnetic transition probability on shell model, Exact treatment of two-nucleons by shall model, two-nucleon wave function, matrix elements of one-body operator and two-body potential, Shell model digonalization, Configuration mixing, relationship between hole state and particle state, State of hole-particle excitation and core polarization, Seniority and fractional percentage by second-quantization technique.

References:

- 1. M.K. Pal Theory of Nuclear Structure, Affiliated East-West, Madras-1992.
- 2. Y. R. Waghmare, Introductory Nuclear Physics, Oxford-IBH, Bombay, 1981.
- 3. K. L. G. Heyde, The Nuclear Shell Model, (Springer-Verlag, 1994)
- 4. R. D. Lawson, Theory of the Nuclear Shell Model, (Clarendon Press, 1980).
- 5. A. R. Edmonds, Angular Momentum in Quantum Mechanics, (Princeton University Press, 1957
- 6. D. M. Brink and G. R. Satchler, Angular Momentum, (Clarendon Press, Oxford, 1968).
- 7. R. D. Lawson, Theory of the Nuclear Shell Model, (Clarendon Press, 1980)
- 8. D. Vautherin and D. M. Brink, Phys. Rev. C 5, 626 (1972)
- 9. T. R. H. Skyrme. Philos. Mag. 1, 1043 (1956); Nucl. Phys. 9, 615 (1959); 9, 635 (1959)
- 10. W. Kohn and L. J. Sham, Phys. Rev. 140 A1133 (1965).
- 11. P. J. Brussaard and P. W. M. Glaudemans, Shell Model Applications in Nuclear Spectroscopy, (North Holland, 1977).
- 12. A. de Shalit and I. Talmi, Nuclear Shell Theory, (Academic Press, 1963).

**NOTE:**- In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5 questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	5-404 (b)	No. of hour per semester	52
Name of the course	Nuclear Technology			
Duration of the Course	O	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	3 X 3)		
Tutorial	13 (1	3 X 1)		
Semester End Examination	Total Maximu	m Marks = 100	Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	MM 5		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

# Section: A

**The interaction of radiation with matter:** Introduction, Heavy charged particle interactions, electron interactions. Gamma rays interactions:- photoelectric effect, Compton scattering, pair production and attenuation. Neutrons interactions:- moderation, nuclear reaction and elastic and inelastic scattering.

**Detectors and Instrumentation:** Introduction, Gas detectors: ionization chamber, proportional counter, and Geiger-Mueller counter. Scintillation counters. Semiconductor Detectors, Neutrons detectors

**Biological Effects of radiation:** Initial interactions, Dose, dose rate and dose distribution, Damage to critical tissue, Human exposure to radiation and Risk assessment.

# Section: B

**Industrial and Analytical Applications:** Industrial uses:- Tracing, Gauging, material modification sterilization, food preservation. Neutron activation analysis, Rutherford backscattering, particle induced X-ray Emission Accelerator Mass spectroscopy

**Nuclear Medicine:** Projection Imaging: X-Radiography and the Gamma Camera, Computed Tomography, Positron Emission Tomography (PET), Magnetic resonance Imaging (MRI), Radiation Therapy.

**Mossbauer Spectroscopy:** Resonant absorption of gamma rays, the Mossbauer effect, Application: nano material spectroscopy and nuclear spectroscopy.

# Section C:

**Nuclear Energy Power from Fission:** Characteristic of fission, The chain Reaction in a thermal fission reactor, the reactor, reactor operation, commercial thermal reactions, the breeder reactor, accelerator driven systems

**Power from Fusion:** Thermonuclear reaction and energy production, Fusion in hot medium, progress towards fusion power, fusion in early universe, stellar burning The p-p chains, Beyond hydrogen burning, and nucleosynthesis: Production of light elements (up to Fe), Production of the heavy elements - supernovae

### **Recommended Books and Course Materials**

- 1. Lilley Nuclear Physics Principles and Applications. *Good general text covering most of the course.*
- 2. Krane Introductory Nuclear Physics. *Covers most of the course in variable level of detail.*
- 3. Leo Techniques for Nuclear and Particle Physics Experiments. A lot of practical detail.
- 4. Murray Nuclear Energy. *Good general text on fission and fusion*.
- 5. Bowers & Deeming Astrophysics I (Stars). *Covers solar nuclear physics*.
- 6. Roth & Poty Nuclear Methods of Dating. *For radiocarbon and geological dating*.
- 7. Webb The Physics of Medical Imaging, 1988. *Covers the nuclear imaging methods in adequate detail.*
- **NOTE:** In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS	5-404 (C)	No. of hour per semester	52
Name of the course	Opto - Electronics			
Duration of the Course	Oı	ne Semester	(13 Weeks)	
Lectures to be Delivered	39 ( 13	<b>3</b> X 3)		
Tutorial	13 (13 X 1)			
Semester End Examination	Total Maximum Marks = 100		Pass Marks	
	Theory	MM 80	32	
	Internal Assessment	MM 15	06	
	Attendance	<b>MM 5</b>		

Note: Internal Assessment on the basis of two house tests (one in the middle of the semester i.e.  $7^{\rm th}$  week and the second at the closing of the semester i.e.  $14^{\rm th}$  week

## Section-A

**Injection luminescence:** Recombination processes, the spectrum of recombination radiations, Direct and Indirect band gap Semiconductors, The Internal Quantum Efficiency, The External Quantum Efficiency

The basic principles of laser actions: spontaneous and stimulated emission and absorption, the condition for the laser action, Types of laser, Semiconductor lasers;

Theory of Laser action in Semiconductors, condition for gain, The threshold conditions for oscillations, rates of spontaneous and stimulated emission, effect of refractive index, calculation of the gain coefficients, relation of the gain coefficient to current density, Semiconductor Injection Laser :Efficiency, Stripe geometry

LED materials, commercial LED materials, LED construction, Response time of LED's, LED derive circuitry.

# Section-B

**Optical Detectors:** Introduction, Device types, Optical Detection. Principles, Absorption, quantum efficiency, Responsivity, Long wavelength cut off, Photoconductive Detectors, Characteristics of particular photoconductive materials. Solar cell, Holography and its applications, Liquid crystal displays The Optical Fiber , Multimode and Single Mode Fibers, Glass Fibers, Plastic Optical Fibers, Fiber-Optic Bundle, Fabrication of Optical Fibers , Preform fabrication, Fiber Fabrication , Free Space Optics

## Section-C

**Junction Detectors :** detectors performance parameters Semiconductors p-i-n diodes, General Principle, quantum efficiency, Materials and design for p-i-n photodiodes. Impulse & frequency response of p-i-n photodiodes. Avalanche photodiodes detectors. The multiplication process . Avalanche photodiodes (APD) design, APD bandwidth, phototransistors

## **References:**

**1.**Optical communication systems. John Gowar (Prentice Hall of India Pvt.Ltd.New Delhi 1987.)

**2.**Optical fibre communications-Principles and practice John.M.Senior.Prentice Hall International (1985)

**3.**Optoelectronics-An Introduction(Second edition) J.Wilson. , J.F.B Hawkes Prentice Hall International (1989).

**4.**S.M.Sze Physics of the semiconductor devices. 2<sup>nd</sup> edition(1983) Wiley Eastern Ltd.

5 Fiber Optics And Lasers - The Two Revolutions Ajoy Ghatak and K Thyagarajan

**NOTE:** In all, 10 questions will be set. Question No.1 will cover the entire syllabus and will be of objective/short answer type. The remaining 9 questions will be three each from sections A, B and C. The students will attempt 5questions in all; including question No.1 (compulsory) and at least one from each section

Course Code	PHYMS-405	No. of hour per 180 semester
Name of the course	Proj	ect
Duration of the Course	One Semester	(13 Weeks)
Semester End Examination	Total Maximum Marks = 100	Pass Marks =40

### M.Sc. IV Semester PHYMS-405 Project

All the M.Sc. Physics Students will do a supervised Physics Project in IV Semester. Department considers it an important culmination of training in Physics learning and research. This project shall be a supervised collaborative work in Theoretical Physics (Condensed Matter Physics, Nuclear Physics, Particle Physics), Experimental Physics, Computational Physics. The project will aim to introduce student to the basics and methodology of research in physics, which is done via theory, computation and experiments either all together or separately by one of these approaches. It is intended to give research exposure to students at M.Sc. level itself. Following will be the modalities:

- (i) Since lot of ground work including purchase of components/ equipments may be involved depending on the choice of the project, a strict schedule will be drawn and followed, to meet the deadline for submitting the project as laid down below.
- (ii) The students will be allotted M.Sc. IV Semester project in consultation with their supervisors well in advance but not later than middle of third semester i.e. 31<sup>st</sup> oct to give students ample time to work on the allotted topics in consultation with their supervisors. To develop team spirit and group learning, students will be allotted projects in groups of three to four students but not more than four students in any case.
- (iii) Students will be informed about their respective groups (three four students per group) which will be formed by inviting applications from the students who want to together as a group in the office of Physics Department, after due recommendation from the supervisor under whose supervision they wish to work along with a tentative title/topic by 30<sup>th</sup> of September.
- (iv) Students can choose topics from the following major fields or any other field decided from time to time for which department has the faculty and facilities
  - i) Particle Physics/ Nuclear Physics
  - ii) Condensed Matter Physics/ Material Sciences
  - iii) Computational Physics
  - iv) Electronics
  - v) Experimental Physics
- (v) Students will discuss the topic with the supervisors and submit a one page typed abstract giving the plan of the same by 31<sup>st</sup> November along with the list of components

etc. (for Experimental Project) needed for the project and start working on the project utilizing time for gathering resource material, references, setting up the experiments, understanding the theoretical frame work, and writing of the programs for computation if any. During the period of project students will have to give a seminar as per the schedule notified by the chairman. The plan of work should include information about.

- a) Gathering resource material
- b) Setting up of the experiment if any
- c) Understanding of the theoretical frame work.
- d) Writing of the program for computation if any
- e) References
- (vi) Group of students working on a particular topic will be required to give a presentation in the beginning of the IV semester i.e. February/ March about the progress made by them during vacations. The presentation should be preferably in the forms of a power point presentation.
- (vii) Ind presentation of the progress of the work will be held in April.
- (viii) A complete seminar on the project will be held in the month of June before submission of the project report.
- (ix) Three copies of the project report will be required to be submitted in the office of the Physics department for final evaluation by the external examiner.
- (x) A format of the project report as per the details given in below:

### **Title Page**

### M.Sc. Project Report

### <u>On</u>

### **Title of the Project**

Supervised by:

Submitted by:

Name of the Group

Name 1 Name 2 Name 3

Physics Department Himachal Pradesh University Summer Hill, Shimla-5 Session Month Year

# <u>Page 2</u>

(Preferably on (Guide's) letter head)

# Certificate

This is to certify that the project entitled "**Title of Project**" aimed at "Project purpose" was worked upon by the following students under my supervision at Physics Laboratory in Physics Department, H.P. University, Shimla-5.

Name 1 with signatures Name 2 with signatures Name 3 with signatures

It is certified that this is a live project done by the team and has not been submitted for any degree.

Chairman

Name of Guide

<u>Page 3</u>

### Acknowledgements

# <u>Page 4</u>

Preface

# <u>Page 5</u>

Contents

# <u> Page 6</u>

Abbreviations used

<u>Page 7</u>

List of Tables

# Page 8

List of Graph and figures

Page 9

Introduction

Chapter 1 Chapter 2 Chapter 3

Concluding remarks

# End of Report

Appendices Source code and other relevant appendices Bibliography /References.

# **Instructions for the Formatting and Presentation of Project Report**

The following instructions be strictly adhered to while formatting the Project Report.

Top margin	= 2.54  cm	
Bottom margin	= 2.54  cm	
Left margin	= 3.17  cm	
Header and Footer	= 3.17  cm	
Page Size	= 1.25  cm (from edge)	
Font	= Times new Roman	
- Body test size	12pt	
- Chapter headings	18 pt Bold	
- Section heading16 ptBold		
- Sub Section heading	14 pt Bold	
Header and footers		
- Header Cha	pter Name	
- Footer Pag	e number	
Spacing before and after body text para	graph 6 pt uniform	
Spacing before section headings	Zero	
Spacing after section headings	12	
Line spacing	1.5 lines	
TablesCer	ntered, captions must.	
DiagramsCentered, caption	s must, No text around Diagrams	

Page Numbering scheme for entailing chapters.... Roman Numbers Page Numbering scheme for entailing pages of chapters ..... Arabic The pages starting from Certificate to list of graph and figures must be enlisted in chronological sequence using Roman Numbers. Hard Bound -

Final Project report must be

- **Rexene Covered**
- Golden text to be used on cover -
- Print details on side strip also in text book format.

Paper to be used

Bond paper

#### Total Number of copies to be submitted along with soft copy on a CD 4 Copies

## Last Date for Submission of Project Report

Last date for submission of project report shall be one month after the last theory paper examination of IV Semester for regular students.



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s of M.A. English Nov. 2007 in phased manner)

(Each course carries 75 marks)

### SEMESTER I

### Course I History of English Literature from Chaucer to 1800

(Questions will be set on movements and trends and not on individual authors)

Instructions: Question No. 1 will be compulsory. The students will have to write short notes (in about 150 to 200 words) on any three topics out of six given topics. (3x8=24 marks)

In addition to the compulsory question, 5 questions, each with internal choice, will be set. The students will have to attempt three questions out of these five. (3x17=51 marks)

### **Course II Poetry from Chaucer to Pope:**

Chaucer:	-The Prologueø, -The Nunøs Priestøs Taleø
Donne:	-The Sun-Rising, ø The Extasie, ø -The Canonization, ø - The
	Anniversary,ø-The Flea,ø-A Valediction: Forbidding Mourning,
Milton:	Paradise Lost, Bk. I, and Lycidas, ø-LøAllegroø
Pope:	The Rape of the Lock, -Epistle to Dr. Arbuthnotø

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3X17=51 marks)

### **Course III Shakespeare and his Contemporaries**

Marlowe:	Doctor Faustus
Shakespeare:	Tempest
Shakespeare:	Twelfth Night
Ben Jonson:	Volpone

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 marks)

### **Course IV Nineteenth Century Fiction**

Emily Bronte:Wuthering HeightsCharles Dickens:Hard TimesGeorge Eliot:The Mill on the FlossThomas Hardy:Tess of the D'Urbevylles

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)



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e question with internal choice will be set. In addition one be set on the background and will be of general nature. The testions out of these. (3x17=51 marks)

### SEMESTER II

- **Course V** History of English Literature: Nineteenth and Twentieth Centuries (Questions will be set on movements and trends and not on individual authors)
- Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 150 to 200 words) out of given 12 items. (3x8=24 marks)

In addition to the compulsory question, 5 questions, each with internal choice, will be set. The students will have to attempt three questions out of these five. (3x17=51 marks)

### **Course VI Romantic and Victorian Poetry**

Blake:	Songs of Innocence and Songs of Experience
Wordsworth:	-Tintern Abbey,ø-Ode: Intimations of Immortality,ø
Coleridge:	-The Rime of the Ancient Mariner,ø-Kubla Khanø
Keats:	-Ode on a Grecian Urn,ø-Ode to a Nightingale,ø-Ode on
	Melancholy,ø-To Autumnø
Tennyson:	-The Lady of Shalott,ø-Ulysses,ø-The Lotos-Eatersø
Browning:	-Evelyn Hope,ø-The Last Ride Together,ø-My Last Duchess,ø
-	-Rabbi Ben Ezraø

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 marks)

### **Course VII Modern Fiction**

Virginia Woolf:Mrs. DallowayJames Joyce:A Portrait of the Artist as a Young ManD.H. Lawrence:Sons and LoversJoseph Conrad:Heart of DarknessE.M. Forster:A Passage to India

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### Course VIII Growth and Structure of English Language

- I History of Language A.C. Baugh, A History of English Language (chapters 3 to 9)
- II Structure of Language
  - (a) Phonemes: Consonants, Vowels, Stress and Intonation
  - (b) Morphemes: Roots and Affixes, Derivational and Inflectional morphemes, Allomorphs



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compulsory. The students will have to write short notes three 0 words) out of six topics from both section I and section II (5x3=15 marks)

In sections I and II four questions will be set in each section out of which the student will have to attempt two questions in each section. (15x2=30)+(15x2=30)

### SEMESTER III

### Course IX Literary Criticism from Aristotle to T.S. Eliot

Aristotle:	The Poetics
Dryden:	Essay of Dramatic Poesy
Coleridge:	Biographia Literatia (chapters 13-18)
Arnold:	-The Fuction of Criticism in the Present Time, ø-The Study of
	Poetryø
Eliot:	-Tradition and Individual Talent,ø-The Frontiers of Criticism,ø
	-Essay on Hamletø

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### Course X Modern British and American Poetry

W.B. Yeats:	-The Second Coming, ø-Sailing to Byzantium, ø-A Prayer for My
	Daughter,ø-Among School Children,ø-Leda and the Swanø
T.S. Eliot:	The Waste Land
W.H. Auden:	-The Unknown Citizen,ø-In Memory of W.B. Years,ø
	-The Shield of Achilles,ø-September 1, 1939ø
Walt Whitman:	-Song of Myself (1, 5, 33), -Out of the Cradle Endlessly
	Rocking, øA Passage to India'.
Robert Frost:	-Birches,ø-Design,ø-Mending Wall,ø-After Apple Picking,ø
	-The Road not Taken,ø-Home Burialø
William Carlos William	s: Poems in Modern Poets One (Published by Faber and Faber)

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### **Course XI Modern British Drama**

G.B. Shaw:	Arms and the Man
Oscar Wilde:	An Ideal Husband
T.S. Eliot:	Murder in the Cathedral
John Arden:	Sergeant Musgrave's Dance

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)



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ed texts one question with internal choice will be set. In th internal choice will be set on the background and will be of nts will have to attempt three questions out of these. (3x17=51)

### **Course XII World Fiction**

Dostoevsky: Ernest Hemingway: Margaret Atwood: Chinua Achebe: V.S. Naipaul: Crime and Punishment The Old Man and the Sea Surfacing Things Fall Apart A House for Mr. Biswas

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### Course-XII-i African Literature

Chinua Achebe:	A Man of the People
Ngugi wa ThiongØO:	A Grain of Wheat
Nadin Gordimer:	My Son's Story
Bessie Head:	The Collector of Treasures (short stories)
Wole Soyinka:	A Dance of the Forests

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### Course-XII-ii Australian Literature

Patrick White:	The Solid Mandala
David Malouf:	Remembering Babylon
David Williamson:	The Removalists
Jack Davis:	No Sugar

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### Course-XII-iii Canadian Literature

Robertson Davisøs:	Fifth Business
Sharon Pollock:	The Komagata Maru Incident
M.G. Vassangi:	The Book of Secrets
Lee Maracle:	Sundogs



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compulsory. The students will have to write short notes on six is) out of given 12 items. (4x6=24 marks)

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From each or the preserved texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these. (3x17=51 mark)

### SEMESTER IV

### Course XIII Contemporary Literary Theory

- Ferdinand de Saussure

   a. õThe Object of Studyø
   b. -Nature of the Linguistic Signø
- Jacques Derrida

   Structure, Sign and Play in the Discourse of the Human Sciencesø
- 3. Terry Eagleton a. -Capitalism, Modernism and Postmodernismø
- 4. Roland Barthes a. -The Death of the Authorø
- Elaine Showalter

   a. Feminist Criticism in the Wildernessø
   [1-5 in *Modern Criticism and Theory: A Reader*, ed. David Lodge (London, New York: Longman, 1988)]
- Toril Moi: -Feminist Literary Theoryø [In Modern Literary Theory: A Comparative Introduction, ed. Ann Jefferson and David Rubey (2<sup>nd</sup> ed. London: Batsford, 1986)
- J. Hillis Miller

   a. -Culture Studies and Readingø
   [In Literary Theories: A Reader and Guide, ed. Julian Wolfreys Edinburgh University Press, 1997]
- Homi K.Bhabha

   a. -Dissemination: Time, Narrative and the Margins of Modern Nationø
   [In *The Post-Colonial Studies Reader*, ed. Bill Ashcroft. Gareth Griffiths and Helen Triffin (London and New York: Routledge, 1995)]
- Arun Mukhrejee

   a. -Whose Postcolonialism and Whose Postmodernism?
   [in World Literature Written in English, 30,2 (1990):1-9 and in Arun Mukherjee, Postcolonialism: My Living (Toronto: TSAR, 1998)]

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these.

(3x17=51 mark)



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Berton Breent. *Momer Courage and* Her Children

Henrik Jbsen: *Ghosts* Anton Chekhov: *The Cherry Orchard* Samuel Beckett: *Waiting for Godot* 

### OR

### American Drama

Eugene OaNeill: Desire under the Elms Arthur Miller: Death of a Salesman Tennessee Williams: The Glass Menagerie Edward Albee: Who's Afraid of Virginia Woolf?

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these.

(3x17=51 mark)

### Course XV Indian Writing in English

Raja Rao:	Kanthapura
R.K. Narayan:	The Vendor of Sweets
Anita Desai:	Clear Light of Day
A.K. Ramanujan:	-The Snakes,ø-Obituary,ø-The Stridersø
Keki N. Daruwala:	Ruminations, #The Fighting Eagles, #The Mistress,
	-Boat-ride Along the Gangaø
Nissim Ezekiel:	-Poet, Lover, Birdwatcher,ø-Enterprise,ø-The Visitorø

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these.

(3x17=51 mark)

### **Course XVI Indian Writing in Translation**

Kalidas:	Abhijnanshakuntalam
	(English translation by M.R. Kale, pub. Motilal Banarasidas)
Bhisham Sahni:	Tamas
U.R. Ananthamurthy:	Samskar
Mahasweta Devi:	Rudali
	(English translation by Anujam Katyal, pub. Seagull)
Shiv Kumar:	Luna
	(English translation by Ish Kumar

### OR

### Literature and Gender

Virginia Woolf:	A Room of One's Own
Caryl Churchill:	Cloud Nine
Toni Morrison:	Beloved
Binodini Dasi:	An Autobiography
	(Translated into English by Rimli Bhattacharya)



Maria Campbell:Half-BreedDrew Hayden Taylor:SomedayKim Scott:BenangSally Morgan:My Place

Instructions: Question No. 1 will be compulsory. The students will have to write short notes on six items (in about 100 words) out of given 12 items. (4x6=24 marks)

From each of the prescribed texts one question with internal choice will be set. In addition one question with internal choice will be set on the background and will be of general nature. The students will have to attempt three questions out of these.

(3x17=51 mark)

### PATTERN OF TESTING

1. In Course I and Course V Question No. 1 will be compulsory. The students will have to write short notes (in about 150 to 200 words) on any three topics out of six given topics.

(3x8=24 marks)

In addition to the compulsory question, **5 questions, each with internal choice, will be set**. The students will have to **attempt three questions out of these five.** (17x3=51 marks)

 In Course VIII Question No. 1 will be compulsory. The students will have to write short notes on three topics (of about 100 to 150 words) out of six topics from both section I and section II. (5x3=15 marks)



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# PRADESH UNIVERWSITY JT OF POLITICAL SCIENCE SHIMLA- 5.

# M.A. (POLITICAL SCIENCE) SYLLABUS

M.A (Pol.Science) Course consists of sixteen papers with four papers in each semester. each paper contains hundred marks (100 Marks). Students are required to attempt FOUR questions in Each paper and time allowed is 03 Hours. Following will be the Sixteen courses:

# M.A IST SEMESTER...

- Course- I: Western Political Thought: From Plato to Bodin
- Course- II: Government and politics in India
- Course-III Comparative Politics

Course- IV: International politics (Theories, Approaches & concepts

### IInd SEMESTER

- Course-V: Western political Thought: From Hobbes to Marx
- Course- VI: Recent Trends in Indian politics..
- Course- VII: Comparative Politics and political Analysis
- Course- VIII: Emerging World Order

# **IIIRD SEMESTER**

- Course-IX: Indian political Thought OR Theories, Approaches and Concepts
- Course-X Regional politics in India
- Course-XI: Theories of Nationalism and processes of Nation Building
- Course-XII Indiaøs foreign policy and Relations

# **IVTH SEMESTER**

- Course: XII Democratic Theory OR Modern Indian Political Thought
- Course: XIV; Politics in South Asia
- Course: XV: Society, Economy and politics in Himachal Pradesh
- Course-XVI; Public International Law

### OR

Marxism after Marx OR Political Economy of Development

# M.A (POL.SCIENCE) IST SEMESTER

# <u>COURSE – I</u>



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### L THOUGHT; FROM PLATO TO BODIN

Max. Marks : 100 Time ; 3 Hrs

NOTE: students are required to attempt FOUR questions. All questions Carry equal marks.

This course will consist of a study of the following thinkers:

- 1. <u>PLATO:</u>
- a) Notion of permanence and change
- b) Platoøs views on State, Justice, Communism, Education and philosopher king
- c) Plato: A Totalitarian or Democrat

### 2 <u>ARISTOTLE</u>:

- a) Aristotleøs critique of Plato
- b) Aristotleøs views on State and Govt. slavery, property, revolution and maintaining constitutional stability
- c) Aristotle as the first Political Scientist

### 3 <u>ST. : AUGUSTINE</u>:

Political ideas and view on the relationship between the State and Church

### 4 <u>ST. THOMAS ACOUINAS:</u>

- a) St. Thomasøs views on Society and Government, the relationship Between the State and Church
- b) Classification of Law
- c) Aristotleøs influence on St. Thomas Aquinas

### : <u>MACHIAVELLI</u>

- a) Machiavelli on power, politics and State Craft
- b) Views on relation between ends and means
- 5 <u>BODIN:</u> Views on State and Sovereignty

### **SELECTED READINGS:**

Andrew Hacker, Political Theory, Philosophy, Ideology, Science,

New York: The Macmillan Company, 1961.

David Ross, Aristotle, London, Methuen & Co., 1964



<u>r: Plato and his predecessors</u>, London: Methuen & Co.,

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------ The Political Thought of Plato and Aristotle, New York:G.P.Putnamøs, 1906

Ernest Cassider, The Myth of the State, New York: Doubleday and Company, 1955.

Felix Raab, The English Face of Machiavelli, London: Routledge & Kegan Paul, 1965.

George H.Sabine, Thomas L.Thorson, <u>A History of Political Theory</u>, New Delhi: Oxford & IBH Publishing Co., 1973.

M. Butterfield, The Statecraft of Machiavelli, New York The Macmillan Company, 1956.

O.P. Bakshi, <u>Politics and Prejudice: Notes on Aristotle¢ Political</u> Theory, Delhi: The Delhi University Press, 1975.

Ronald B. Levinson, In Defence of Plato, Cambridge: Harvard University Press, 1953.

Richard Lewis, Nettleship, <u>Lectures on the Republic of Plato</u>, London: Macmillan & Co. 1969.

R.H.S. Grossman, Plato Today, London: Unwin Books, 1963.

Sheldon S. Wolin, Politics and Vision, Boston: Little Brown & co, 1960.

V.P. Verma, Political Philosophy of Aristotle, Delhi: Triveni Publications, 1983

V. Venkata Rao, Ancient Political Thought, Delhi: S. Chand & Co. 1969.

# <u>COURSE –II</u> <u>GOVERNMENT & POLITICS IN INDIA</u>

Max. Marks : 100

Time : 3Hrs

# **NOTE:** Students are required to attempt Four questions only. All questions carry equal marks.

1. Historical legacies and their impact on the politics of post-independence period.



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constitution making.Socio-economic composition of hilosophy of constitution.

- 3. Structures of the Government: At centre state and grassroots level, interrelationship between executive, legislature and judiciary; working of the role of legislature causes and consequences, judicial review and judicial activism, panchayati Raj : Structures and processes.
- 4. Growth and decline of political institutions.
- 5. Political parties: National, Regional, caste based, religion based, their ideology, support base and role.
- Pressure Groups: their nature, strategies, methods of lobbying (with reference to Agriculture, Business. Industry, Bureaucracy, Military, Peasantry, Working class, NGOS etc.)
- 7. Election, Electoral politics and voting behaviour, Role of Election Commission, need for electoral reforms.
- 8. Centre-state Relations: Constitutional provisions. Federal structure and autonomy deman, Demand for statehood, more finance, and secessionism.
- 9. Developmental strategies: politics of development and underdevelopment in India: Conflict, violence, terrorism, state terrorism.
- 10. Secularism in India: Problems and Perspectives.
- 11. Future of Democracy in India.

# **SELECTED READINGS**:

- Grenvile Austin, <u>Indian Constitution: The Cornerstone of a Nation</u>, New York: Oxford University Press, 1972.
- K.R. Bombwall, <u>Indian Constitution and Administration</u>, Ambala Cantt: Modern Publishers, 1970
- M.V.Pylee, Constitutional Government, Bombay: Asia Publishing 1968.
- Charles Bettleheim, India Independent, Delhi: Khosa Publishers, 1977
- R.L. Hardgrave, India <u>Government and Politics in Developing Nation</u>, New York: Hartcourt Brace, 1975
- Rajni Kothari, Politics in India, New Delhi: Orient Longman, 1972
- ----- Caste in Indian Politics, New Delhi Orient Longman 1972


Politics in India, London: Hutchiyson, 1967.

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ystem, London: George Allen & Unwin, 1971.

C.H. Philips, Politics and Society in India, London: George Allen & Unwin, 1963.

Susanne M. Rudolph,öConsensus and Conflict in Indian Society,ö World Politics, Vol. 12,

(April 1961) pp. 385-99.

J.R. Sewach, Dynamics of Indian Government and Politics, New Delhi: Sterling, 1990.

A.S. Narang, Indian Government and Politics, Delhi: Gitanjali Press, 1994.

K.C. Markenday, Aspects of Indian Polity, (Vol.I & II), Jullundar: ABS,1990

C.P. Bhambhari, Politics in India Since Independence, Delhi: Shipra, 1996.

Asger Ali Engineer and Moin Shakir, Communalism in India, Delhi: Ajanta , 1985.

Akhtar Majeed (ed), <u>Regionalism: Development of Tension in India</u>, New Delhi: Cosmo, 1934.

S.A.H. Haggi (ed), <u>Democracy</u>, <u>Pluralism and Nation Building</u>, Delhi: NB Dublishers, 1984. Rasheeduddin Khan, <u>Federal India</u>, <u>Delhi</u> Vikas, 1992.

Randhir Singh, Of Marxism and Indian Politics, Delhi: Ajanta, 1990.

------ Five Lectures in Marxist Mode, Delhi: Ajanta, 1993.

Paul R. Brass, The Politics of India Since Independence, New Delhi: Orient Longman, 1990.

Rudolph and Ruoalph, In Pursuit of Lakshmi: Political Economy of Indian States, New Delhi: Orient Longman, 1991.

V.R. Mehta, Democracy, Modernization and Politics in India, New Delhi: Manohar, 1988.



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#### **Political Science Ist Semester:**

# <u>COURSE – III</u>

# **COMPARATIVE POLITICS**

Max. Marks :100 MarksTime :3 Hours

Note :Student are required to attempt Four questions. All questions carry equal marks.

- 1. Meaning, Nature and Scope of Comparative Politics. Development and Recent Trends.
- 2. Comparative Method, its nature and problems, Various approaches to the study of the comparative politics with special reference to Functionalist and Marxist perspective
- 3. Political participation Election and Voting Behaviour in U.S.A. U.K., Russia and India.
- 4. Theories of ruling class and Political Elites in U.S.A. U.K., Russia and India.
- 5. Modern Typologies of Political system: Liberal, Democratic Authoritarian and totalitarian.

# **SELECTED READINGS:**



vernment, London: George Allen 1970.

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ork: Oxford University Press, 1957.

Dawryl Baskin, American Pluralisn Society, New York: Von Nostrand 1971.

G.Almond and B. Powell, <u>Comparative Politics</u>: <u>A Developmental Approach</u>, Boston: Little Brown, 1966.

H.Eakstein and D. Apter, <u>Comparative Politics: A Reader</u>, New Yorks Free Press, 1963.

Jean Blondel Comparative Politics, New York: Free Press, 1963.

Lester W. Millbrach and M.L. Goel, <u>Political Participation</u>, Chicago: Rand Mcnally College Publishing Co. 1977.

Mehran Kamrava, <u>Understanding Comparative Politics</u>: <u>A Framework for Analysis</u> London: Rontledge, 1996.

R.C. Macridis, The Study of Comparative Government, Garden City: Doubleday, 1955.

Robert, A Dahl, <u>Pluralist Democracy in the United States</u>, Calcutta: Scientific Books, 1969. <u>Who Governs ?</u> New Haven, Yale University Press ,1961,

Samarsen and Ashish Bhandari, <u>Advance Reading in Comparative Politics</u>, New Delhi <u>Sandarbh,1998</u>

T.B. Bottomore, Elites & Society: Penguin 1971.

Vidya Bhushan, Comparative Politics, New Delhi: Atlantic Publishers. 1997.



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COURSE -IV

# **I NTERNATIONAL POLITICS**

#### THEORIES, APPROACHES AND CONCEPTS:

#### Max. Marks: 100 Marks

#### Time 3 Hours

Note: Students are required to attempt Four questions. All questions carry equal marks.

- I. Nature scope and Development (of the study of International Politics) as a Discipline. Question of Autonomy of International Politics.
- II. <u>Theories and Approaches</u>
- i) Idealist Realist controversy
- ii) Realist Approach with special reference to Hans Morgenthau
- iii) Debate over classical and scientific theories (Headly Bull vs. Mortan-Kaplan).
- iv) Behavioral Approaches- system approach (Mortan Kaplan), Communication Decision Making
- v) Marxist Leninist approach.

#### III. <u>Concept:</u>

- National Powers and its elements with special reference to Geo-Politics and Ideology
- ii) National Interest
- Dominance and Dependence: theories of Imperialism, Colonialism and Neo- Colonalism
- iv) Foreign Policy and Diplomacy
- v) The Nation-State system and Non-State actors in International Politics.



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# **<u>SELECTED READINGS</u>**:

A. Benerjee	MarxistTheory and Third World, New Delhi: Sage, 1984.
C.A.Beity,	Political Theory and International Relations, New York: Columbia
	University Press, 1977.
Headley Bull,	The Anarchical Society: A study of Order in International Politics
	New York Columbi University Press,1977 .
J.W. Burton,	International Relations: A General Theory, Bombay: Allen and
	Unwin, 1971
R.L. Pfalzgraff, Jr. an	d Contending Theories of International
James E. Dougherty,	Relations Philadepphia: J.B. Lippincott Co., 1971.
Karl Deutsch,	The Analysis of International Relations Eaglewood cliffs: prentice
	Hall, 1968.
KHoisti;	International Politics: Frame work for Analysis, Eaglewood Cliffs:
	Prentice Hall, 1983.
Mortan Kaplan	System and Processes in International Politics New York: Willy
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Verman Von Dyke <u>International Politics</u>, Bombay: Vakil, Feffer & sons, Pvt. Ltd. 1968.

# COURSE- V

# WESTERN POLITICAL THOUGHT: HOBBES TO MARX

#### Max Marks: 100

#### Time: 3Hours

**Note:** Students are required to attempt Four questions. All questions carry equal marks.



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Human Nature, State of Nature, Social Contract and

Political obligation

- b) Hobbes : Theory of Sovereignty
- c) Hobbes: An Individualist or an Absolutist
- d) Hobbes as Precursor of Market society
- e) Contribution of Hobbes

# LOCKE:

- a) Lockeøs Views on Human Nature, State of Nature, Social Contract and political obligation
- b) Lockeøs theory of property
- c) Locke: an individualist or majority rule democrat
- d) Philosophical Ambiguities of Locke

# **ROUSSEAU:**

- a) Rousseauøs views on Human Nature ,State of Nature, Social Contract and Political obligation
- b) Rousseauøs views on General Will
- c) Rousseau : an individualist or an absolutist
- d) Contribution of Rousseau to subsequent Political thought.

#### J. BENTHAM:

Benthamøs theory of utilitarianism, its objectives, basis and implications.

J.S. MILL:

- a) Milløs revision of Benthamøs utilitarianism
- b) J.S. Milløs views on Liberty
- c) Milløs views on representive government

HEGEL:

- a) Hegel on Dialectical Idealism
- b) Hegeløs philosophy of History
- c) Hegel on civil society and state: views on individual and freedom

# MARX:

a) Marx on Alienation and Liberation



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- d) On class structure, class relations and class war
- e) Classless society and withering of state.

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- Alfred Cobban, <u>Rousseau and the Modern State</u>, London: George Allen & Unwin, 1970.
- Bernard Cullen, <u>Hegeløs Social and Political Thought: An Introduction</u>, Budbin: Gill & Macmillan, 1979.
- Bertell Ollman, <u>Marxism: An Uncommon Introduction</u>, New Delhi: Sterling Publishers, 1990.
- Bhikhu Parekh, Benthamøs Political Thought, U.S. A. Harper & Row, 1973.

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- C.B. MacPherson, <u>The Political Theory of Possessive Individualism: Hobbes to Locke</u>, London: Oxford University Press, 1965.
- David McClellan , The Thought of Karl Marx, London: The Macmillan Press, 1971.
- George H.Sabine, Thomas L. Thorson, <u>A History of Political Theory</u>, New Delhi :Oxford & IBH Publishing Co, 1973.
- J.W. Gough , John Lockeøs Political Philosophy, Oxford: Clarendon Press, 1973.
- Louis Althusser, For Marx, London: Cox and Wyman, 1969.
- Leo Strauss, The Political Philosophy of Hobbes, Oxford: Clarendon Press, 1936.
- Mulford Sibley, Political Ideas and Ideologies, Delhi: Surjeet Publication, 1981.
- Martin Seliger, The Liberal Politics of John Locke, London: George Allen & Unwin, 1968.
- Roger D. Masters, <u>The Political Philosophy of Rousseau</u>, Princeton: Princeton University Press, 1968.
- Thomas Hobbes, Leviathan, with an Introduction by K.R. Minogue, London: Everymanøs Liberty, 1973.

V.P. Verma , <u>Political Philosophy of Hegel</u>, New Delhi: Trimurti Publications, 1973

Z.A.Pelczynski(ed.), <u>Hegeløs Political Philosophy and Perspectives</u>, Cambridge: Cambridge University Press, 1971.



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#### **COURSE-VI**

# **RECENT TRENDS IN INDIAN POLITICS**

Max. Marks: 100

Time: 3 Hours

Note: Students are required to attempt any Four question. All questions carry equal marks.

- 1. Approaches to the study of Indian politics, Historical Constitutional Liberal, Marxist.
- 2. Coalition Politics at Centre and in the States: Problems and Prospects
- 3. The Nature of Indian State: The question of civil liberties, democratic rights and human rights.
- 4. The problem of governability in India.
- 5. Emergence of regional forces and regionalization of Indian Politics.
- 6. Ethnicity and Nationality question in India
- 7. Nature of state Politics in India
- 8. Globalization liberalization and Indian Politics
- 9. Political processes in India : Politics of Dalits- Backward Class, Schedule Castes, Schedule Tribes, The question of reservation. ii) Communal Politics



Click Here to upgrade to Unlimited Pages and Expanded Features Hindutva and Rise of Hindu Nationalism with reference

ing Dal, Shiv Sena Courses, Consequences and implications for Indian society and politics.

10 Politics of manø movements in India: i) Language question and Movement for Linguistic

reorganizations of states .ii) Peasant movements iii) Workers movements

11. Changing Dynamics of Caste, Class & Power.

# SELECTED READING

- A.S Narang , Ethnic Identities and Federalism , Shimla Indian Institute of Advance Studies, 1995.
- Paul R. Brass, <u>Language, Religion and Politics in North India</u>, Cambridge: Cambridge University Press, 1974.
- Paul R. Brass, <u>Politics of India Since Independence</u>, New Delhi: Orient Longman, 1990.
- Achin Vanaik, <u>The Painful Transition: Bourgeois Democracy in India</u>, London Verso, 1990
- Arvind N.Dass,India Invented: Nation in the Making, New Delhi: Manohar, 1992.Atul Kohli,Democracy and Discontent: Indiaøs Growing Crisis of Governability,
  - Cambridge: Cambridge University Press, 1991
- V.R.Mehta I<u>deology</u>, <u>Modernization and politics in India</u> New Delhi: ` Manohar,1988.
- Myron Weiner <u>The Indian Paradox, Essays in Indian Politics</u>, New Delhi: Sage Publications, 1989
- R.K. Burman, <u>Tribes in Perspective</u>, New Delhi: Mittal Publications, 1994.

Iqbal Narain (ed) <u>State Politics in India</u>, Meerut Meenakshi Publication, 1976.

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 Randhir Singh <u>Of Marxism and Indian Politics</u> Delhi: Ajanta Publications, 1990.
 <u>Five Essays in Marxist Mode</u>, Delhi: Ajanta Publication, 1993.
 B.Mohanan (ed) <u>Globalization of Economy: Vision for the Future</u>, New Delhi ; Gyan Publishing House 1995.
 A.Vidyanathan, <u>The Indian Economy Crisis, Response and Prospect</u>, New Delhi:



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ationalist in India The Rise of BJP, New Delhi Vistaav Publications, 1994.

C.P.Bhambhari, <u>The Indian State</u>, New Delhi: Shipra 1996.
 <u>Politics in India Since Independence</u> New Delhi, Shipra ,1996
 Moin Shakir, <u>State and Politics in Contemporary India</u> .Delhi: Ajanta Publications, 1986.

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Ramesh K. Chauhan, <u>Punjab and the Nationality question in India</u>, Delhi: Deep & Deep 1995.

Gopal Singh and Hari Lal Sharma <u>Reservation Politics in India</u>, Delhi: Deep & Deep, 1995.

S.A.H. Haqqi (ed), <u>Democracy Pluralism and Nation Building</u>, Delhi NBO Publishers ,1984.

Rajani Kothari, <u>State Against Democracy</u>, Delhi: Ajanta Pub, 1988.

Andre Beteille, <u>Caste, Class and Power</u>, California: Berkley, 1966.

AKhtar Majeed, (ed ) Regionalism: Development of Tensions in India

Madhu Limaye, Indian Policy in Transition, New Delhi: Rediant, 1990

Jeveed Alam, <u>Indian Living with Modernity</u> New Delhi: Oxford University Press, 1990.

Magazines and Journals:

Economic and political weekly, Mainstream, Social Scientist, Politics India, Frontline, India Today.



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# M.A. (POLITICAL SCIENCE) II ND SEMESTER: COURSE- VII

# **COMPARATIVE POLITICS AND POLITICAL ANALESSES**

Max. Marks: 100

Time: 3 Hours

Note: Students are required to attempt four questions. All questions carry equal marks.

- 1. Units and levels of analysis Micro and macro analysis.
- 2. Political culture and Political Socialization.
- 3. Modernization, Political Development and Political Decay.
- 4. Dependence Theory and Center- Periphery model, Democratization and growth of Political Consciousness, Problem of Participation.
- 5. Social change and violence and problem of legitimacy.
- 6. Theories of Political Parties and Pressure Groups : A comparative analysis.
- 7. Types of Political Executive, Legislature and Judiciary: A Comparative analysis.
- 8. Contemporary ideologies: An analysis.

#### **SELECTED READINGS:**

G.A. Almond and G.B. Powell:	Comparative Politics: A Development Approach
	Bosto: Fre Press, 1966,
Jean Blondel:	Comparative Politics, New York: Free Press: 1963.
T.B. Bottomore:	Elites and Society. Penguin, 1971.
M. Eckstein and D. Apter:	Comparative Politics: A Reader, New York: Free Press,
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Almond and Colemsn:	Politics of Developing Areas, Princeton: Princeton
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C. Wright Mills :	Power Elites New York Oxford University Press 1959,
S.P. Huntington : Po	olitical Development and Political Decay, World Politics,
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David Apter:	Politics of Modernization, Chicago: University of
	Chicago Press, 1965
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	Analysis London: Routledge, 1996
Samara Sen and Ashisn Bhandari:	Advance readings in Comparative government and
	Politics (3Volumes), New Delhi Sandarill
S D Vorme	
S.r. venna.	Modern Political Theory New Delhi: Vikas
S.r. venna.	<u>Modern Political Theory</u> New Delhi: Vikas Publication.

Almond and Coleman:	Politics i	n Developing	Areas P	rinceton:	Princeton
	University	Press, 1971			
Lester W. Millerath and M.L.Goel:	Political	Participation,	Chicago	o Rand	Mcnally
	Publishing	Company, 197	1		



# COURSE – VIII EMERGING WORLD ORDER

Max. Mark: 100

Time: 3 Hours

Note: Students are required to attempt Four questions. All questions carry equal marks. One question on topic No.8 is compulsory.



Click Here to upgrade to Unlimited Pages and Expanded Features neteenth century International system. Two world Wars:

ences. Decline of balance of power system.

- 2. Decolonization, Emergence of Super Powers, Bipolarity and Cold war.
- 3. Arms race Disarmament, Nuclear disarmament: Issue of Proliferation, discrimination and Hegemony
- End of cold war new world order (or disorder) Unipolar, tripolar, Multipolor. Economic Order: Reality of aid and trade W.T.O. Transfer of technology, IMF, World Bank, MNCøs
- 5. Globalization, Regionalization
- 6. Emerging issues in changing World Ethnicity, Environment sustainable development, Human rights
- Debate about emerging World order and the Futuristic vision: i)Paul Kenhedy, Fuku Yamah and Semuel P. Huntington (Defenders) ii) Noam Chonsky and M. Choscodovsky (Critics)

1005

# **SELECTED READINGS:**

Kanti P. Bajpal and Harish C. Shukil (ed):: Interpreting world Politics New Delhi: Sage

D 1 11 ...

	Publications 1995.
Paul Kennedy:	Preparing for Twenty First Century, London:
	Font one Press, 1994
	Rise and fall of Great Powers Economic
	Economic Change and Military Conflict 1500-
	<u>2000</u> New York ,1987.

Francis C. Fuku Yamah:	End of History and the Last Man London:	lamilton
	1992	
S.P. Huntington	The Clash Of Civilization and Remaking of	<u>World</u>
	Order, New Delhi Penguin 1997.	
Noam Chomsky	World Order-Old and New New Delhi	
	Oxford University Press, 1998	



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Max Singer and Aaron wildavsky

<u>Globalization of Poverty Impact of IMF and World</u> <u>Bank Reforms</u> New Delhi India Press,1997 <u>The Real World Order-Zones of Turmoil</u>, New Jersy Chettan House Publishers 1993.

#### **COURSE-IX**

#### **INDIAN POLITICAL THOUGHT**

Max Marks 100

Time: 3 Hours

Note: Students are required to attempt Four questions. All questions carry equal marks.

# VEDIC PERIOD:

1. i) Ideas on social and Political Questions in the Vedas.

ii) Reflection on the role of Sabha and Samiti in the Vedic period.

Santiparvan (Mahabharata)

- i) Theories on origin of the state in Mahabharata
- ii) Ideas on Rajadharma and Dandniti in Santiparvan

#### MANU:



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iii) Concepts of Danda

# KAUTILAYA.

- I) Kingship: origin and role
- II) Element of State
- III) Kautilya on statecraft
- IV) Relation between Ethics and Politics

#### VIVEKANANDA:

- I) Ideas on Nationalism
- II) Freedom
- III) Social Philosophy of Vivekananda

# AUROBINDO GHOSH:

- i) On Nationalism
- ii) Ideal of Human unity
- iii) Aurobindoøs critique of reason

#### iv) Views on Freedom

#### GANDHI:

- i) Ends and Means
- ii) Relationship between religion and Politics
- iii) Trusteeship
- iv) Critique of Modern Civilization
- v) Satyagraha
- vi) Summing up Gandhi on Ideal Society
- vii) Relevance of Gandhi

#### **SELECTED READINGS:**

A.V.Rathna Reddy:

<u>The Political Philosophy of Swami Vivekananda,</u>
New Delhi: Sterling Publishers, 1984.
<u>Ancient Indian Political thought and Institutions,</u>
Bombay: Asia Publishing House, 1968

B.A. Saletore:

Your complimentary use period has ended. Thank you for using PDF Complete.	Social and Political Thought of Candhi Calautta
Click Here to upgrade to Unlimited Pages and Expanded Features	Allied Publishers, 1969
Joan V. Bondurant:	Conquest of Violence: The Gandhian Philosophy
	of Conflict, New Jersey: Princeton University Press, 1958.
Karan singh:	Prophet of Indian Nationalism: A study of the Political thought of Sri Aurobindo Ghosh 1893-
Ram Sharan Sharma:	<u>1910,</u> London : George Allen and Unwin, 1963 <u>Aspects of Political Ideas and institutions in Ancient</u> <u>Indian</u> ,Delhi:Motilal Banarsidass,1959

Suneera Kapoor:	Shri Aurobindo Ghosh and Bal Gangadhar Tilak:
	The Spirit of Freedom, New Delhi Deep and Deep
	Pub.,1991.
U.N.Ghoshal,A:	History of Indian political Ideas, Bombay:
	Oxford University Press, 1966
V.P.Verma:	The Political Philosophy of Aurobindo, Delhi:
	Motilal Banarsidass,1976
	Modern Indian political thought, Agra: Lakshmi Narain
	Agarwal 1961



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# COURSE-IX THEORIES APPROCHES AND CONCEPTS

Max marks: 100

Time : 3hrs

Note: Students are required to attempt four questions. All question carry equal marks.

1. What is politics: Traditional and modern definition?

2. Thought, Theory, Pholosophy and science.

3. State of political theory today: decline or resurgence.

4. Liberty, Equality, Justice and Political Obligation.

5. Power, authority, legitimacy.

6. Liberalism, Marxism and Fascism.

7. Realitionship between Ends and means.

8. Behaviouralism and post behaviouralism

9. Imperialism, Colonalism and neo-colonialism

10. Theories of violence and non-violence

11. Tradition & Modernity

12. Post-modernism.

#### **SELECTED READINGS**:

Amin Sa

Amın Samır:	Unequal Development: An Essay on the Social
	Formation of Peripheral Capitalism, Haddocks:
	Harvester Press, 1976
Andrew Hacker:	Political Theory, Philosophy, Ideology Science,



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Dante Germino:

New York: Macmillan,1960<u>.</u> <u>Issues in Political Theory</u>, New Delhi: Sterling 1985. <u>Beyond Ideology: The Revival of Political Theory</u>,

New York: Harper & Row, 1967

Isaiah Berilin:	Four Essays on Liberty, Oxford University Press,
	1975
James Charlesworth, ed.:	Contemporary Political Analysis, New York: Free
	Press of Clence, 1967
John Rawls	A Theory of Justice, London: Oxford University Press
	1972
John S. Augustine, ed.:	Strategies for Third world Development New Delhi:
	Sage Publications 1989. John V
Bondurant:	Conquest of Violence: The Gandhian Philosophy of
	Conflict, Princeton ,Princeton University Press
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James Gould and V. V. Th	orsby ed.: Contemporary Political Thought: Issues in Scope,
	Value and Direction, New York: Harper and Row
	1967
L.Kalakowaski:	Main Currents in Marxism, Vol. I-III, Oxford, Oxford
	University Press,1981
Lenin	Imperialism The Highest Stage of Capitalism, Seclected
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_Mulford Sibley:	Political Ideas and Ideologies, Delhi: Surjeet Publications,
	1981
Randhir Singh:	Reason, Revolution and Political Theory New Delhi: Peopleøs
	Publishing House 1967
Robert Hollingov	Post-Modernism and the Social Sciences: A Theortic
	Approach, New Delhi Sage Publications, 1994.



rnity of Tradition, Chicago: Chicageo University

67

S.P. Verma <u>Modern Political Theory</u>, New Delhi: Vikas Publishing House, 1975. .W.T.Denniger: <u>Problems in Social and Political Thought: A Philosophical Introduction</u>, New York: Macmillan & Co, 1965.



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# COURE – X

# **REGIONAL POLITICS IN INDIA**

Max Marks: 100

#### Time: 3 Hours

Note: Students are required to attempt Four questions. All questions carry equal marks.

- 1. Approaches to study of regional politics in India
- 2. Variations of socio-Economic development in different regions of India Politics of regionalism in Indian states with special reference to demand for creation of new states Uttarakhand ,Jharkhand and Gorkhaland.
- 3. Politics of secessionism, Kashmir and Assam.
- 4. Caste as factor in the politics of states with reference to North South Variations.
- 5. Study of Movements.
- i) Dalit and Backeard caste movements in U.P. & Bihar
- ii) Dravid movement in Tamil Nadu
- iii) Peasant movements in Punjab, Haryana & Western U.P.
- 6. Politics of Tribalism with special reference to North East
- 7. Communal Politics in Indian states with special reference to Uttar Pradesh Maharahtra and Gujarat.
- 8. Regional Political politics in Indian Politics, Akali Dal, T.D.P. D.M.K. and A.I.A.D.M.K.
- 9. Grassroots politics in Indian states with special reference to Rajasthan, Karnataka and West Bengal.

#### **SELECTED READINGS:**

M.J.Akbar:

India: The Siege within: Challenges to a Nationøs Unity, Middlesex: Penguin Books 1985.



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Click Here to upgrade to Inlimited Pages and Expanded Features	<u>Kashmir towards insurgency</u> , New Deini: Orient Longman, 1993
Ramesh K. Chauhan,:	Punjab and the Nationality: Question in India, Delhi:
	Deep & Deep, 1995
Devinder Pal Sandhu:	Sikhs in Indian Politics: Study of a Minority New
	Delhi: Patriot Publishers, 1992.
Rajinder Kau:	Sikh Identity and National Integration New Delhi:
	Intellectual Publishers 1992.
A.S.Narang:	Storm Over Satulej: The Akali Politics, New Delhi:
	Gitanjali Publishing House, 1983.
Gopal Singh:	Punjab Today. New Delhi: Intellenctual Publishers,
	1987.
	Politics of Sikh Homeland, Delhi: Ajanta, 1994

Magazines and Journals:

Economic and Political Weekly, Mainstream, social scientist, Politics India, Frontline, India Today.

# **COURSE- XI**

#### THEORIES OF NATIONALISM AND PROCESSES OF NATION BUILDING

Max. Marks: 100

Time: 3 Hours

Note: Students are required to attempt Four questions. All questions carry equal marks.

- 1. Nation, State Nation-Building, State- Building
- 2. Theories of Nationalism



s of nationalism and nation state.

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l of Nation Building, British, German and American

- 5. Experience with the socialist model of national building special reference to Russia, China and Cuba.
- 6. Broad differences of early and late modernizing nations
- 7. Problems of Nation-Building in Developing Regions.

#### **SELECTED READINGS:**

Boyd C.S:	Faces of Nationalism: New Realities and old Myths,
	New York: Harcourt Brace Javanovich, Inc. 1972.
Benedict Anderson:	Imagined Communities: Reflection on the Origin and
	spread of Nationalism, D London: Verso, 1993.
	A Royal Institute of International affairs Report on
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J.M. Blan:	. The National Question Decolonizing the theory of
	Nationalism Clifton place: Zedikar Publishers, 1987.
Paul R. Bras:	Ethnicity and NationalismTheory and Comparison
	Delhi: Sage Publications, 1991.
Walker Connor:	Ethno Nationalism The Quit for Understanding,
	Princeton: Princeton University Press, 1994.
Kari W. Detach:	Nationalism and Social Communication London:
	M.I.T. Press, 1961.
Rupert Emerson,:	From Empice to Nation, Boston: Harvard University
	Press, 1960.
Ernest, Gelloner:	Nations and Nationalism, Oxford: Blackwell New
	Delhi: Select Books Service syndicate, 1986,
E.J. Hobsbawm:	Nations and Nationalism Since 1780, Cambridge:
	Cambridge University Press, 1990.
Carbton J.H. Hayes:	<u>Nationalism A Religion,</u> New York: MacMillon
	Company, 1960



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Gumar Myrdal:	Asian Drama, 3 vols, London: Penguin, 1968.
A.D.Smith:	Theories of Nationalism London: Duckworth, 1983.
Barrington Moore:	Social origin of Dictatiorship and Democracy, Londor
	Penguin, 1969.
Hans Konn:	Nationalism Its Meaning and History Princetion: Var
	Nostrand, 1955.
	The Ideas of Nationalism: A Study in its Origin
	And Backgriounds, New York: The Macillan
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Rajni Kothari ed:	State and Nation Building: A third world Perspective
	New Delhi Allied Pub. Pvt.Ltd. 1976.

Louis L.Snyder ed.:	The Dynamics of Nationalism Readings in its Meaning	
	and Development, Princeton: D. Van Nostrand Co.	
	1964	
Eisenstadt:	Modernization Protest and Change, Prentice Mall;	
	Englewood Cliffs, New Jersy 1966.	
S.P. Huhtington:	Political Order in Changing Societies, Boston: Harvard,	
	1960	
I.L. Horowitz:	Three Worlds of Development, New York: oxford	
	University Press, 1972	



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#### COURSE - XII

#### **INDIA'S FOREIGN POLIY AND RELATIONS**

Max. Marks: 100

Time : 3Hours

Note: Students are required to attempt only Four questions. All questions carry equal marks.

- 1. Evolution objectives and Determinates of Indian Foreign policy. The changing International situation and its impact on India*ø*s Foreign policy.
- 2. Domestic roots of Indian Foreign Policy.
- 3. India as regional power in World politics
- 4. India relations with neighboring states, Pakistan, Sri Lanka Nepal, Bangladesh.
- 5 Indiaøs relations with U.S.A. China and Russia
- 6 India and NAM.
- 7 India and U.N.O.
- 8 India and West Asia with special reference to Palestanian issue, Iran and Iraq Problem
- 9 Nuclear issue and Indiaøs security.

#### **SELECTED READINGS:**



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minited Pages and Expanded Peatures	National interest and Indian Foreign Policy, Dolhi
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	Kannga Publications, 1992
C.P. Bnambhri:	Foreign Policy of India, New Delhi: Sterling 1987
J.Bandyopadhyaya:	The Making of Indias Foreign Policy, Bombay: Allied
	Publishers, 1979.
Imuaz Annmad:	State and Foreign Policy: Indiaøs role in South Asia.
	New Delhi: Vikas Publishing House, 1993.
K.P.Mishra:	Foreign Policy of India: A Book of Readings New
	Delhi: Thompson Press, 1977.
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Pran Chopra:	Crisis of Foreign Policy ; Perspectives and issues,
	Allahabad wheeler Publishing, 1994.
J.N. Dixit:	Across Borders: Fifty years of Indian Foreign Policy,
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Foreign Services Institute,	Indian Foreign Policy New Delhi: Konrark Publishers
	2 Volumes, 1998.
P.N. Haskar:	Indiages Foreign Policy and its problems New Delhi:
	Patriot Publishers, 1989.
Harcharan Singh Josh (ed):	Indiaøs Foreign Policy: Nehru to Rao: New Delhi:
	Indian Council of World Affair 1994
B.R. Nanda(ed):	Indian Foreign Policy: The Nehru Years. New Delhi:
	Radiant Publisher Ed 2 1990
	Tudiult 1 doublet. 20., 2, 1770.



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# COURS- XIII DEMOCRATIC THEORY

Max. Marks: 100 Time : 3 Hours

NOTE; Students are required to attempt FOUR questions. All questions carry equal marks. 1.

- (a) Traditional Liberal democratic Theory: Central themes from Locks to J.S. Mill
- (b) Twentieth Century restatement of Liberal democratic theory: Laski, Macpherson, Rawls and Dworkin
- 2. Communitarianism vs. Individualism Debate: Charles Taylor and Robert Nozick
- 3. Empirical Democratic Theory: Schumpeter and Robert Dahl
- 4. (a) Marxist critique of liberal democracy(b) Critique of Elite Theories: Michel, Mosca, Pareto

# **SELECTED READINGS:**

A.G.Cohen:	õ <u>Capitalism, Freedom and Protetariatö in Alan</u> <u>Ryan. ed., The Idea of Freedom</u> , Oxford: Oxford University Press 1979.
C.B. Macpherson:	<u>The Life and Times of Liberal Democracy</u> , New York : Oxford University Press, 1977.
David Held:	Models of Democracy, U.K : Polity Press, 1995
C.Parry:	Political Elites, London: Allen and Unwin, 1969
J. Rawls :	<u>A Theory of Justice</u> , Cambridge: Harward University Press 1971.
J.S Schumpeter:	Capitalism ,Socialism and Democracy, London: Allen and Unwin,1976
John Palmenatz:	Democracy and Illusion, London: Longman, 1973



R.A. Dahl:Polyarchy, Participation and Opposition, New Haven:<br/>Yale University Press 1971.R. Michels:Political Parties, New York: Free Press, 1962R. Nozick:Anarchy, State and Utopia, Oxford : Basil Black well<br/>1974.

Shlomo Avner Avrde Shalit ed.

<u>Communitarianism and Individualisn</u>, New York: Oxford University Press, 1992



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# COURSE : XIII

#### **MODERN INDIAN POLITICAL THOUGHT**

MAX. Marks 100 Time 3 Hours

NOTE: Students are required to attempt FOUR question. All Question carry equal Marks.

#### BHAGAT SINGH:

- i) Impact of Marxism on Bhagat Singh
- ii) His ideas on revolution and vision of Independent India
- iii) His views on atheism and concept of secularism.

#### SUBHASH CHANDRA BOSE:

- i) His concept of nationalism
- ii) His strategy against British Imperialism
- iii) Impact on Subhash Chandra Bose of Socialism and Fascism

#### M.N.Roy:

- i) M.N.Roy as a Marxist and his differences with Lenin
- ii) M.N. Royøs critique of Marxism
- iii) Views on Radical Humanism and concept of organized democracy

#### JAWAHARLAL NEHRU:

- i) Concept of Democratic Socialism
- ii) Concept of Secularism
- iii) Nehruøs model of nation building
- iv) Nehruøs nationalism and internationalism

#### J.P.NARAYAN:

- i) Concept of Socialism
- ii) Views on Sarvodaya and partyless democracy
- iii) Total Revolution

# RAM MANOHAR LOHIA :

- i) Lohiaøs concept of socialism
- ii) Concept of Chaukhamba Rajya
- iii) Concept of Small machine technology
- iv) Views on Caste, Class and power

#### DR. B.R. AMBEDKAR:

i) Ambedkarøs view on Varna system and annihilation of caste



cial Justice tionality ndian Polity

<b>SELECTED READINGS;</b>	
A.Appadorai:	Indian Political Thinking in the twentieth Century: From Naoroji to Nehru: A Introductory Survey. Oxford: Oxford University Press, 1971.
Benudhar Pradhan,:	<u>The Socialist Thought of Jawaharlal Nehru</u> , Gurgaon: The Academic Press, 1989
Chandradeo Prasad:	Political Ideas of Dr. Ram Manohar Lohia, New Delhi; Delhi: Commonwealth Publishers, 1989
M.N.Dass :	<u>The Political Philosophy of Jawaharlal Nehru</u> , New York: The John day Company, 1960
M.N.Roy:	NEW HUMANISM; A Manifesto, Delhi: Publication, 1981
Jai Prakash Narayan:	Socialism, Sarvodaya and Democracy Selected Works Of J.P.Narayan, ed., Bimal Prasad, New Delhi: Asia Publshing House, 1964.
	<u>Towards Total Revolution</u> , Vol.I toIV, ed., Brahmanand, Bombay: Popular Prakashan 1978.
Kamlesh Mohan:	Bhagat Singh, The Man and his Ideology, Chandigarh: Director, Information and Public, Relation, Punjab
Shiv Verma, ed.:	Selected Writings of Shaheed Bhagat Singh, New Delhi: National Book Centre, 1986
V.P.Verma:	Modern Indian Political Thought, Agra: Lakshmi Narain agarwal .,1971
V.R. Mehta:	Foundation of Indian Political Thought, New Delhi; Manchar Publishers 1996
W.N. Kuber	<u>Ambedkar: A Critical Study</u> ., New Delhi: Peopleøs Publishing House 1991.

# **COURSE-XIV**

# **POLITICS IN SOUTH ASIA**

Max. Marks	:	100
Time	:	3 Hours



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mpt FOUR question. All questions carry

- 1. South Asia as distinct :International subsystemøgeographical and strategic Importance, demographic, socio- cultural composition, Natural resources, Industrialization and technological development.
- 2. Colonialism and its legacies
- 3. Post colonial states in South Asia:
  - i) Development, democracy and dictatorship
  - Political Institutions and Governmental Processes: Role of Political parties and political development, Legislature, Executive Judiciary and Bureaucracy, and Electoral system.
  - iii) Political elites, and pressure groups in South Asia States with special Reference to role of Military in Pakistan and Bangladesh
  - iv) Religion and Ethnicity in South Asia Politics
  - v) Issue of interaction and Nation Building in South Asia
  - vi) Co-operation and Conflict in South Asia with special reference SAARC
  - vii) Nuclear polity of Indian and Pakistan, Kashmir problem, Tamil question.
  - viii) Issues of Human Rights and peopleøs movement in South Asia, nature Origin and characteristics of political terrorism in South Asia.
- NOTE: This paper will deal only with India, Bangladesh, Pakistan, Sri Lanka and Nepal

#### **SELECTED READINGS**;

Gowher Rizv:	, <u>South Asia in a Changing International Orde</u> r, New Delhi: Sage Publications, 1993
Hartmut Elsenhans:	<u>Development and Under development: The History,</u> <u>Economics and Politics of North- South Relations</u> , New Delhi: Sage publications, 1991



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of proximity: India and Sri Lankaøs Ethnic Crisis, New Sage Publications 1993.

Kumar Rupe Singh &: Rhawar MuntazInternal Com Publications,Stephen Philip Cohen:Security ofVeena KurkrejaCivil Militar Publications		
Publications,         Stephen Philip Cohen:       Security of         Veena Kurkreja       Civil Militar         Publications	Kumar Rupe Singh &: Rhawar Muntaz	Internal
Veena Kurkreja <u>Civil Militar</u> Publications	Stanhan Philin Cohan:	Publicati
Veena Kurkreja <u>Civil Militan</u> Publications	Stephen Finnp Conen.	Securit
	Veena Kurkreja	<u>Civil M</u> Publicati
	Ross Mallick:	<u>Develo</u> New Del
Ross Mallick: <u>Developme</u> New Delhi:	Sumantra Bose:	<u>States,</u> 1994
Ross Mallick:Developme New Delhi:Sumantra Bose:States, Nati 1004	Ramkant and B.C Upreti,	Ed.: <u>Nation-</u> Publishe
Ross Mallick:Developme New Delhi:Sumantra Bose:States, Nati 1994 .Ramkant and B.C Upreti, Ed.: Nation-Buil Publishers, 1		

# COURSE-XV

# SOCIETY, ECONOMY AND POLITICS OF HIMACHAL PRADESH Max Marks ; 100

Time ; 3 Hours

NOTE; Students are required to attempt any FOUR question. All questions carry Equal marks.

- 1. Politics of Statehood in Himachal. The movement for separate state, attaining Status of separate state.
- 2. Demographic structure of Himachal: Area, population and Climate, Tribal and



as and New (merged) areas. ture, Agriculture, Business, trade and Industry,

- 4. Political parties and Political Development in Himachal.
- 5. Politics of pressure Groups in Himachal with special reference to fruit, Vegetable and apple Growers Association.
- 6. Electoral Politics and voting Behaviour in Himachal.
- 7. Caste in Himachal Politics.
- 8. Politics of sub-regionalism in Himachal
- 9. Panchayati Raj in Himachal before and after 73<sup>rd</sup> Amendment.
- 10. Students Politics in Himachal-SFI, ABVP AND NSUI

#### **SELECT READINGS;**

M.A Ahluwalia:	History of Himachal Pradesh, New Delhi: Intellectual
	Publishing House, 1988.
Ranbir Sharma:	Party Politics in Himachal State, Delhi: National Publishing
	House, 1977
Ramesh K. Verma :	Regionalism and Sub-Regionalism in State Politics, New
	Delhi: Deep & Deep Publication, 1994.
Shakuntla:	Panchayati Raj in Himachal, Delhi: Deep & Deep
	Publication, 1994
Mian Goverdhan Singh	History, Culture, & Economy of Himachal, Shimla:
	Minerva Publishers ,1994

Documents

Statistical Outline of Himachal Pradesh , Economic Survey of Himachal Pradesh, State Gazetters.

Census Report all documents are Government of Himachal Pradesh Publications.

#### M.A.(POL.SCIENCE) IVth SEMESTER:

#### **COURSE-XVI**

#### PUBLIC INTERNATIONAL LAW

Max Marks	:	100
Time	:	3 Hours

NOTE; Students are required to attempt FOUR questions. All the questions carry equal marks. The candidates will attempt ONE question from each of the four parts.

#### PART-I

#### INRODUCTION



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iv)

Communist, Afro-Asian

- Relation of International Law with Municipal Law
- v) Codification and Progressive Development of International Law
- vi) Individual, Human Rights and International Law.

#### PART- II

#### LAW OF PEACE:

- i) Recognition
- ii) Asylum
- iii) Changing nature of Law of Sea, Space and Outer Space
- iv Piracy including the problem of Hi jacking.

# PART-III

#### LAW OF WAR

- i) Pacific and Forcible methods of settlement of International Disputes
- ii) War Crimes and Treatment of Prisoners of War(POW)
- iii) General Laws of War and Changing nature of War in 21<sup>st</sup> century
- iv) Prize Courts

#### PART-IV

#### LAW OF NEUTRALITY

- i) Changing Nature of Neutrality in 20<sup>th</sup> & 21<sup>st</sup> centuries
- ii) Rights and Duties of Neutrats and Belligerents
- iii) Blockade, Embargo
- iv) Contraband

#### SELECTED READINGS:

J.C.Starke	Introduction to International Law, London; Buterworks 1977.
C.G.Fenwick	International Law, Bombay: Vakils, 1971.
R.P. Anand	Asian States and Development of Universal International
	Law.New Delhi: Vikas 1972.


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tates and International Law, New Delhi: Vikas\_1972.

ited Pages and Expanded Features	porary International Law.
Lancberpanht (ed.,)	Oppenheimøs International Law, London 1955.
Gregory Tunkin	Contemporary International Law, Moscow: Progress, 1969.
Ian Brounlie	Principal of Public International Law, Oxford: Oxford UniversityPress, 1973.
Michael Akehurst	<u>A Modern Introduction to International Law</u> ,London: George Allen & Unwin,1970.
JOURNALS	

Indian Journal of International Law Amercian Journal of International Law

# COURSE-XVI

# POLITICAL ECONOMY OF DEVELOPMENT

Max. Marks	:	100
Time	:	3Hours

NOTE: Students are required to attempt FOUR questions. All the questions carry equal marks. The students will attempt TWO questions from each of two parts.

## PART ó I CONCEPTUAL FRAMEWORK

- 1. Basic Concept: Mode of Production and Superstructure. Imperialism: Leninism and Contemporary Imperialism.
- 2. Economic Crisis: Salient features of the economic crisis. Bourgeois theories, Social Democratic and Marsxian. Non-Leninist theory of Imperialism. Kautsky, Hiferding, Luxumberg, Gramsci, Trotsky, Bukharian and Automatic collapse of capitalism.
- 3. Development Perspectives: Neo-Marxist theories of under development: Wallerststein and Perrry Anderson.

# PART-II



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# NDIAN CONTEXT

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dia: Transition from Feudalism to Capitalism,

Asiatic Mode of Production.

- 2. Nehruvian Model: State led Development and its critique, Globalisation and Restructuring of Indian economy, Transnationalisation of world economy and Emerging International Trading Order: Implications for Indiaøs economy.
- 3. Globalisation and Nation-States
- 4. Political Parities in India and Political Economy of Development and Underdevelopment.

# **SELECTED READINGS:**

Samir Amin :	<u>Unequal Development: An Essay on the Social</u> <u>Formation of Peripherical Capitalism</u> , Haddocks: Harbester Press, 1976.
	Accumlators on a World Scale
John S. Augustine:	Stragegies for Third World Development, New Delhi: Sage. Publications ,1989.
Hartmut Elsenhans:	<u>Development and underdevelopment</u> : The History, <u>Economics and Politics of North South Relations</u> ,New Delhi: Sage Publications,1991.
Andre Guner Frank:	Capitalism and Underdevelopment in Latin America, Penguin,1971
Welterstein,:	Globalisation of Poverty, New Delhi: Other India Press, 1997
Prabhat Patnaik (ed) :	Lenin and Imperialism, New Delhi: Orient Longman, 1986
Rajwant Singh and Subhasl	n Ghatade (ed): <u>Globalization of Capital</u> Ahmedabad: Lal Parcham, 1997



World Economy in Transition: An Indian tive, New Delhi: Haranand Pub, 1993.

Michael Wolfraun:

Political Economy: Marxist Sstudy Courses, Tillinots: Banner Press, 19

## **COURSE-XVI**

## MARXISM AFTER MARK

Max. Marks	;	100
Time	;	3Hours

NOTE; Students are required to attempt FOUR questions. All questions carry equal marks.

## BERNSTEIN;

The Revisionist Controversy and the Criticism of Revolutionary Marxism

#### LENIN:

The party revolution imperialism and imperialist wars the state, the national Question

## ROSA LUXUMBURG;:

Social reform or revolution, the mass strike, assessment of the Soviet Revolution, the national question,

#### TROTSKY:

His analysis of the Soviet system, The bureaucracy, thermidor, bolshevism And Stalinism, fascism, democracy and war, permanent revolution

#### MAO ZEDONG:

Maoøs philosophy, Mao and the peasantry, revolution strategy, new Democracy, revolutionary reconstruction

## GORBACHOV:

Reassessing the revolutionary experience, problems of democracy in Socialist societies,

#### **SELECTED READINGS:**

David, Mclellan, ed:	Marxism: Essential writings, Delhi: Oxford University Press	
	1961	
	Marxism after Marx: An Introduction, Delhi: The	
	Macmillan Press, 1979.	
J.Starr:	Continuing the Revelution. The Political Thought of Mao, Princeton: Princeton University Press, 1979	



<u>Id Perestroikat: Challenges and Choices facing</u> <u>chav</u>, New Delhi: Abhinav Publications, 1989

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Neil Harding :	Lenings Political Thought ,2 Vols, Lodon: The Macmillan
	Press, 1977.
R.H. Soloman:	Maoø Revolution and the Chinese Political Culture Bombay:
	Oxford University Press,1971

# M.Sc. Botany

#### Semester I

#### **MARKS: 400**

Course No.	Title of Course N	
1	BIOLOGY AND DIVERSITY OF ALGAE AND FUNGI	60
II	BIOLOGY AND DIVERSITY OF MICROBES AND PLANT PATHOGENS	60
III	<b>BIOLOGY AND DIVERSITY OF BRYOPHYTES AND PTERIDOPHYTES</b>	60
IV	PLANT RESOURCE UTILIZATION AND BREEDING	60
	PRACTICAL I-IV (20 MARKS Each)	80
	INTERNAL ASSESSMENT (15 Marks Each)	60
	ATTENDANCE (5 Marks Each)	20
	TOTAL	400

## Semester II

# **MARKS: 400**

Course No.	Title of Course Mark	
V	CELL AND MOLECULAR BIOLOGY (COMMON COURSE)	60
VI	<b>BIOSTATISTICS &amp; COMPUTER AOOLICATIONS (COMMON COURSE)</b>	60
VII	BIOLOGY AND DIVERSITY OF GYMNOSPERMS	60
VIII	BIOLOGY AND DIVERSITY OF ANGIOSPERMS I	60
	PRACTICAL V-VII (20 MARKS EACH)	80
	INTERNAL ASSESSMENT (15 MARKS EACH)	60
	ATTENDANCE (5 MARKS EACH)	20
	TOTAL	400

## Semester III

#### **MARKS: 400**

Course No.	Title of Course	Marks
IX	CYTOGENETICS AND EVOLUTION (COMMON COURSE)	60
X	IMMUNOLOGY AND BIOTECHNOLOGY (COMMON COURSE)	60
XI	BIOLOGY AND DIVERSITY OF ANGIOSPERMS II	60
XII	PLANT PHYSIOLOGY	60
	PRACTICAL IV-XII (20 MARKS EACH)	80
	INTERNAL ASSESSMENT (15 MARKS EACH)	60
	ATTENDANCE (5 MARKS EACH)	20
	TOTAL	400

## Semester IV

## **MARKS: 300**

Course No.	Title of Course	Marks
XIII	BIOCHEMISTRY (COMMON COURSE)	60
XIV	ECOLOGY (COMMON COURSE)	60
XV	SPECIAL PAPER	60
	PRACTICAL XIII-XV (20 MARKS EACH)	60
	INTERNAL ASSESSMENT (15 MARKS EACH)	45
	ATTENDANCE (5 MARKS EACH)	15
	TOTAL	300

Grand Total: 1500

**Special Paper:** 1. Advanced Topics in Mycology 2. Advanced Topics in applied Microbiology 3. Advanced Topics in Plant Pathology 4. Wood Sciences, Forest Biodiversity and Plant Resources 5. Biodiversity, Bioprospecting, Ethnobotany and Sustainable Utilization of Plant Resources 6. Plant Reproduction, Tissue Culture and Horticultural Sciences 7. Advanced Palnt Physiology and Biochemistry.

#### Semester I

Course I: -

## **BIOLOGY AND DIVEERSITY OF ALAGAE AND FUNGI**

## Algae:

- 1. Algae in diversified habitats (terrestrial, fresh water, marine)
- 2. Thallus organization in algae
- 3. Cell ultra-structure
- 4. Reproduction (Vegetative, asexual, sexual) and patterns of life cycle.
- 5. Criteria for classification of algae (pigments, reserved food, flagella).
- 6. Fine structure of algal plastids.
- 7. Algal blooms.-
- 8. Algal biofertilizres
- 9. Economic importance of algae
- 10. General account of lichens and their economic importance

## Suggested Reading:

Fritsch, F. E. The structure and reproduction of algae. Vol. I & II, London, Cambridge Univ. Press (1971-72)

Kamat, N. D. (1982), Topics in algae, Sai Kirpa Prakashan, Aurangabad.

Kumar, H. D. (1988). Introductory Phycology. Affiliated East-West Press limited, New Delhi.

Round, F. E (1986). The biology of algae. Cambridge University Press, Cambridge.

Kumar, H. D.. (1985). Algal cell Biology. Affiliated East-West Pres Limited, New Delhi.

Moris. I. (1967). An Introduction to the Algae. Hutchinsen University Library, London.

## Fungi:

- i) Introduction to Mycology: General characteristics of fungi, their significance to human, organization of fungal cell, thallus and modifications thereof; ultrastructure, reproduction (vegetative, asexual, sexual), recent trends in classification.
- Comparative study of habit, habitat, somatic organization, anamorphs, teleomorphs and evolutionary tendencies ,in any of these phases in the life cycle of the members of Dictyosteliomycota and Myxomycota (Dictyostelium, physarum) Chytridiomycota and Oomycota (olpidium, synchytrium, Allomyces, Plasmodiophora, Saprolegnia, Pythium, Pyytophora and Downy mildews), Zygomycota (within members of Zygomycetes), Ascomycota (Ascocarp development, ascocarp types, centrum types and their bearing on classification, with emphasis on Protomyces, Taphrina, Yeast, Penicillum, Aspergillus, Chaetomium, Neurospora, Claviceps and Venturia; and general account of powdery mildews and Discomycetes, Basidiomycota, (basidiocarp types, development, general account of Hymenomycetes, Ustilaginomycetes and urediniomycetes, Alternaria, Helminthosporium, Cercospora, Colletotrichum, Pyricularia, Fusarium

- iii) Sex hormones in fungi, Heterothallisum and parasexual cycle in fungi, nutrition in fungi (saprophytes, parasites, predators, symbionts).
- iv) mportance oof Fungi in different microbiological and Biotechnological processes fungi min food and food industry, as agents of biodeteriooration and biodegradation, in agricturue, in medical biotechnology and as agents of biotransformation, biosorption and biomining.

## Suggested Books :

- 1. Ainsworth, G. C., Sparrow, F. K. And Man, A. F. S. The fungi- an advanced treatise Academic Press, 1973.
- 2. Alexopoulos, C. J. and Mims, C. W. Introductory mycology, 3<sup>rd</sup> Edition , Wiley- Easter, New Delhi
- 3. Alexopoulos, C. J. and Mims, C, W. and Blackwell, M, Introductriy mycology. John Wiley and Sons. 1996
- 4. Deacon, J. W. Introction to Modern Mycology ELBS.
- 5. Moore- Landerckar, E. J. 1972. Fundamentals of the fungi. Prentice hall, Englewood Cliffs.
- 6. Burnett, H. L. Fundamentals of Mycology . Edwand Arnold, London.
- 7. Aneja Krand Mehrotra R. S. Introductory Mycology.
- 8. Dube, R. and Mukerji, K. G. 2001. Microbial Technology A. P. H. > Publishing corporation, New Delhi.
- 9. Gupta, R and Mukerji, K. G. 2001 Microbial Technology A. P. H. Publishing Coproration, New delhi.

## Course II: BIOLOPGY AND DIVERSITYT OF MICROBES AND PLANT PATHOGEN

- 1. History of plant pathogens, concept, diagnoses, classification, importance and identification of unknown diseases; symptomology and disease development.
- 2. Host- pathogen interaction at plant and cellular level: Mechanism of pathogen attack and defense: Physical, Physiological, biochemical and molecular aspects.
- 3. Host-pathogen- interaction at population level: Transmission and spread of plant pathogens, disease epidemics,, modeling and disease forecasting to control crop losses.
- 4. Management of plant disease: Chemical, Biological, IPM system, development of transgenics, biopesticides, plant diseases clinics, quarantine.
- 5. Genetics of plant disease: Gene for virulence and avirulence. Their application in resistance and susceptibility, induced resistance (immunization)
- 6. Specific plant disease caused by diverse pathogens: Black wart disease of potato, Club root of crucifers, damping of seedlings, late blight of potato, downy mildew of grapes an bajra, stem gall of coriander, peach leaf curl, powdery mildew of wheat and apple, apple scab, general account of rusts, smut and bunts, Fusarial wilt of tomato, rhizome rot of ginger, tikka disease of groundnut, red rot of sugarcane, brown leaf spot and blast of rice. Bacterial blight bean, common scab of potato, fire blight of apple, citrus canker, potato leaf roll, potato spindle tuber, tobacco mosaic virus.

## Suggested Books:

- 1. Agrios, G. N. Plant Pathology, Academic Press, 1988
- 2. Butler, E. J and Jones, S. G. Plant Pathology, Periodical Expert Book Agency Delhi, 1986
- 3. Mehrotra, R. S. Plant pathology. Tata Mc Graw- Hill. Ublishing Company, New Delhi
- 4. Bilgrami, K. S. and Dubey, H. C. text Book of modern Plant pathology, Vikas, New Delhi, 1980
- 5. Mundkar, B. b. Fingi and Plant Diseases. Mc Millan , 1967
- 6. Wood, R. K. S. Physiological plant Pathology. Blackwell Scientific Publications, 1967
- 7. Tarr, S. A. J Principals oof Plant pathology. Mc Millan, 1972

- 8. Horsfall, J. G. and Dimond, E. Palnt Pathology, Academic Press, New York
- 9. Horsfall, J. G. and Cowling, E.B. Plant Disease Vol. I-V. Academic Press, New York

# **MICROBES:**

- 1. History and scope of microbiology, landmarks in microbiology, major groups of microorganism, characterization, identification and classification of microorganism
- 2. **Structure of Bacteria** : Structure and fine structure of cell and of internal and external structure to cell wall, spores and cysts. Nutrition of bacteria: modes of nutrition, nutritional types, growth characteristic, reproduction and genetic recombination: Binary fission, resting structure, conjugation, transformation and transduction; mechanism of antibacterial action.
- 3. General account of Rickettsia, Chlamydeae, Mollicutes and disease caused by them
- 4. **Virus:** History, structure and classification, plant and animal virsues, nature and transmission, genome organization (TMV, CMV, CAMV and Gemini viruses), isolation and purification, detection, identification and economic importance; Bacteriophages, viroids and prions nature and importance
- 5. Viruses in cancer; Principals of immunology: general account of immunity, allergy anmtigen- antibody, serology and types of vaccines.
- 6. Applications of microbes inn agriculture (Biofertilizers, biopesticides), industry (alcoholic beverages, citric acid, penicillin production), environment (pollution indicator and control), and genetic engineering.

# Suggested Reading:

- 1. Stanier, R. Y. Geneeral Microbiology MacMillan, 1970
- 2. Pelezzar, M. J. Reid, R. D. and Chan, E. C. S. Microbiology, Tata McGraw Hill, 1977
- 3. Kumar, H. D and Rai, D. C. microbes and Microbial processes East West 1990
- 4. Ketchum, P. A. Microbiology- concepts and applications, Wiley, Neew York 1980
- 5. Tauro, P. Kapoor, K. K. and Yadav, K. s. An Introduction to Microbiology. Wiley Eastern Ltd. 1996
- 6. Schlegel, H. G. General Microbiology. Cambridge University Press 1996
- 7. Gupta, R. and Mukerji, K. G. 2001 Microbial Technology. A. P. H. Publishing Corporation New Delhi.
- 8. Tortora, G. J. Funke, B. R. and case, C. L. Microbiology –An Introduction, Addison Wesley Longman, Inc. California.

# Corse III: BIOLOGY AND DIVERSITY OF BRYOPHYTES PTERIDOPHYTES

# **BROPHYTES:**

- 1. General Introduction and Salient feature of Bryophytes. Comparison among Cryptogamous plants.
- 2. Classification of Bryophytes into Liverworts, Hornworts and Mosses.
- 3. A general account of Marchantiales, Jungermanniales, Anthoceerotales, Sphagnales, Funariales and Polytrichales (emphasis is not to be placed on Families or type Studies)
- 4. A general account of Peristome in Mosses
- 5. Origin of land Plants including Fossil evidence.
- 6. Primitive versus Advanced /Derived feature and Evolutionary Lines within Bryophytes.
- 7. Alteration of generation in Bryophytes.
- 8. Morphogenesis in Bryophytes.
- 9. Distribution and Ecology of Bryophytes in India with particular reference to Himachal Pradesh.
- 10. Ecological importance of Bryophytes.
- 11. Economic importance of Bryophytes.

## Suggested Readings:

Cavers, F. 1911. The inter-relationship of Bryophyta. Newe Phytology Reprint No. 4:1-203

Chopra, R.S 1976. Inter- elationship of Indian Bryophytes. The Chronica Botanica, New Delhi

Chopra, R. S and Kumar, S. S. 1976. Musci of fteh Western Himalyas and the Punjab plains. The chronic Botanica, New delhi

Parihar, N. S. 1972. An Introduction to Embryophyta vol I. Bryophyta Central Book Depot, Allahbad

Puri, p. 1981 Bryophytes: Morphology, Groeth and differentiation Atma Ram and Sons, Delhi and Lucknow

Rashid, A. 1998. An Introduction too Bryophyta (Diversity, Development and Differentiation). Vikas Publishing House Pvt. Ltd. New Delhi, 298pp.

Udar, R. 1976 Bryology in India. The Chronica Botanica, New Delhi

Watson, E. V. 1971. The Structure an dlife of Bryophytes. Hutchinson University Library, London.

## **PTERIDOPHYTES :**

- 1. General introduction and salient feature of pteridophytes; comparision among archegoniatae.
- 2. Classification of Pteridophytes.
- 3. Introduction to Palaebotany, some basic principles and techniques.
- 4. A general account of the following fossils pteridophytes: Rhynia, Horneophyton, Trimerophyton, Psilophyton, Zosterophyllum, Asteroxylon, Lepidodendron, Sigillaria, Pleuromeia, Nathorstiana, sphenophyllum, sphenophyyostachys, Calamites, Cladoxylon, Etapteris, Ankyropteris and Osmundites
- 5. Salient feature of Psilopsida, Lycopsida, Sphenopsida and Pteropsida (Emphasis is not to be placed on orders, Families or Types studies.
- 6. Structure and Evolution of Stelar system in Pteridophytes.
- 7. Telome Theory or the Evolution of Sporophyte in Pteridophytes.
- 8. Alteration of Generations in Pteridophytes.
- 9. Natural and Induced Implications of Apogamy in Pteridophytes.
- 10. Natural and Induced implications of Appspory in Pteridophytes.
- 11. Heterospory and seed habit in Pteridophytes
- 12. Distribution and Ecology of the Ferns of the Himalayas with particular reference to Himachal Pradesh.
- 13. Cytological Evolution in Pteridophytes .
- 14. Economic importance of Pteridophytes.

## Suggested Reading:

Andrews, H. N. 1961. Studies in Palaenobotany. John wiley and sons, Inc, Neew York and London

Khullar, S. P. 1994, An illustrated fern flora of west Himalaya Vol I Inteenational book Distributors, Dehradun, India 506 pp.

Khullar, S. p. 2000. An illustrated fern flroa of West Himalaya Vol. II. In ternational Book distributors, Dehradun, India, 538pp.

Parihar, N. S 1996. The Biology and Morphology of Pteridophytes. Central book Depot, Allahabad, 777pp.

Rashid, A. R 1999 Introduction too Pteridophyta- Diversity, Development and Differentiation. 2<sup>nd</sup> Revised Edition. Vikas Publishing Co. New Delhi, 426pp.

Seth, M. K., Kumari, A., Tahkur. R., Khullar, S. P. 2003. Pictorial Guide to Common Himalayan Pteridophytes Vol I Peridophytes of Shimla

Sharma, O. P. 1990. Text book of Pteridophytes. Mc Millan India Ltd. New Delhi, 360pp.

Smith, G.M. 1971. Cryptogamic Botany, Vol II. Bryophytes and Pteridophytes

Tata Mc Graw Hill Publishing Co. New delhi, 546 pp

Sporne, K. R. 1982. The Morphology of Pteridophytes. Hutchinson University Library, London (Reprinted in 1991 by B. I. Publishing Pvt. Ltd. , Bombay)

Stewart, W. N. and Rothwell, G. W. 1993 Palaeobotany and the evolution of pLants Cambridge University Press, London

## **Course IV: PLANT RESOURCES UTILIZATION AND BREEDING**

**1.Forest Products Wood and Timber:** General Introduction, Formation and Composition of wood, Difference between softwoods and hardwoods, Sapwood and Heartwood, Storied and Nonstoried wood, and between Ring porous and Diffuse porous woods, Definitions of various types of annual Rings; Properties and seasoning of woods; uses of woods, structure and identification important timber plants namely Pinus, Cedrus, Tectona and Populus.

2.Nonwood forest Products I- Bamboo- The Green Gold of India, Its structure, Properties and uses

3. Nonwood Forest products II- Cork – Its structure, properties and uses

4. Nonwood Forest products: III- Tannins and Dyes : A general account

5. Nonwood Forest products IV- Gums and Resins – A general account

6. Plant resources I – Aromatic Plants- a general account, essential oils and Perfumery

7. Plant resources II- Psychoactive drugs and poisons from plants: a general Account

**8.** Plant resources III- Fruits and Nuts- a list of important fruits and nuts with particular reference to Himachal Pradesh. (Details are not required)

**9. Plant resources IV- Underexploited/ underutilized plants-** Winged or Goa Bean (Psophocarpus tetragonium); Jojoba or hohba (Simmondisa chinensis), Guayule or Wuyule (Parthenium argentatum), Leucaena or subabul (Leucaena ieucocephala) and Triticale (Triticosecale). A general account, of Edible wild plant.

**10. Plants resources V- Ornamental Plants-** A list of important ormanamenatl plants of himachal Pradesh. Economic importance of flowers.

**11. Plant resources VI- Bioenergy (biofules) of plant origin-** A general account of fuel wood, energy Plantations, organic waste materials for energy, petroleum plants. Alcobol Fuel and Biogas.

**12.** A general account of the origin of cultivated Plants with special reference to Vavilov's centres of origin.

13. A general account , of Plant introduction and Acclimatization.

14. Methods and modes of reproduction in relation to breeding Self pollinated, Cross pollinated, Vegetatively propagated and Apomictic Plants.

15. A general account sof Inbreeding Depression and Heterosis; Exploitation of Hybrid Vigour; Production of Hybrids, Composites and Synthetics.

#### Suggested Readings:

Anonymous, 1970, 1972, 1983. Indian Forest Utilization. Vols. I-II, Controller of Publications, Delhi and Forest Research Institute and Colleges, Dehradun, I-360, 361-642

Anonymous, 1975, Underexploited Tropical Plants with Promising Value. National Academy of Sciences. Washington, D.C. 1990pp.

Anonymous 1980. Firewood crops: Shrubs and Tree Species for Energy Production. National Academy of Sciences, Washington, D.C. 237pp.

Arora, R. K. and Pandey, A. 1996. Wild Edible Plants of India: Diversity, Conservation and Use. ICAR, NBPGR, New Delhi, 294pp.

Chaudhari, H. K. 1971., 1986. Elementary principles of Plant Breeding. Oxford and IBH Publishing CO., Pvt. Ltd., New Delhi, 327pp.

Chopra, V. L. 2001. Plant Breeidng: Field Crops. Oxford and Pvt. Ltd., New Delhi.

Kocchar, S. L. 1998. Economic Botany of the Tropics, 2<sup>nd</sup> Ed. Macmillan India Ltd., Delhi.

Poehlmann, J. M. and Sleeper, D. R. 1995. Breeding Field Crops. Panima Publishing House, New Delhi.

Sambamurthy, A. V. S.S. and Subramanyam, N.S. 1989. A. Textbook of Economic Botany. Wiley Eastern Ltd., New Delhi

Seth, M. K., Channel., S. and Thakur, R. 2002. Pictorial Guide to some Common Ornamental Plants in the Himalayas.

Sharma, J. R. 1994. Principles and Practices of Plant Breeding. Tata Mc Graw Hill Publishing Co., New Delhi, 599pp.

Sharma, O. P. 1996. Hills economic Botany (By Late Dr. A. F. Hill and Adapted By Dr. O. P. Sharma) Tata Mc Graw Hill Co. Ltd., New Delhi, 731pp.

Simpson , B. B. and Conner- Ogorzaly, M. 1986. Economic Botany- Palnts n our World. Mc. Graw Hill, New York, 640pp.

## SEMESTER II

## COURSE V: CELL AND MOLECULAR BIOLOGY (COMMON COURSE)

# 1. Structural organization of plant and animal cell :

- i) Cell Wall: structure, function and biogenesis
- ii) Plasma membrane: structure , models, functions, sites for ATPases, ion carries, channels and pump
- iii) Plasmodesmata: structure, role improvement of molecules, comparison with gap junctions.
- iv) Plant vacuole: Tonoplast membrane, ATPase as storage organelle.
- v) Structure and functions of microbodies: Golgi apparatus, lysosomes, endoplasmic reticulum
- 2. **Chloroplast and mitochondria**: Structure, genome organization, gene expression, nucleochloplastic interactions, biogenesis of mitochondria
- 3. **Nucleus:** structure, nuclearpores, nucleosome organization, nucleolus.
- 4. **The cytoskeleton**: Organization and role of microtubules and microfilaments, motor movements, implications in flagellar and other movements.
- 5. **Cell cycle and apoptosis**: Control mechanism, role of cyclins, cyclin- dependent linases, cytokinesis and cell plate formation, mechanism of programmed cell death.
- 6. Gene expression:
- i) DNA structure; A,B, and Z forms; replication, damage and repair
- ii) Transcription, promoters and transcription factors, splicing, mRNA transport, rRNA biosynthesis, difference in prokaryotes and eukaryotes.
- iii) Transcription: structure of ribosome, mechanism of translation, initiation, elongation and termination, structure and role of RNA.
- 7. Regulation of gene expression in prokaryotes and eukaryotes.
- 8. Protein sorting: Targeting of proteins to organelles.

# Suggested Reading:

Lewin, B 2000 Vil Offord University Press, New York.

Alberts, B,. Bray, D, Lewis, j. Raff, M., Roberts, K, K and Watson, J. D. 1999 Molecular biology of the cell. Ga land Publishing, Inc., New York.

Wolfe, S. L. 1993. Molecular and Cell biology, Wordsworth Publishing Co., California, USA.

Buchana, B, B., Gruissem, W. and Jones , R. l. 2000. Biochemistry and molecular biology of plants, American society of plant physiologist, Maryland, USA.

Frifelder, D. molecular biology. John and Bartlette Publisheres, inc., Boston, USA

## COURSE VI: BIOSTATISTICS AND COMPUTER APPLICATION: (COMMON COURSE)

- 1. Brief description and tabulation of data and its graphical representation
- 2. Measures of central tendency and dispersion: mean, median, range, standard deviation and variance. Correlation and simple linear regression
- 3. Sampling: Sampling Techniques, sampling errors, Framing Hypothesis, level of significance, test of significance (F & t test), chi-square test.
- 4. Introduction of digital computers; Organization; low-level and high level languages; binary number system.
- 5. Flow charts and programming techniques.
- 6. Introduction to programming in Q Basic.
- 7. Introduction to data structure and database concepts; introduction to internet and its application
- 8. Introduction to MS OFFICE software, covering word processing; Spreadsheets and presentation software.
- Computer Oriented Statistical Techniques.
  Frequency table of single discrete variable, Computation of mean, variance and standard deviation; t-test, correlation coefficient.
- 10. Bioinformatics

# CORSE VII: BIOLOGY AND DIVERSITY OF GYMNOSPERMS

- 1. General Introduction and Salient feature of Gymnosperms.
- 2. Comparison among Tracheophyta
- 3. Classification of Gymnosperms
- 4. Introduction too Palaeobotany, some basic principles and techniques.
- 5. A general account oof the following Fossil Cycadopsida: Archeopteris, Tetrasticha, Heterangium, Lyginopteris, Sphaerostoma, Telangium, Crossotheca, Medullosa, Pachytesta, Whittleseya, Aulotheca, Doleerotheca, Calamopitys, Glossopteris, Hirsutum, Caytonia, Williamsonia, wiellandiella, Cysadeoidea, Pentoxylon and Palaeocycas.
- 6. A genereal account of following fossil Coniferopsida: Eristophyton, Mesoxylon, Cordaites, Fossil Conifers and Trichophys.
- 7. Salient feature of living Cycadales, Coniferales (including Taxus) and Ginkogoales (Emphasis is not to be placed on families or Type Studies.)
- 8. A general account of Ephedrales, Welwitshiales and Genetales.
- 9. Distribution of Conifers in India with particular reference to Himachal Pradesh.
- 10. Economic Importance of Gymnosperms
- 11. Structure, Identification and Evolution of wood in Conifers.
- 12. Structure, Properties and Uses of the following commercial timbers: Blue Pine, Chir pine, Deodar, Cypress and Yew.
- 13. Structure, Identification and Evolution of Bark in living gymnosperms.
- 14. Comparative account of the Leaf Anatomy of the living gymnosperms
- 15. Comparative study of Males cones of living gymnosperms
- 16. Pollination mechanism in living gymnosperms
- 17. Comparative study of Female Cones of living Gymnosperms
- 18. Comparative study of Males Gametophytes of living Gymnosperms
- 19. Comparative study of Females Gametophytes of living Gymnosperms

- 20. Structure and evolution of Archegonium in Gymnosperms
- **21.** Cytological Evolution in Gymnosperms.

#### SUGGESTED READING:

Andrew, H. N. 1961. Studies in Palaeobotany. John Wiley and Sons, Inc. New York and London

Biswas, C And Johri, B. M 1997. The Gymnospeerms. Narosa Publishing House, New Delhi, 494pp.

Bhatnagar, S. P; and Moitra, A. 1996, Gymnospeerms, New Age International Pvt. Ltd., New Delhi, 470pp.

Chamberlain, C. J. 1934. Gymnospeerms structure and evolution. Chicago (Reprinted 1957, New York).

Coulter, J. m. and Chamberlain, C. J. 1917 Morphology of Gymnosperms. Chicago (Reprinted 1974, Central Book Depot, Allahbad)

Datta, S. C. 1966. An Introduction too Gymnospeerms. Asia Publishing House, Bombay

Kakakr, R. K. And Kakkar, B. R. 1995. The Gmnospeerms (Fossils and Living). Central Publishing House, Allahabad, 777pp.

Mehra, P. N. 1998. Inmdian conifers, Gnetophytes and Phylogeny of Gymnosperms. Raj Bandhu Industrial Co., New Delhi, 264pp.

Raizada, M. B. and Sahni, K. C. 1960 Living Indian Gymnospeerms. Part I (Cycadales, Ginkogoales and coniferales) Indian Forest Records. N. S. Botany 5:i-iv, 73-150, Forest Research Institute, Dehradun

Sahni, K. C. 1990 Gymnosperms of India Adjacent countries. Bishen Sinngh Mahendra Pal Singh, Dehradun, 169pp. +48plates+ 9 Photographs.

Singh, H 1c978. Encyclopedia of Plant Anatomy. Part X. Embryology of Gymnosperms, Gebruder Bortaeger, Berlin, Stuttgart.

Sporne, K. R 1965. The Morphology of Gymnosperms. Hutchinson and Co. (Publishers)

## COURSE VII: BIOLOGY AND DIVERSITY OF ANGIOSPERMS-I

#### (MORPHOLOGY, TAXONOMY AND PLANT RESOURCE CONSERVATION)

Morphology:

- 1. Fossil Angiosperms
- 2. Origin and evolution of Angiosperms (Special reference to Bennettitalea, Gnetalean, Caytonialean and herbaceous origin theories)

#### Taxonomy:

#### 1. Systems of angiosperem classification

- i) Phenetic vs Phylogenetic system
- ii) Relative merits and demerits of major systems of classification.

# 2. International code of Botanical Nomenclature

## i)History

ii)Principles and rules

- iii) Type method
- iv) Principles of priority and its limitation V
- v) Names of Hybrids and cultivars

# 3. The Species Concept

- i) Taxonomic hierarchy, species, genus, family and other categories
- ii) Principles used in assessing relationship, delimitation of taxa and attribution of rank

# 4. Modern Taxonomy

- i) Inputs for taxonomy
- ii) Taxonomy in relation to anatomy, embryology, palynology, cytology, secondary metabolites in Plants

# 5. Numerical taxonomy

- i) Concepts, Characters and attributes
- ii) OTU's
- iii) Cluster analysis
- iv) Cladistics

# 6. Systematic in practices

- i) Importance and role of herbarium, specimens and their prepation
- ii) Botanical Garden, Importance and role
- iii) Value of computers and databases for identification

# 7. Concepts of Phytogeography

- i) Endemism, hotspots and hottest hotspots
- ii) Plant exploration, invasion and introductions
- iii) Local plant diversity and its socio-economic importance

# **Plant Resource Conservation**

i) Principles of conservation

ii)Extinctions

iii)Environmental Status of plants based on I. U. C. N

iv)Strategies for In-situ and Ex- situ conservation Principles and practices

# Practical:

Based on the above topics

# Suggested Readings:

Coble, A. J. 1969. Numerical Taxonomy. Academic Press, London

Davis, P. . & Heywood, V. H. 1973. Principles of angiosperms Taxonomy. Robert E. Kreugeer Pub. Co., New York

Eames, A. J. I 1961. Morphology of the Angiospeerms. McMgraw- Hill, Neew York.

Harrison, H. J. 1971. New concepts in Flowering Plant Taxonomy. Hieman, London

Heywood, V. H. & Moore, D. M 1984. Current Concepts in Plant Taxonomy Academic Press, London. Global

Heywood, V. 1995. Global Biodiversity Assessment Cambridge Univ., Cambridge.

Radford, A. E. 1986 Fundamentals of Plant Systematics- Harper & Row, USA

Stace, C. A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London

Takhtajan, A. L. 1997. Diversity and Classification of Flowering Plants Columbia University Press, New York.

Woodland, D. W. 1991. Contemporary Plant Systematics. Prentice Hall, New Jersey

## SEMESTER III

# **COURSE IX: CYTOGENETICS & EVOLUTION (COMMON COURSE)**

## 1. Chromosome Organization:

- 1.1 Structure of chromosomes, DNA packaging and DNA replication
- 1.2 Metaphase chromosomes, centromere, Kinetochore, Telomere and its importance
- 1.3 Heterochromatin and euchchromatin
- 1.4 Chromosome banding
- 1.5 Polytene and lampbrush chromosomes
- 2. Sex chromosomes, sex determination and dosage compensation in Drosophila and human.

## 3. Mendelian and non-Mendelian Inheritance:

- 3.1 Mendelian inheritance and its modification
- 3.2 Maternal effect
- 3.3 Epigenetic inheritance
- 3.4 Extra nuclear inheritance
- 4. Variation in Chromosome structure and number

# 5. Brief description of gene expression:

- 5.1 Genetic code
- 5.2 Transcription and translation
- 5.3 Regulation of gene expression

# 6. Gene mutation and DNA repair:

- 6.1 Consequences of Mutations
- 6.2 Occurrence and causes of gene mutation
- 6.3 DNA repair

# 7. Quantitative genetics:

- 7.1 Quantitative traits
- 7.2 Polygenic inheritance
- 7.3 Heritability

# 8. Population genetics and evolution:

- 8.1 Gene in populations
- 8.2 The Hardy- Weinberg Equilibrium
- 8.3 Factors that changes allele frequencies in populations:

a) Mutations b) Migration c) Natural selection d) Randoim genetic drift e) Genetic load.

## 9. Origin and evolution of species:

- 9.1 Biological species concept
- 9.2 Anagenesis and cladogenesis
- 9.3 Alllopatric, parapatric and sympatric speciation
- 9.4 Gradualism and pubctuated equilibrium
- 9.5 Neo- Darwinism
- 9.6 The shifting- Balance Theory of Evolution

# 10. Molecular evolution:

- 10.1 Experimental approaches used to compare species at molecular level
- 10.2 Phylogenetic trees
- 10.3 Molecular drive- a cohesive mode of species evolution
- 10.4 Neutral theory of Molecular Evolution

# **Suggested Readings:**

- 1. Gardener, E. J., Simmon, M. J and Snustad, D. P. Principles of Genetics. John Wiley & Sons, Inc. NY
- 2. Weaver, R. F and Hedrick, P. W Genetics Wm. C. Brown Publishers
- 3. Brown, T. A. Genetics- A Molecular Approach. Chapman & Hall
- 4. Mitra, s. Genetics- A Blueprint of Life. Tat mc Graw Hill
- 5. Dobzhansky, Th; Genetics and origin of Species. Columbia University Press.
- 6. Dobzhansky, Th; Ayala, F. J; Stebbins, G. L. and Valentine, J. M. Evolution . Surjeet Publishers Delhi
- 7. Futuyama, D. J. evolutionary Biology, Suinuaer Associations. INC Publishers .Dunderand.
- 8. King, M. species evolution- the role of chromosomal change. The Cambridge University Press, Cambridge.
- 9. Merrel, D. J. Evolution and Genetics Holt. Richart and Winston Inc.
- 10. Strikbergeer, M, W, Evolution. Jones and Barlett Publishers. Boston London.

# COURSE X: IMMUNOLOGY AND BIOTECHNOLOGY :COMMON COURSE)

# Introduction to Immunology:

Innate and acquired immunity, characteristics if immune response, humoral and cellular immunity, benefits and damaging effects of immunology

# Cell and tissues of immune system:

Cell of immune system, primary and secondary lymphoid organs

# Antigens:

Immunogenes, major classes of antigens, physical and chemical properties of antigens.

# Immunoglobulins:

Structure and functions of immunoglobulins, classes and subclasses of human immunoglobulins, polymorphism, primary and secondary immune response.

# **Complement System:**

Complement proteins, pathways of complement activation

#### Antigen- antibody reaction

Precipitaition, aggIntination, Immuunofluorescence, radioimmunoassay, ELISA, immunoblotting.

#### Monoclonal antibodies:

Hybridoma, Isolation and characterization of monoclonal antibodies.

#### Hypersensitivity

Anaphylaxis, antibody-mediated cytotoxic and immune complex reactions, delayed –type hypersensitivity.

#### **BIOTECHNOLOGY:**

**Biotechnology:** Scope, significance, microbes and microbial systems and their improvement for biotechnological use.

Principles and techniques of plant and animal cell culture.

Principles and applications of DNa recombinant technology to agricultural and human diseases. Aims, strategies for development of transgenics (with suitable examples), intellectual property rights, possible ecological risk and ethical concerns. Construction of genomic/c DNA libraries, PCR and DNA finger printing.

Fermentation technology, design, process, scale up downstream processing, production of antibiotics, beverages, enzymes; Ethanol and methane from biomass; bioremediation, biopesticides and biosensors, single cell protein.

#### Suggested Reading:

- 1. Immunology by Jaris Kuby
- 2. Immunology by J. A. Bellanti
- 3. Fundamentals of Immunology by W. e. Paul
- 4. Essential Immunology by J. M. Roitt
- 5. Immunology by E.S. Golub
- 6. Immunology by E. Benjamini, R Coice and G. Sunshine
- 7. Walker, J. M. And Gungold, E. B Eds.) Molecular Biology and Biotechnology, Royal Society of Chemistry, Cambridge, 1990
- 8. Maniaties. T, N. ; Fritsch, E, F. and Sembrook, T. molecular Cloning A laboratory Mannual, cold spring Herber, New York, 1990
- 9. Domain, A. L. and Solomon, N.A (eds.) Mannual of Industrial. Microbiology and Biotechnology. American Society of Microbiology Washington, 1986.
- 10. Ptimrose, S. B., Molecular biotechnology (second Edition), Blackwell Scientific Publications, Oxford, 1991.
- 11. Kumar, H. D.; A text Book onn Biotechnology, affiliates East West Press Pvt. Ltd., New Delhi, 1993.

#### CORSE XI: BIOLOGY AND DIVERSITY OF ANGIOSPERMS -II

## (PLANT DEVELOPMENT, REPRODUCTION BIOLOGY, PALYNOLOGY, TISSUE CULTURE)

**Plant Development:** 

- 1. Apical, lateral and intercalary meristems- their ultra structure, histochemistry and organogenesis.
- 2. Anomalus growth-stem
- 3. Ecological anatomy

# **Reproductive Biology:**

i)

- 1. Male Gametophytes
  - Structure of anthers ii) Microsporogenesis ii) Role of tapetum iv) Pllen development v) Male sterility vi) Sperm dimorphism vii) Pollen tube growth and guidance
- 2. Female Gametophytes:

i) Ovule development ii) Megasorogenesis iii) Structure and organization of the embryosac iv) Nutrition of the embryo sac.

3. Pollen pistil interaction fertilization

Pollen –stigma interaction, sporophytic and gametophytic self incompatibility (Cytological, biochemical and molecular aspects; *In vitro* fertilization)

- 4. Seed Development
  - i) Endosperm development during early, maturation and desiccation stages
  - ii) Embryogenesis, ultrastructure and nuclear cytology; cell lineage during late embryo development
  - iii) Embryo culture
- 5. Seed Dormancy
  - i) Importance and types of Dormanvy
  - ii) Overcoming seed dormancy

# Palynology:

- i) Basic techniques to study pollen
- ii) Pollen viability and storage
- iii) Pollen allergy

# Tissue Culture:

- i) Methods of tissue culture
- ii) Haploid induction; fundamental aspects
- iii) Protoplasts; their isolation, culture and fusion
- iv) Applied aspects of tissue culture
  - a) Clonal propagation
  - b) Propagation of pathogen-free plants
  - c) Germs- plasm storage and conservation

Practicals: Based on the above topics

# Suggested Readings:

Bhojwani, S. S & Bhatnagar, S. P. 2000. The Embryology of Angiosperms , Vikas

Bhojwani, S. S & Radan , M. K. 1983. Plant Tissue Culture : Theory and Practices Elsevier, Amsterdam

Burgess, J. 1985 An Introduction to Plant Cell Development Cambridge Univ. Press, Cambridge.

Fahn, A. 1982 Plant Anatomy. Pergamon Press, Cambridge

Falk. D. A., Olwell., M & Millan, C 1996. Restoring Biodiversity. Columbia, USA

Howell, S. H. 1998. Molecular Genetics and Plant Development Cambridge Univ., Cambridge.

Lydon, R. F. 19990 Plant Development. The Cellular Basis, Unnin Human, London

Raghvan, V 1999. Development Biology of Flowering Plants. Springer Verlag Neew York

Shivanna, K. R & Rangaswamy, N. S. 1992. Pollen biology: A Laboratory Manual. Springer Verlag, Berlin

Shivanna, K. R & Johri, B. M 1985. The Angiosperms pollen: Structure and Function. Wiley Eaasten Ltd., New York.

# COURSE XII: PLANT PHSIOLOGY

- 1. Plant –water relations, transport of solutes: Physicochemical properties of water, water potential, apparent free space, bulk movement of water, SPAC, passive and active solute transport.
- 2. Stomatal physiology: Chemiosmotic mechanism of stomatal movements, hormonal regulation and significance of calcium ions.
- 3. Photochemistry and Photosynthesis: General concepts and historical background, evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, Photooxidation of water, mechanism of electron and proton transport, carbon assimilation: the calvin cycle, photorespiration and its significance, the c4 cycle, the CAM pathways, biosynthesis of starch and sucrose, physiological and ecological considerations.
- 4. Respiration : Overview of plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis, structure and functions of ATP, pentose phosphate pathways, glyoxylate cycle, alternative oxidase system
- 5. Nitrogen fixation, nitrogen and sulphur metaboloim: Overview, biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation, sulphate uptake, transport and assimilation.
- 6. Sensory photobiology: History of discovery of phytochromes and cryptochromes, their photochemical and biochemical properties, photobiology of light- induced responses, cellular localization, molecular mechanism of action of photomorphogenetic receptors, signing and gene expression
- 7. Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberllins, cytokinins, ethylele, abscisic acid.
- 8. The flowering precess: Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development- genetic and molecular analysis, role of vernalization.

## Suggested Reading:

Buchanan, BB. Gruissem, W. and Jones R. L. 2000. Biochemistry and molecular biology pf plants. American society of Plant Physiologists, Maryland, USA Goodwin, T. W. and Mercer, L. E. 1989 Introductory Planat Biochemistry, Pergamon Press, New York, USA

Moore, T. C. 1989 Biochemisttry and Physiology of plants hormones (2<sup>nd</sup> edition) springer Verlag, New York, USA

Salisbury, F. B. and Ross, C. W. 1992. Plant Physiology (4<sup>th</sup> edition) Wadsworth publishing company, California, USA

Taiz, I. and Zeiger, E 1998. Plant Physiology (2<sup>nd</sup> edition) Sinnaur Associates Inc. Publishers, Massachusetts, USA

Wilkins, M. B. (ed.) 1984 Advanced plant physiology, ELBS, Longman, UK.

## Semester IV

## Course XIII: Biochemistry (Common Course)

- **1.** A review of laws of therinodynamics, redox potentials.
- 2. Carbohydrate- classification, occurrence, structure and function of monosaccharides, oligosaccharides.
- **3.** Lipids- cliassification, occurrence structure and importance of acyl lipids and phoshphates, biosynthesis of fatty acids, β- oxidation and role of polyunsaturated fatty acids.
- 4. Outlines of Nitrogen fixation, symbiotic and non-symbiotic.
- 5. Amino acids, peptides and proteins. Occurrence, structure and function of amino acids, stereoisomers. Synthesis of amino acids by reductive amination, GS-GOGAT system, transamination, classification ofpreoteins according to solubility, structure and function of proteins. Conjugate proteins, lectins and their importance, proteins synthesis, transcription, translation degradation, and protein folding.
- 6. Protein- ligand, protein- protein, nucleic acid-protein and nucleic acid-ligand interactions. Enzymesclassification, mode of action . enzyme kinetics (Michaelis- Menten Constant), Enzyme inhibition. Coenzymes, cofactors, Ribozymes.
- 7. Nucleic acid bases-their structure. Structure and function of DNA, genetic code, different kinds of RNA and their origin. Role in protein, synthesis and in reverse transcription. DNA polymorphism.
- 8. Biosybnthesis and function of secondary metabolites phenolics, flabonids, terpenoids.
- 9. Alkalods and steroids , suberins.
- 10. Importance of Acetyl Co. A and Shikimic acid in intermediary metabolism.
- 11. Chemical foundations of biology e.g. pH, acids, bases, buffers, weak bonds, free energy, resonance, isomerisation etc.

Suggested Reading:

- 1. Zubay, G. 1988, Biochemistrrey (2<sup>nd</sup> ed.) Macmillan Publ. House N. Y.
- 2. Mahler, H. R. and codes E. H. 1971. Biologist chemistry, Harper International
- 3. Lehinger A. 1. 1978. Biochemistry Kalyani Publishers, Ludhiana
- 4. Goodwin T.W. and Meriar L. e. I. 1989 Introductory plant Biochemistry pergamon press VY.
- 5. Conn, E. E. and shimap. P. K. 1976. Outlines of Biochemistry Wiley Eastern.
- 6. Styer, Biochemistry.
- 7. Freifelder Molecular biochemistry.

## Course XIV: Ecology (Common Course)

- 1. Climate, soil and vegetation patterns and organization : Life zones, major biomes, vegetation, soil types, concepts of community, ecological succession.
- 2. Ecosystem organization : Structure and functions, primary production, energy dynamics, litter fall arid decomposition, global biogeochemical cycles, minerals cycles in terrestrial and aquatic ecosystems.
- 3. Population growth and dynamics: Models of population growth (Stochastic and time lag), reproduction strategies, mating preference, spacing r and k selection, case studies in population dynamics.
- 4. Predation: Predators- Prey interaction, Host parasite interaction, role of predation in nature.
- 5. Competition and Mutualism: Types and theories of competition, commensalism and mutualism, Plant-Pollinator and animal interaction, Niche theory.
- 6. Biological diversity: Concepts and levels, role of biodiversity in ecosystem functions and stability, speciation and ectionation, IUCN categories of threat, distribution and global patterns, Terrestrial biodiversity hot spots.
- 7. Environmental pollution: Types, sources, effects on plant and animal ecosystems, Greenhouse gases, Ozone layer ozone hole, consequences of climatic change.
- 8. Ecological management: Concepts, sustainable development, sustainability indicators, degraded ecosystem and their regeneration with special reference to waste lands, forests and aquatic ecosystems.

#### Suggested Reading:

Begon and Mortimer: Population Ecology

Horace and Quick: population Ecology

Elseth, G. D. : Population Biology

Thomas C. E. Population Biology

Kerbs CJ Ecology

Kerbs CJ: Ecological Methodology

Slanden & Bang: Biology of pupulations

Hillary S E: Ecology 2000

Merrit Emlern J: An evolutionary approach

Brewer: Principles of Ecology

Price P W: Slobodchikoff and Gand W. S: A new Ecology

Odum: Fundamnetlas oof Ecology

H. D. kumar – General Ecology- 1997

J. Merritt Emlen ecology – 1973

#### **Course XV : Special Paper**

## ADVANCED TOPICS IN MYCOLOGY

- 1. Ecology of fresh water fungi, thermophiles and psychrophiles
- 2. Domestication and Mycophagy: edible and poisonous mushrooms, mushroom toxins, cultivation technology for button and oyster mushrooms, diseases and pests of button mushrooms, nutritive value of mushrooms.
- 3. Growth, nutrition, differentiation and metabolites of fungi.
- 4. Mycotoxins and their medical and veterinary effects.
- 5. Effect of plant parasitic and their other fungi on man.

## Suggested Reading:

- 1. Ainsworth, G. C. and Sussman, A. S. The fungi, Academic Press, Newe York. 1968
- Alexopoulos, C. J. and Mims, C, W. 1979. And Blackwell, M. Introductory Mycology, Wiley Eastrn limited, New Delhi.
- **3.** Burnett, J. H. 1976. Fundamentals of Mycology, Edw and Arnold, London.
- 4. Alexopoulas, C. J., Mims, C. W. And Blackwell, M. Introductory Mycology. John Wiley and Sons.
- 5. Deacon, J. W. Introduction to Modern Mycology. ELBS.
- 6. Horsfall, J. G. and Cowling, E. B. Plant Disease Vol. I-V. academic Press, New York.
- 7. Moore- Landeckar, E. J. 1972. Fundamentals oof the fungi. Prentice hall, Englewood Cliffs.
- 8. Burnett, H. L. Fundamentals of Mycology. Edwand Arnold, London.
- 9. Aneja K. R., and Mehrotra, R. S. introductory Mycology.
- **10.** Dube, H. C. an introduction to fungi. Vikas Publ. New Delhi.

## COURSE XV: ADVANCED TOPICS IN APPLIED MICROBIOLOGY

## 1. Food Microbiology:

- i) Types of microorganisms in food
- ii) Food spoilage
- iii) Methods of food preservation
- iv) Food poisoning
- v) Microbiology of milk and milk products.

## 2. Industrial Microbiology:

- i) Types of fermentation
- ii) Fundamentals of Bioreactor design
- iii) Microbial production of acetic acid, alcohol, cyanocobalamin, citric aicd and penicillin.
- iv) Yeast as fermentative agent in food and beverage production.

## 3. Environmental and agricultural Microbiology:

- i) Microbiology of air, Water and sewage.
- ii) Microbial degration of organic matter in soil.
- iii) Nitrogen fixation by microorganisms.
- iv) Microbial pesticides.
- 4. Medical Microbiology:

- Brief account of causal agents, main symptoms, route of infection and control of following disease:
  Cholera, diphtheria, leprosy, syphilis, tetanus, tuberculosis, typhoid, whooping cough, dysentery
  (Amoebic and bacterial), kala azzar, AIDS, rabies, Japanese- Encephalitis.
- ii) Mechanisms of microbial pathogenecity
- iii) Host- parasite interactions.

## 5. Immunology:

- i) Nature of antigen and antibody
- ii) Types of immunoglobulins
- iii) Types of immunity: Brief account of active, passive, innate, and acquired immunity
- iv) Common antigen: antibody reactions agglutination, precipitation, complement fixation, immunofluorescence, radioimmunoassay, enzyme, linked immmunonosorbant assay (ELISA), neutralization
- v) Brief account of hypersensitivity and autoimmunization.

## **Suggested Books:**

- 1. Jay, J. M. 1987. Modern food Microbiology, CBS Publisheers and Distributors, New York.
- 2. Casida, L. E. 1968. Industrial Microbiology, Wiley, 1968.
- 3. Stolp, H. 1988. Microbial ecology: Organisms, Habitats & Activities. Cambridge University Press, Cambridge. University Press Cambridge.
- 4. Ananthanaryan, R. and Jayram paniker, C. K. 1986. A text Book of microbiology, 3<sub>rd</sub> <sup>limited,</sup> Edition. Orient Long man Madras.
- 5. Joshi, K. R. and Osamo, N. O. 1992. Immunology, agro Botanical Publishers (India) Bikaner.
- 6. Frazieer, W. C. and Westhoff, d.C. Food Microbiology tata Mc Graw- hill Publishing Company Ltd. New Delhi. 1995
- 7. Precott, L. M, Harley, J. p. and Klein, D. A. Microbiology. WCB Brown Publishers.
- 8. Tortora, G. j., Funke, B. R. and case, C. L. Microbiology- An Introduction. Addison Wesley Longman, Inc. California.

#### COURSE XV: SPECIAL PAPER

## ADVANCED TOPICS IN PLANT PATHOLOGY

- Disease due to non-parasitic agents: Adverse climatic conditions, mechanical and chemical injury, adverse soil conditions. Disease due to deficiency, excess or imbalance of the elements essential to plant growth, correction of deficiency disease. Toxicity diseases. Angiosperms, algae and protozoa as plant pathogens, plant injury due to insects, mites nematodes and other pests.
- 2. Roots diseases: Pre-emergence killing, damping off, seedling blight, root rots caused by cortical parasites, vascular wilt diseases. Hypertrophy disease. Non-parasitic root pathogens, predisposing factors. Control of root diseases.
- 3. Diagnosis and management of plant diseases.
- 4. Mechanism of disease induction by fungi, bacteria, mycoplasma and viruses.
- 5. Mechanism of action fungicides.

# Suggested Book:

- 1. Agrios, G. N. Plant Pathology, Academic Press, 1988.
- 2. Baker, F. and Cook, R. J. 1974. Biologist Control of Plant Pathogen. W. H. Freeman & Co. Ssan Francisco.
- 3. Bilgrami, K. S. and Dubey, H. C. text Book of modern, Plant pathology, Vikas, New Delhi; 1980.
- 4. Horsfall, J.G. and Cowling, E. B. Palnt pathology- An Advanced Treatise. Vol- III Academic Press, New York.
- 5. Horsfall, J. G. and Cowling, E.B. Palnt Disease Vol. I-V. Academic Press, New York.
- 6. Mehrotra, R.S Palnt Pathology, tata Mc Graw Hill Publishing Company, New Delhi.
- 7. Tarr, S. A. J. Priciplals of Plant Pathology Mc Millan, 1972.
- 8. Wood, R. K. S. Physiological Plant Pathology Blackwell Scientific Publications, 1967.

# COURSE XV: SPECIAL PAPER

# WOOD SCIENCE, FOREST BIODIVERSITY AND PLANT RESOURCES:

- 1. Structure of Vascular Cambium and its role on wood formation:
- 2. Biochemical components of wood and their distribution in woody cell wall.
- 3. Basic Structure, Formation and Modications of the Woody cell Wall.
- 4. Structure, Identification and Evolution of Coniferous woods with particulars reference to Chir Pine, Blue Pine, Deodar, Fir, Spruce, Cypress and Yew.
- 5. Structure, Identification and Evolution of Dicot woods with particulars reference to Sal, Teak, Shisham, Walnut, Mulberry, Indian Oak, Toon and Himalayan poplar.
- 6. A general account of texture, figure, spiral grain and knots in woods
- 7. **FOREST DIVERSITY:** A general concepts of forest biodiversity, sustainable development and conservation of plant resources,. Endemism and importance of wild plants.
- 8. **PLANT RESOURCES I-VASCULAR CRYPTOGAMS:** Economic Importance and distribution of Vascular Cryptogams in the Himalaya with particular reference to Himachal Pradesh.
- 9. **PLANT RESOURCE II- GYMNOSPERMS** Economic importance and Distribution of Gymnosperms of India with particular reference to Himachal Pradesh.
- 10. Plant Resource III- Woody Plants (Shrubs, Lianas and Trees)- Economic importance of woody plants and their distribution in Himachal Pradesh.
- 11. Forest Conservation : Factors contribution to the loss of forest biodiversity, IUCN categories of threat and Red Data Books; Principles and Practices for Conservation.

Suggested Readings:

Agrawal, H. O. and Seth, M. K. 2000. Sericulture in India Vols. I-IV. Bishen Sinfg Mahendra Pal singh, Dehradun, 984 pp.

Bawa, R and Khosla, P. K. 1998. Biodiversity of Forest Species (A Community Forestry Approach) Bishen Singh Mahendra Pal, Dehradun, 218pp.

Carquist, S. 1988, Comparative wood Anatomy- Systematic, Ecological and Evolutionary Aspects of Dicotyledonous woods. Springer Veerlag, Berlin.

Dhar, U(Ed.) 1993. Himalayan Biodiversity. Him Vikas Publication No. 3, Gyanodya Prakashan, Nainital, 543pp.

Heywood, H. H. and Waston, R. T. 1995. Global Biodiversity Assessment, UNEP, Cambridge Universityt Press, Cambridge, U. k.

Jane, F. W. 1970. The Structure of wood. Adam and Charles Blanck London.

Kothari,, A. 1997. Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.

Krattiger, A. F. et. Al: (Eds.). 1994. Widening Perspectives on Biodiversity. Natraj Publishers, Dehradun, 473pp.

Nair, M. N. B. 1998. Wood Anatomy and Major Uses of Woods. Faculty of Forestry, University Putra, Malaysia, 434 PM Serdong, Selangor, Malaysia.

Nair, M. N. B. et. Al. (Eds.) 1998. Sustainable Management of Nonwood Forest Products. Faculty, University Putra Malaysia, 434004 PM Serdong, Selangor, Malaysia.

Panshin, A. J. and deZeeuw, C. Textbook of Wood Technology. Vol. I. Mc Graw Hill Book Co., New York.

Rao, R. R. 1994 Biodiversity in India (Floristic Aspect) Bishen Singh Mahendra Pal Singh, Dehradun, 315pp.

Seth, M. K. 2002. Tress and Their Economic importanc.

Seth, M. K., Kumari, A., Takur,, R and Khullar, S. P. 2002.. Pictorial Guide to Common Himalayan Oteridophytes. Vol. I. Pteridophytes of Shimla.

Seth, M. K., Chandel,, S and Thakur, R. 2002 Shrubs and their Economic importance.

Prof. S. p. Khullar's Festschrift volume.

Seth, M. K., Sharma, S.. and Thakur, R. 2002. Pictoral Guide to some common shrubs of the Himalaya Vol. I.

Timell, T. E. 1986. Compression wood in Gymnosperms. Vols. I-III. Springer- Verlag

Berlin, Heidelberg, New York, Tokyo.

#### COURSE XV: SPECIAL PAPER

#### BIODIVERSITY, BIOPROSPECTING, ETHNOBOTANY AND SUSTAINABLE UTILIZATION OF PLANT RESOURCES

23

## 1. Biodiversity

Concepts, Extent and status of biodiversity in India, Cause of biodiversity loss Mechanism for sustainable utilization of Biological resources

- 2. Himalayan Plant Resources
- 3. Wasteland Management in Himalayan region
- 4. Strategies for in situ and ex situ conservation of Biodiversity
- 5. Remote sensing and Bioresources
- 6. Bio-indicators
- 7. Red Data Book
- 8. Traditional Botanical Knowledge
- 9. Methods of Research in Ethnobotany
- 10. Sources in informatics of Medicinal Plant
- 11. Global importance of Medicinal Plant
- 12. Economic aspects of Exploitation of Medicinal plants
- 13. Conservation of plant genetics resources: The role of Biotechnology

#### **Practicals:**

- 1. Visits to tribal areas and collection of plant material used by tribes
- 2. Identification and description of 10 plants of ethnobotanical value
- 3. Identification and description of 10 plants used by tribal for their house hold
- 4. Collection of plants used by tribals in their socio-cultural customs and tabbos
- 5. Collection of 5 plants used by the tribals in their magico-religious belief.

#### **Books:**

Cotton, C. M. 1996. Ethnobotany- Principles and applications John Heywood, Wiley, V.(ed.) 1995. Global Biodiversity Assessment . Cambridge Univ. , Camb.

Jaon, S. K. (ed.) A. Manual of Ethnobotany Scientific

Pub., Jodhpur. Jain, S. K. (ed.) 1989. Methods and Approaches in Ethnobotany, Surya

Pub, Dehradun Swaminathan, M. S & Kocchar, S. L.(eds.) 1989. Plants and Society

Macmillan, Wagner, H., Hikino, H & Farnswarth, N. 1989. Economic and Medicinal Plant Research. Vils.1-3. Academic Press, London.

## COURSE XV: SPECIAL PAPER

#### PLANT REPRODUCTION, TISSUE CULTURE AND HORTICULTURAL SCIENCES

- 1. Role of tapetum in pollen development
- 2. Subcellular detail of constituent cell of embryo sac.

- **3.** Post- fertilization structural changes in embryo sac.
- 4. Intra-ovarian pollination
- **5.** Gametic transformation
- 6. Cellular totipotency
- 7. In vitro- pollination
- 8. Nutrient media used for in vitro culture of plant tissues
- 9. Special methods of propagation
- 10. Applied aspects of cultivated plants
- 11. Growth regulators and their use in horticulture
- 12. Weed control
- 13. Packing systems
- 14. Principles of landscaping

Practicals: Based on the above topics

Suggested Reading:

Davis, H. & Heywood, V. H. 1963. Principles of angiosperm Taxonomy. Oliver & Boyd Edinburgh & London

Hartman H & Kester, D. E. 1972. Plant Propagation –m Principles and practices. Prentice Hall. Embryology of Angiosperms. Springer Verlag, New York.

Raghavan, V. 1976. Experimental Embryogenesis in Vascular plants. Academic Press, London

Stanley, R. G. & Linskens, H. F. 1974. Pollen- biology, Biochemistry, Management, Springer

Berlin- Heidalberg New York.

## COURSE XV: SPECIAL PAPER

## ADVANCED PLANT PHYSIOLOGY

- **1.** Some important phytochemical techniques: Principles and applications of chromatography, electrophoresis, centrifugation and tracer techniques.
- **2.** Physiology and biochemistry of phytochromosome: Structure, biosynthesis, metabolism, transport, function and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroid, polyamines, jasmonic acid and ssalicylic acid.
- **3.** Synthetic growth regulators: Discovery, chemical nature, effects on growth on growth and development and mechanism of action of cycocel, Phosphon D, B-nine, AMO 1618, morphactin, phenolics.
- **4.** Signal transduction: Overview, receptors and G proteins, phospholipid signaling, role of cyclic nucleotides, calcium- calmodulin cascade, diversity in protein kinases and phosphatase, sucrose- sensing mechanism.
- **5.** Seed Physiology: Seed viability, longevity, biochemical deterioration, seed dormancy, metabolism of germination seeds, environmental and hormonal control of seed dormancy/germination
- 6. Senescence: Physiological and biochemical basis of senescence3.

**7.** Stress Physiology: Concept of biological stress, plant responses and mechanism of tolerance of various abiotic stresses- Water- deficit stress, salinity stress, heavy metal toxicity and stress, freezing and heat stress, oxidative stress.

## Suggested Readings:

Annual reviews of plant physiology and plant molecular biology

Aspinall D. and Paleg, L. G. (eds.) 1981. The physiology and biochemistry of drought resistance in plants, academic Press. London

Bewley, J. D. and Black, m. 1982 Physiology and biochemistry of seeds (vol 1 & 2) Springeer Verlag

Buchana B. b., Gruissem, W and Jones, R. l. 2000. Biochemistry ans molecular biology of plants. American Society of plant physiologists, Maryland, USA

Freifelder, D. Physical biochemistry

Goodwin, T. W. and Mercer L. E. 1989. Introductory Plant Biochemistry, Pergamon Press, New York, USA

Moore, T. C. 1989 biochemistry and physiology of plant hormones (2 nd edition), Springer Verlag, New York, USA

Salisbury, F. B and Ross, C. W. 1992 Plant Physiology (4 th edition), Wadsworth Publishing company California, USA

Taiz, L. and Zeiger, E. 1998 Plant Physiology (2<sup>nd</sup> edition), Sinnauer Associates Inc. Publishers, Massachussetts, USA

Wilkins M. B.(ed.) 1984. Advanced Plant physiology ELBS, Longman, U, K.

#### HIMACHAL PRADESH UNIVERSITY, SHIMLA-171005

FACULTY OF PHYSICAL SCIENCES



#### **REVISED SYLLABI**

## FOR M.Sc. CHEMISTRY

(SEMESTER SYSTEM) (SESSION 2020-21 AND ONWARDS)

#### HIMACHAL PRADESH UNIVERSITY DEPARTMENT OF CHEMISTRY, SHIMLA-171005 INDIA

#### HIMACHAL PRADESH UNIVERSITY DEPARTMENT OF CHEMISTRY

#### <u>PROCEEDINGS OF THE MEETING OF THE BOARD OF STUDIEIS IN (PG) IN THE SUBJECT OF</u> <u>CHEMISTRY</u>

A meeting of the Board of Studies in PG in the subject of Chemistry was held on 23-04-2019 at 11.00AM in the Departmental Library of the Chemistry Department. The following were present:

1	Prof. Baljit Singh	Chairman & Convener
2	Prof. Kiran Singh	External Expert
3	Prof. D.K.Sharma	Member
4	Prof. S.K.Sharma	Member
5	Prof. S. Chauhan	Member

The following decisions were taken:

- 1. The scheme as well as the course contents of the syllabi of M. Sc. Chemistry, spread over four semesters (I-IV) applicable w. e. f. the Academic Session 2019-2020 i.e. July, 2019 onwards, was discussed and recommended for the consideration of the Faculty of Physical Sciences (as per annexure "A").
- 2. The scheme as well as the course contents of the syllabi of M. Phil, Chemistry (Organic, Inorganic and Physical Chemistry specialization), applicable w. e. f. the Academic Session 2019-2020 i.e. July, 2019 onwards, was discussed and recommended for the consideration of the Faculty of Physical Sciences (as per annexure "B").
- 3. BOS (PG) approved the syllabil for the Ph.D. course work for the students enrolled for Ph.D. without M. Phil degree as per H.P.U. rules and recommended the same for the consideration of the Faculty of Physical Sciences (as per annexure "C"). It was further resolved that the Ph.D. course work will run concurrently with the M. Phil Ist semester.
- 4. In order to maintain the academic standard in respect of research and teaching as well as to maintain the uniformity in PG Institutes of Chemistry affiliated to H.P. University, the BOS recommended that henceforth the concerned P. G. Institute will fix a suitable date for the P.G. practical examinations in consultation with the convener of BOS (PG) and the convener will draw a penal of examiners for final approval of the competent authorities.
- 5 The BOS authorized the Chairman & Convener of the BOS (PG) to make typographic corrections and mistakes if any.

6. It was resolved by the BOS (PG) that the pass percentage will be 40% for the M. Sc (Chemistry). The detail of pass percentage will be as under:

1 0		
A. In Theory	-	40% (32/80)
B. In I.A.	-	40% (08/20)
C. In Practical	-	40% (20/50)

However in case of M. Phil and Ph.D course work, the pass percentage will be 50%.

The meeting ended with a vote of thanks to the chair.

Prof. Kiran Singh External Expert Prof. D.K. Sharma Member Prof. S.K Sharma Member Prof. S. Chauhan Member

Prof. Baljit Singh Chairman & Convener

# <u>Annexure-"A"</u> <u>A Detailed Scheme and Course Contents of the Syllabi for M.Sc. Chemistry Spread Over Four Semesters (I-IV) For</u> <u>Session 2019-20 and Onwards</u>

EMESTER-I			
Course No.	Title	Max.	Internal
		Marks	Assessment
		Theory	
Course-I	Inorganic Chemistry	80	20
Course-II	Organic Chemistry	80	20
Course-III	Physical Chemistry	80	20
Course-IV	Mathematics for Chemists and Applications of	80	20
	computer in Chemistry		
SEMESTER-II			
Course-V	Inorganic Chemistry	80	20
Course-VI	Organic Chemistry	80	20
Course-VII	Physical Chemistry	80	20
Course-VIII	Chemistry of Life and Enviromental Chemistry	80	20
Course-IX (Practical I and II Semesters	Inorganic Chemistry-A	50	
Common to all)	Organic Chemistry-B	50	
	Physical Chemistry-C	50	
<u>SEMESTER-III</u>			
Course-X	Inorganic Chemistry	80	20
Course-XI	Organic Chemistry	80	20
Course-XII	Physical Chemistry	80	20
Course-XIII (Special Paper-I)	Any one of the following:	80	20
	Inorganic Chemistry-A		
	Organic Chemistry-B		
	Physical Chemistry-C		
Course-XIV (Practical Common to all)	Inorganic Chemistry-A	50	
	Organic Chemistry-B	50	
	Physical Chemistry-C	50	
<u>SEMESTER-IV</u>			
(A	A dream and Organic Chemistry specialization)	80	20
Course-XV A (Special Paper-II)	Advanced Organometallics	80	20
Course-X VI A (Special Paper-III)	Modern Techniques of Chemical Analysis	80	20
Course-X VII A (Special Paper-IV)	D' L Cl t	80	20
Course-X VIII A (Special Paper-V)	Bio-Inorganic Chemistry	80	20
<u>SEMILSTER-IV</u> (P. Organia Chamistry specialization)			
(	B - Organic Chemistry specialization)	80	20
Course XVI D (Special Paper-II)	Netwol modules	80	20
Course XVI B (Special Paper-III)	Natural products	80	20
Course XVIII B (Special Paper-IV)	Delymen Chemistry	80	20
Course-X VIII B (Special Paper-V)	Polymer Chemistry	80	20
<u>SEMIESTER-IV</u>			
	A dream and Quantum Chamistry	80	20
Course-XV C (Special Paper-II)	Advanced Quantum Chemistry	80	20
Course XVII C (Special Paper-III)	Dianhysiaal Chemistry	80	20
Course XVIII C (Special Paper-IV)	Chamietry of Magramalogylag	80	20
Course-Avine (Special 1 aper-v) Chemistry of Iviacionioecules 00 20			
Course XIX A Inorganic Chemistry Dracticals 75			
Course VIV P	Organic Chemistry Practicals	75	
	Digane Chemistry Practicals	75	
Course-AIA C	r nysical Unemistry Practicals	/5	
Course-AA	(SEMINARS FOR all inree specializations)	23	

Note : The following criteria will be implemented with regards to the award of internal assessment:

- 1. Internal Assessment (I.A.) of 20 Marks will be added to each theory paper.
- These marks would , however be split as following: (a) 5 Marks for attendance in theory as well as in practical classes. The Weightage to attendance will be as follows: upto 75% with condonation from competent authority as per provision under ordinance-<u>ZERO</u>. Without condonation upto 75%- <u>ONE</u> <u>MARK</u>. 76-80%- <u>TWO MARKS</u>, 81-85% <u>THREE MARKS</u>, 86-90%- <u>FOUR MARKS</u> and above 91% <u>FIVE MARKS</u>.
- 3. The award of 15 Marks would be based on the performance of one Class Test of 15 Marks and this Test will be of objective / very short answer type .

#### SEMESTER-I (COURSE – I) (INORGANIC CHEMISTRY)

Lectures-60 Max. Marks-80

Note: i. Ten questions will be set by the examiner selecting TWO from each unit. As far as possible every question will be divided into Two – Three Parts. The students shall attempt FIVE questions selecting ONE from each unit. ii. Students can ask for Character Tables (except for C2V and C3V point groups) if required.

#### UNIT-I

**Group theory:** The concept of group, Symmetry elements and symmetry operations, Assignment of point groups to Inorganic molecules, some general rules for multiplications of symmetry operations, Multiplication tables for water and ammonia, Representations (matrices, matrix representations for  $C_2V$  and  $C_3V$  point groups irreducible representations), Character and character tables for  $C_2V$  and  $C_3V$  point groups. Applications of group theory to chemical bonding (hybrid orbitals for  $\sigma$ -bonding in different geometries and hybrid orbitals for  $\pi$ -bonding. Symmetries of molecular orbitals in BF<sub>3</sub>,  $C_2H_4$  and  $B_2H_6$ .

#### UNIT-II

**Non-Aqueous Solvents:** Factors justifying the need of Non-Aqueous solution Chemistry and failure of water as a Solvent. Solution chemistry of Sulphuric acid: Physical properties, Ionic self-dehydration in  $H_2SO_4$ , high electrical conductance in spite of high viscosity, Chemistry of  $H_2SO_4$  as an acid, as a dehydrating agent, as an oxidizing agent, as a medium to carry out acid-base neutralization reaction and as a differentiating solvent. Liquid BrF3: Physical properties, solubilities in BrF3, self-ionization, acid base neutralization reactions, solvolytic reactions and formation of transition metal fluorides.

#### **UNIT-III**

**Inorganic Hydrides:** Classification, preparation, bonding and their applications. Transition metal compounds with bonds to hydrogen, carbonyl hydrides and hydride anions. Classification, nomenclature, Wade's Rules, preparation, structure and bonding in boron hydrides (boranes) and carboranes,

#### UNIT-IV

**Organic Reagents in Inorganic Chemistry:** Chelation, factors determining the stability of chelates (effect of ring size, oxidation state of the metal, coordination number of the metal); Use of the following reagents in analysis:

(a) Dimethylglyoxime (in analytical chemistry)

(b) EDTA (in analytical chemistry and chemotherapy)

(c) 8-Hydroxyquinoline (in analytical chemistry and chemotherapy)

(d) 1,10-Phenanthroline (in analytical chemistry and chemotherapy)

(e) Thiosemicarbazones (in analytical chemistry and chemotherapy)

(f) Dithiazone (in analytical chemistry and chemotherapy)

#### UNIT-V

**Supramolecular Chemistry (Ref. Book 15):** Introduction, Some important concepts, Introduction to Recognition, information and complementarity, Principles of molecular receptor designs, Spherical recognition (cryptates of metal cations) Tetrahedral recognition by macrotricyclic cryptands, Recognition of ammonium ions, Recognition of neutral molecules and anionic substrates (anionic coordination)

#### **Books Recommended:**

- 1. Chemical applications of Group Theory F.A.Cotton
- 2. Inorganic Chemistry Durrant and Durrant
- 3. Symmetry in Chemistry- Jaffe and Orchin
- 4. Non-aqueous solvents H.Sisler
- 5. Non-aqueous solvents T.C.Waddington
- 6. Non-aqueous solvents Logowsky
- 7. Advanced Inorganic Chemistry:Cotton&Wilkinson,VthEdn.
- 8. Concise course in Inorganic Chemistry- J.D.Lee
- 9. Nature of Chemical Bond L. Pauling
- 10. Chemistry of Elements Greenwood and Earnshaw
- 11. Inorganic Chemistry T. Moeller
- 12. Inorganic Chemistry J.E.Huheey 3rd Edn.
- 13. Topics in Current Chemistry (Inorganic/Bio-Chemistry)-Vol. 64
- 14. A Text Book of Quantitative Inorganic Analysis- A.I. Vogel
- 15. Supramolecular Chemistry (Concepts and Perspectives) Jean Marie Lehn(VCH-1995).

#### SEMESTER-I (COURSE - II) (ORGANIC CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit. **Unit I** 

**Supramolecular Chemistry:** Introduction, Bonding other than covalent bond. Addition compounds, Crown ether complexes and Cryptands, Inclusion compounds, Cyclodextrins, Catenanes and Rotaxenes and their applications. **Unit II** 

# **Stereochemistry:** Introduction to Basic Concepts of Stereochemistry: Isomers and their properties, Threo and Erythro isomers, Chirality, Optical isomerism, Geometrical isomerism, Conventions for configurations- D,L and R,S systems, Racemic mixture and Racimization, Resolution of Racemic mixtures, Measurement of optical activity, optical purity, Streoselective and Streospecific reactions, epimerization, epimers, anomers and mutarotation, Axial Chirality (Allenes and Biphenyls), Planar chirality, Helicity, Chirality involving atoms other than carbon atoms, Prochirality: prostreoisomerism and Asymmetric synthesis.

Conformational and Streoisomerism of acylic and cylic systems, cyclohexane, decalins, effect of conformation on reactivity in acylic and cyclohexane systems.

#### Unit III

**Reaction Mechanism:** Structure and Reactivity: Thermodynamic and kinetic requirements, Kinetic and Thermodynamic control, Hammonds postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates.

Effect of structure on reactivity: resonance and field effects, steric effect. Quantitative treatment: Hammett equation and linear free energy relationship, Substituent and reaction constants, Taft equation. Methods of determining Reaction mechanisms,

#### <u>Unit IV</u>

Aliphatic Nucleophilic Substitution: Reactivity effect of substrate structure, leaving group and nucleophile. The SN<sub>2</sub>, SN<sub>1</sub>, mixed SN<sub>1</sub> and SN<sub>2</sub>, SET mechanisms & SNi mechanism. The neighboring group mechanism, neighboring group participation by  $\pi$  and  $\sigma$  bonds, anchimeric assistance. Non-classical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements-Wagner-Meerwein, Pinacol-Pinacolone and Demjanov ring expansion and ring contraction. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Esterification of carboxylic acid, transesterification, Phase-transfer catalysis, and ultrasound, ambident nucleophile, regioselectivity.

## <u>Unit V</u>

Aliphatic Electrophilic substitution: Bimolecular mechanisms- SE2 and SEi. The SE1 mechanism, electrophilic substitution accompanied by double bond shifts, halogenation of aldehydes, ketones, acids and acyl halides. Effect of substrates, leaving group and the solvent system on reactivity. Aliphatic diazonium coupling, Acylation at aliphatic carbon, alkylation of alkanes, Stork-enamine reactions

**Free radical reactions:** Geometry of free radicals, Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate neighboring group assistance, Reactivity in aliphatic and aromatic substrates at a bridgehead and attacking radicals. Effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts (Gomberg Bachmann reaction), Hoffmann -Loffler- Freytag reaction, Hunsdiecker reaction.

#### **Books Recommended**:

- 1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
- 2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
- 3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
- 4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
- 5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall.
- 6. Modern Organic Reactions, H.O. House, Benjamin.
- 7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional.
- 8. Pericyclic Reactions, S.M. Mukherji, Macmillan, India.
- 9. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
- 10. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
- 11. Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.
#### SEMESTER-I (COURSE – III) (PHYSICAL CHEMISTRY)

Lectures-60 Max. Marks-80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit. **UNIT – I** 

**Resonance Spectroscopy**: Principle and Theory of nuclear magnetic resonance (NMR). Chemical shift and spin – spin coupling. Factors influencing chemical – shift and spin – spin coupling of <sup>1</sup>H-NMR. Spin – spin and spin – lattice relaxation processes. Line –width and rate processes. First and second order <sup>1</sup>H-NMR spectra. Concept of NMR spectra of solids (dipole-dipole Interactions). Principle and theory of Electron Spin Resonance (ESR). Hyperfine structure of ESR. Fine structure of ESR (electron-electron coupling / Zero – field splitting of ESR signal. McConnell relation. Mossbaur spectroscopy: isomer – shift, quadrupole interaction and magnetic hyperfine interaction.

#### <u>UNIT - II</u>

**Molecular Spectroscopy:** Rotational spectra of non - rigid diatomic molecules and symmetric - top molecules. Anharmonic oscillator, overtones and hot bands. Diatomic vibrator - rotator (P, Q and R - branches). Rotational - vibrational spectra of symmetric - top molecules. Raman Spectroscopy. Rotational and vibrational Raman spectra of linear molecules, symmetric top molecules, overtones and mutual exclusion principle.

#### <u>UNIT - III</u>

Kinetics of complex reactions: Consecutive and competitive (parallel) first order reactions. Kinetic vs. thermodynamic control reaction. Chain / free radical reactions; thermal  $(H_2 - Br_2)$  and photochemical  $H_2 - Cl_2$ ) reactions. Rice – Herzfeld mechanism of dissociation of organic molecules viz. dissociation of ethane, decomposition of acetaldehyde as 3/2 or  $\frac{1}{2}$  order reactions. Reaction rates and chemical equilibrium, principle of microscopic reversibility, activation energy and activated complex.

## <u>UNIT - IV</u>

Transition state theory and its kinetic and thermodynamic formulation. Potential energy surfaces (basic idea). Kinetics in solutions: diffusion controlled reactions, their rates and influence of the solvent. Kinetics of polymerization: free radical polymerization and Step – Growth Polymerization. Collisions and transition state theories in simple gas reactions, Lindman and Hinshelwood treatment.

#### UNIT - V

- 1) Catalytic activity at surfaces: adsorption and catalysis, the Langmuir Hinshelwood mechanism, the Eley Rideal mechanism. Examples of catalysis: hydrogenation, oxidation and cracking and reforming (qualitative treatment only).
- 2) Study of fast reactions; Flash photolysis and Stopped flow method.

- 1. Chemical Kinetics : K.J. Laidler
- 2. Kinetics and Mechanism of Reaction Rates: A.Frost and G. Pearson.
- 3. Modern Chemical Kinetics: H. Eyring
- 4. Theories of Reaction Rates: K.J. Laidler, H. Eyring and S. Glasston
- 5. Fast Reactions: J.N. Bradly
- 6. Fast Reaction:C. Kalidas
- 7. Fast Reactions in Solutions: Caldin
- 8. Basic Principles of Spectroscopy: R. Chang
- 9. NMR and Chemistry: J.W. Akit
- 10. Introduction to Molecular Spectroscopy: G.M. Barrow
- 11. Physical Chemistry: P.W. Atkins
- 12. Fundamentals of Molecular Spectroscopy: C.N. Banwell
- 13. Physical Chemistry: G.K. Vemulapalli

# **SEMESTER-I**

#### (COURSE - IV)

#### (MATHEMATICS FOR CHEMISTS & APPLICATION OF COMPUTER IN CHEMISTRY)

Lectures: 60

Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible every question will be subdivided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

## Mathematics for Chemists

#### <u>UNIT - I</u>

Differential calculus: functions of single and several variables, partial derivatives, the total derivative, maxima and minima theorem, and simple examples related to chemistry. Vectors: representation and simple properties of vectors (addition and subtraction) vector addition by method of triangles, resolution of vectors. Scalar product of vector. Concept of normalization, orthogonality and complete set of unit vectors.

## UNIT – II

Integral calculus: general and special methods of integration, geometric interpretation of integral, evaluation of definite and some standard integrals related to chemistry. The significance of 'exponential' equations. Differential equations: simple differential equations, separable variables, homogeneous equations, exact equations, linear equations, and equations of first and second order. Application to simple chemistry problems.

## <u>UNIT – III</u>

Matrices and Determinants: Definition of matrix, types of matrices (row, column, null, square, diagonal). Matrix algebra: addition, subtraction, and multiplication by a number, matrix multiplication. Transpose and adjoint of matrix, elementary transformation, representation and applications to solutions of linear equations. Application to simple chemistry problems.

# Application of Computer in Chemistry UNIT – IV

Chemistry and FORTRAN Programming: Introductory FORTRAN concepts, character set, constant variables, data types, subscripted variables, and FORTRAN functions. Data transfer and program execution control: Introduction, format specification for READ and WRITE statements, format commands, control commands and transfer commands.

# <u>UNIT – V</u>

Arrays and replitive computation; Introduction, arrays arrange storage, dimension statement, do comtruel, Nested do – loop continue statement, implied do. Sub – programme (functions and sub –routines): Introduction, sub programme, functions in FORTRAN, function arguments, subroutines, save variable function vs. subroutine programme.

- 1. Mathematical Preparation for Physical Chemistry: F. Daniel
- 2. Mathematical Methods for Science Students: G. Stephemen
- 3. Applied Mathematics for Physical Chemistry: T.R. Barrante
- 4. Fortran 77 & 90: V. Rajaraman
- 5. Computer in Chemistry: K.V. Raman

#### SEMESTER-II (COURSE –V) (INORGANIC CHEMISTRY)

Lectures: 60

Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible everyquestion will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questionsselecting **ONE** from each unit.

#### UNIT-I

**Metal-Ligand Bonding-I:** Recapitulation of Crystal Field Theory including splitting of *d*-orbitals in different environments, Factors affecting the magnitude of crystal field splitting, structural effects (ionic radii, Jahn-Teller effect), Thermodynamic effects of crystal field theory (ligation, hydration and lattice energy), Limitations of crystal field theory, Adjusted Crystal Field Theory (ACFT), Evidences for Metal-Ligand overlap in complexes, *Molecular Orbital Theory* for octahedral, tetrahedral and square planar complexes (excluding mathematical treatment)

#### **UNIT-II**

Atomic Spectroscopy: Energy levels in an atom, coupling of orbital angular momenta, coupling of spin angular momenta, spin orbit coupling, spin orbit coupling  $p_2$  case, Determining the Ground State Terms-Hund's Rule, Hole formulation (derivation of the Term Symbol for a closed sub-shell, derivation of the terms for a  $d_2$  configuration), Calculation of the number of the microstates.

#### UNIT-III

**Electronic Spectra-I:** Splitting of spectroscopic terms (S,P,D.F and G,H,I),  $d^{11}$ - $d^9$  systems in weak fields (excluding mathematics), strong field configurations, transitions from weak to strong crystal fields.

#### **UNIT-IV**

**Electronic Spectra-II:** Correlation diagrams  $(d^{11}-d^9)$  in Oh and Td environments, spin-cross over in coordination compounds. Tanabe Sugano diagrams, Orgel diagrams, evaluation of B,C and  $\beta$  parameters.

#### **UNIT-V**

**Magnetochemistry:** Origin of Magnetic moment, Magnetic susceptibility (diamagnetic, paramagnetic), spin only moment, Russell Saunder's coupling, quenching of orbital angular moment, orbital contribution to a magnetic moment, magnetic moments from magnetic susceptibilities, temperature dependence of magnetic susceptibility, Factors determining paramagnetism, application of magnetochemistry in co-ordination chemistry in spin free and spin paired octahedral and tetrahedral complexes, Van Vlecks formula for magnetic susceptibility.

- 1. Advanced Inorganic Chemistry Cotton and Wilkinson
- 2. Coordination Chemistry- Experimental Methods K.Burger
- 3. Theoretical Inorganic Chemistry Day and Selbin
- 4. Magnetochemistry R.L.Carlin
- 5. Comprehensive Coordination Chemistry Wilkinson, Gillars and McCleverty.
- 6. Inorganic Electronic Spectroscopy A.B.P.Lever
- 7. Concise Inorganic Chemistry J.D.Lee
- 8. Introduction to Ligand Fields B.N.Figgis
- 9. Introduction to Magnetochemistry A.Earnshaw, Academic Press.

#### SEMESTER-II (COURSE - VI) (ORGANIC CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

#### Unit -I

(A) Aromatic Electrophilic Substitution: Arenium ion mechanism, orientation and reactivity, The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles, Diazonium coupling, Vilsmeir - Haack reaction, Scholl reaction, Amination reaction, Fries rearrangement, Hofmann-Martius Reaction, Reversal of Friedel Craft alkylation.

**(B)** Aromatic Nucleophilic Substitution: SNAr, SN1, benzyne and SRN1 mechanism. Reactivity, effect of substrate structure, leaving group and attacking nucleophile, Von Richter, Sommelet-Hauser, and Smiles rearrangements, Ullman reaction, Ziegler alkylation, Schiemann reaction.

#### Unit -II

**Common Organic Reactions and Their Mechanisms:** Perkin condensation, Michael reaction, Robinson annulation, Diekmann reaction, Stobbe condensation, Mannich reaction, Knoevenagel condensation, Benzoin condensation, Witting reaction, Hydroboration, Hydrocarboxylation, Ester hydrolysis, Epoxidation.

#### <u>Unit -III</u>

**Reagents in Organic Synthesis:** Synthesis and applications of BF<sub>3</sub>, NBS, Diazomethane, Lead tetra-acetate, Osmium tetraoxide, Woodward Prevorst hydroxylation reagent, LiAlH<sub>4</sub>, Grignard reagent, organozinc and organolithium reagent.

#### <u>Unit -IV</u>

**Elimination Reactions:** Discussion of  $E_1$ ,  $E_2$ ,  $E_1cB$  and  $E_2C$  Mechanisms and orientation, Reactivity: Effects of substrate structures, attacking base, leaving group and medium. Mechanism and Orientation in Pyrolytic eliminations, Cis elimination, elimination in cyclic systems, eclipsing effects, cleavage of quaternary ammonium hydroxides, Shapiro reaction, Conversion of Ketoxime to nitriles.

#### <u>Unit -V</u>

**Pericyclic Reaction:** Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5 hexatrienes and allyl system. Classification of pericyclic reactions, Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions: conrotatory and disrotatory motions, 4n and 4n+2 and allyl systems. Cycloadditions- antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and chelotropic reactions. Sigmatropic rearrangements-Suprafacial and Antarafacial shifts of H, sigmatropic shifts involving carbon moieties, Claisen, Cope and aza-Cope rearrangements, Ene reaction.

#### **Books recommended:**

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.

- 2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
- 3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
- 4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
- 5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall.
- 6. Modern Organic Reactions, H.O. House, Benjamin.

7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional.

- 8. Pericyclic Reactions, S.M. Mukherji, Macmillan, India.
- 9. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
- 10. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.

#### <u>SEMESTER-II</u> (COURSE –VII) (PHYSICAL CHEMISTRY)

# Lectures: 60

Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

#### <u>UNIT – I</u>

Brief resume of law of thermodynamics. Gibb's and Helmholtz free energy functions and their significance. Partial molal quantities. Partial molal free energy and its variation with temperature and pressure. Determination of partial molar volume. Carnot cycle, Thermodynamic criteria for the feasibility of the process in terms of entropy change, internal energy change, enthalpy and free energy (Gibb's and Helmholtz) change. Gibb's and Helmholtz equation and its utility in cell reaction. Thermodynamics of ideal solutions. Fugacity and activity. Graphical method for the determination of fugacity.

## <u>UNIT – II</u>

Chemical potential in case of ideal gases. Chemical equilibrium constant and its temperature dependence. Law of chemical equilibrium and its application. Clausius and Clapeyron equation and its application for the determination of colligative properties (depression in freezing point, elevation in boiling point and relative lowering of vapour pressure). Determination of molecular weight of non – volatile solutes from colligative properties. Relationship between relative lowering of vapour pressure and osmotic pressure. Van't Hoff equation for dilute solutions and its application.

## <u>UNIT – III</u>

Nernst heat theorem and third law of thermodynamics and its application. Thermodynamic derivation of phase rule and its application to two component systems. Distribution law, its thermodynamic derivation and application. Zeroth law of thermodynamics.

# <u>UNIT – IV</u>

**Non–Equilibrium Thermodynamics:** Basic principles of non – equilibrium thermodynamics: rate laws, second law of thermodynamics for open system, law of conservation of mass, charge and energy flow. Electrokinetic phenomena and expressions for streaming potential, electro- osmotic pressure difference, streaming potential using the linear phenomenological equation.

#### UNIT –V

**Corrosion:** causes and types of corrosion, electrochemical theories of corrosion, kinetics of corrosion (corrosion current and corrosion potential). Corrosion measurements (weight loss, OCP measurement, and polarization methods), passivity and its breakdown. Corrosion prevention (electrochemical, inhibitor, and coating methods).

- 1. Thermodynamics for Chemists: S. Glasstone
- 2. Physical Chemistry: G.M. Barrow
- 3. Non equilibrium Thermodynamics: C. Kalidas
- 4. Non equilibrium Thermodynamics: I. Prigogene
- 5. Electrochemistry: S. Glasstone
- 6. Electrochemistry: P.H. Reiger
- 7. Thermodynamics; R.C. Srivastava, S.K. Saha and A.K. Jain
- 8. Modern Electrochemistry Vol. I: J.O'M Bockris and A.K.N. Reddy
- 9. Physical chemistry: P.W. Attkin.

#### SEMESTER-II (COURSE –VIII) (CHEMISTRY OF LIFE & ENVIROMENTAL CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible, every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

# <u>UNIT-I</u>

**Cell structure and function:** Basic concepts, Overview of metabolic processes (catabolic and anabolic), energy transfer processes, role and significance of ATP (the biological energy currency). Introductory idea of metabolism of proteins and lipids, biosynthesis of proteins and glycerides.

# <u>UNIT-II</u>

**Nucleic acids:** Purine and pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acids (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The Chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and trinucleoside.

# UNIT-III

**Environmental Chemistry:** Atmosphere, environmental segments, composition of the atmosphere, earth's radiation balance, particulates, ions and radicals and their formation, chemical and photochemical reactions in the atmosphere, air pollution, oxides of C,N,S and their effects, acid-rain, smog formation, Green house effects (global warming and ozone depletion, air pollution controls and introduction to analytical methods for monitoring air pollution.

# UNIT-IV

**Hydrosphere:** Chemical composition of water bodies-lakes, streams, rivers, sea etc, hydrological cycle, complexation in natural and waste water and microbially mediated redox reactions. Water pollution-inorganic, organic, pesticides, industrial and radioactive materials, oil spills and oil pollutants, eutrophication, acid-mine drainage, waste water treatment, domestic waste water (aerobic and anaerobic treatment), and industrial waste water treatment.

# <u>UNIT-V</u>

Water quality parameters and standards: Analytical methods for measuring DO, BOD, COD, fluoride, oils and grease and metals (As, Cd, Hg, Pb, Zn,Cu,Cr), Biochemical effects of As, Cd, Hg, Pb, Cr, CN and pesticides. Lithosphere: Soil composition, micro and macro nutrients, soil pollution-fertilizers, pesticides.

- 1. Principles of Biochemistry –A.L.Lehringer
- 2. Introduction to Chemistry of Life-H.J.DeBay
- 3. Outlines of Biochemistry-Conn and Stumpf
- 4. Environmental Chemistry-A.K.De
- 5. Environmental Chemistry-Manaham
- 6. Environmental Pollution Analysis-Khopkar

#### SEMESTER I AND II Practical (COURSE – IX A) (INORGANIC CHEMISTRY PRACTICAL)

Time - 6 hr/week Max. Marks - 50

#### 1. Volumetric Analysis:

(a) Potassium iodate titrations: Determination of iodide, hydrazine, antimony(III) and arsenic (III)

#### (b) Potassium bromate titrations

- i) Determination of antimony (III) and arsenic (III) Direct Method)
- ii) Determination of aluminium, cobalt and zinc (by oxine method)

#### (c) EDTA titrations

- i) Determination of copper, nickel, magnesium
- ii) Back titration
- iii) Alkalimetric titration
- iv) Titration of mixtures using masking and damasking agents
- v) Determination of hardness of water

#### 2. Commercial Analysis:

- i) Determination of available chlorine in bleaching powder
- ii) Determination of Oxygen in hydrogen peroxide.
- iii) Determination of Phosphoric acid in commercial phosphoric acid.
- iv) Determination of Boric acid in borax.
- iv) Analysis of Ores (Dolomite, Pyrolusite) and alloys (Coin, Brass, Bronze).

#### 3. Analysis of mixtures by gravimetric and volumetric methods from the mixture solutions:

- 1. Copper-Nickel
- 2. Copper -Magnesium
- 3. Copper-Zinc
- 4. Iron-Magnesium
- 5. Silver-Zinc
- 6. Copper-Nickel-Zinc
- 7. Fe(II)-Fe(III)

# 4. Green methods of Preparation of the following:

- (i) Bis(acetylacetonato)copper(II)
- (ii) Tris(acetylacetonato)iron(III)
- (iii) Tris(acetylacetonato)manganese(III)

- 1. A text Book of Quantitative Inorganic Analysis: A.I.Vogal.
- 2. Applied Analytical Chemistry: Vermani.
- 3. Commercial Methods of Analysis: Shell & Biffen

#### SEMESTER I AND II (COURSE – IX B) (ORGANIC CHEMISTRY PRACTICAL)

Time - 6 hr/week

Max. Marks - 50

**Qualitative Analysis:** Separation, purification and identification of binary mixture of organic compounds by chemical tests, TLC, column chromatography and IR spectroscopy.

**Organic Synthesis:** Acetylation: - Acetylation of cholesterol and separation of cholesteryl acetate by column chromatography. Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol. Grignard reaction: Synthesis of triphenyl methanol from benzoic acid. Aldol condensation: Dibenzal acetone from benzaldehyde. Sandmeyer reaction: p-chlorotoluene from p-toluidine. Acetoacetic ester condensation: Synthesis of ethyl-n-butylacetoacetate by A.E.E condensation. Preparation of iodoform from acetone (Haloform reaction). Preparation of polystyrene, anthranilic acid, fluorosceine-eosin, and methyl orange

- 1. Experiments and Techniques in Organic Chemistry, D.Pasto, C. Johnson and M.Miller, Prentice Hall.
- 2. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C.Heath.
- 3. Systematic Qualitative Organic Analysis, H.Middleton, Adward Arnold.
- 4. Handbook of Organic Analysis-Qualitative and Quantitative, H.Clark, Adward Arnold.
- 5. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.

# <u>COURSE – IXC</u> (Physical CHEMISTRY PRACTICAL)

Time - 6 hr/week Max. Marks - 50

- 1. <u>Refractive Index (RI) Measurements:</u> Refractive index measurements of pure solvents and analysis of solvent mixtures in terms of composition from the calibration plot..
- 2. <u>Conductometric Measurements</u>: Determination of cell constant, limiting molar conductance of simple electrolytes in water, verification of Ostwald, dilution law for week acetic acid.
- 3. <u>Surface Tension Measurements:</u> Surface tension of pure solvents, analysis of mixtures of two miscible solvents, verification of Gibb's Thomson Rule of surface tension.
- 4. <u>Partition Coefficient</u>: Determination of partition coefficient for  $I_2$  and benzoic acid between two immiscible solvents.
- 5. <u>Adsorption Measurements</u>: Verification of Freundlich adsorption isotherm for I<sub>2</sub>, and acetic acid on charcoal.
- 6. <u>Colloidal Solution</u>: Preparation of sol solution of arsenic sulphide and estimation of flocculation value for NaCl, KCl, BaCl<sub>2</sub>, AlCl<sub>3</sub>.
- 7. <u>Thermochemistry:</u> Determination of water equivalent of thermos flask, and estimation of heat of neutralization for strong acid strong base, weak acid strong base or vice versa, heat of hydration and solution of salts.

- 1. Senior Practical Physical Chemistry: B.D. Khosla, V.C. Garg and A. Khosla
- 2. Experimental Physical Chemistry: V. Athawale and P. Mathur.
- 3. Practical Physical Chemistry: B. Vishwanathan and P.S. Raghavan.
- 4. Practical in Physical Chemistry: P.S. Sindhu

#### SEMESTER-III (COURSE –X) (INORGANIC CHEMISTRY)

Lectures: 60

Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible, everyquestion will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit.

UNIT-I

Metal  $\pi$  Complexes Preparation, reactions, structures and bonding in carbonyl, nitrosyl and phosphine complexes, structural evidences from vibrational spectra. Structure and bonding in metal cyanides, stabilization of unusual oxidation states of transition metals.

#### UNIT-II

**Introductory Analytical Chemistry:** *Data Analysis*– Types and sources of errors, propagation of errors, detection and minimization of various types of errors. Accuracy and precision, average and standard deviation, variance, its analysis and confidence interval, tests of significance (*F*-test, *t*-test and paired t-test), criteria for the rejection of analytical data (4d rule, 2.5d rule, Q-test, average deviation and standard deviation), least-square analysis.

## UNIT-III

**Photoelectron Spectroscopy:** Basic principle, photoionization process, ionization energies, Koopman's theorem, ESCA, photoelectron spectra of simple molecules, (N2, O2) Photoelectron spectra for the isoelectronic sequence Ne, HF, H2O, NH3 and CH4, chemical information from ESCA, Auger electron spectroscopy – basic idea.

## UNIT-IV

Lanthanides and Actinides:- Spectral and magnetic properties, comparison of Inner transition and transition metals, Transuranium elements (formation and colour of ions in aqueous solution), uses of lanthanide compounds as shift reagents, periodicity of translawrencium elements.

#### UNIT-V

**Nuclear Chemistry:** Nuclear binding energy and stability, nuclear models (nuclear shell model and collective model). Nuclear reactions: types of reactions, nuclear cross-sections, Q-value. Natural and artificial radioactivity, radioactive decay and equilibrium, Nuclear fission, fission product and fission yields, Nuclear fusion.

**Radioactive techniques:** Tracer technique, (neutron activation analysis), Counting techniques such as G.M. Ionization and proportional counters.

# **Books Recommended:**

- 1. Advanced Inorganic Chemistry Cotton and Wilkinson
- 2. Fundamentals of Analytical Chemistry Skoog and West
- 3. Quantitative Inorganic Analysis Vogel
- 4. Chemistry of the Elements Greenwood and Earnshaw
- 5. Nuclear Chemistry-U.C.Dash
- 6. Nuclear Chemistry B.G.Harvey
- 7. Nuclear Chemistry Arnikar
- 8. Techniques in Inorganic Chemistry Vol. II (Nuclear Chemistry-Johnson and Others).
- 9. Modern Aspects of Inorganic Chemistry-H.J.Emeleus and A.G.Sharpe
- 10. Inorganic Chemistry, 4th Edition, J.E.Huheey, E.A.Keiter and R.L.Keiter.
- 11. Analytical Chemistry-G.D.Christian
- 12. Chemical Structure and Bonding- Dekock and Gray

13. The Organometallic Chemistry of Transition metals: R.H. Crabtree.14. Electronic absorption spectroscopy and related techniques: D.N. Sathyanarayan

### <u>SEMESTER-III</u> (COURSE - XI) (ORGANIC CHEMISTRY)

#### Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit. Unit -I

**Ultra Violet and Visible Spectroscopy:** Electronic transitions (185-800 nm), Beer- Lambert Law, Effect of solvent on electronic transitions, Ultra Violet bands of carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Steric effect in biphenyls, Fieser- Woodward rules for conjugated dienes and carbonyl compounds, ultra violet spectra of aromatic and heterocyclic compounds.. Applications of UV- visible spectroscopy in organic chemistry.

#### <u>Unit -II</u>

**Infrared Spectroscopy:** Principle, Instrumentation and sample handling, Characteristic vibrational frequencies of common organic compounds, Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance. Introduction to Raman spectroscopy. Applications of IR and Raman Spectroscopy in organic chemistry.

# <u>Unit -III</u>

**Nuclear Magnetic Resonance (NMR) Spectroscopy:** General introduction, chemical shift, spin-spin interaction, shielding mechanism, chemical shift values and correlation of protons present in different groups in organic compounds. chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei, virtual coupling. Stereochemistry, hindered rotation, Karplus- relationship of coupling constant with dihedral angle. First and second order spectra, Simplification of complex spectra-nuclear magnetic double resonance, spin tickling, INDOR, contact shift reagents, solvent effects. Fourier transform technique, nuclear Overhauser effect (NOE). Introduction to resonance of other nuclei – <sup>19</sup>F, <sup>31</sup>P, <sup>13</sup>C, NMR, 2-D and 3-D NMR, Applications of NMR in organic chemistry.

# Unit -V

**Mass Spectrometry:** Introduction, ion production—EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, and ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, Molecular ion peak, Meta-stable peak, McLafferty rearrangement. Nitrogen Rule. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination. Introduction to negative ion Mass spectrometry, TOF-MALDI.

Problems based upon IR, UV, NMR and mass spectroscopy.

# <u>Unit -V</u>

**Photochemistry** – **I:** Introduction and Basic principles of photochemistry. Interaction of electromagnetic radiations with matter, Types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy, actinometry. Photochemistry of alkenes: cis-trans isomerization, dimerization of alkenes, photochemistry of conjugated olefins, photo-oxidation of alkenes and polyenes Photochemistry of Aromatic compounds: Isomerization, addition and substitution, photo-reduction of aromatic hydrocarbons

**Photochemistry** – **II:** Photochemistry of Carbonyl compounds: Norrish Type I and II, Intermolecular and Intramolecular hydrogen abstraction, Paterno -Buchi reaction,  $\alpha$  and  $\beta$ - cleavage reactions of cyclic and acyclic carbonyl compounds, Formation of oxetane and cyclobutane from  $\alpha,\beta$  unsaturated ketones, Photo-reduction of carbonyl compounds, Photo-rearrangement of enones, dienones, epoxyketones, Photo Fries rearrangement.

- 1. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpeuch and G.J. Martin, Heyden.
- 2. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C.Bassler and T.C.Morrill, John Wiley.
- 3. Introduction to NMR Spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
- 4. Application of Spectroscopy of Organic Compounds, J.R. Dyer, Prentice Hall.
- 5. Spectroscopic Methods in Organic Chemistry, D.H. Williams, I. Fleming, Tata McGraw-Hill.
- 6. Organic spectroscopy by Jagmohan
- 7. Organic spectroscopy by W. Kemp.
- 8. Fundamentals of Photochemistry, K.K.Rohtagi Mukherji, Wiley-Eastern.
- 9. Essentials of Molecular Photochemistry, A. Gilbert and J.Baggot, Blackwell Scientific Publication.
- 10. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
- 11. Introductory Photochemistry, A. Cox and T. Camp, McGraw-Hill.
- 12. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
- 13. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.
- 14. Organic Photochemistry Vol.I, II, III. Ed. Orville L. Chapman.
- 15. Organic Photochemistry, Ed. Robert O. Kan.
- 16. Spectroscopy by Pavia

#### <u>SEMESTER-III</u> (COURSE –XII) (PHYSICAL CHEMISTRY)

# Lectures: 60

Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit.

#### **Statistical Thermodynamics**

#### <u>UNIT – I</u>

Basic Terminology: probability, phase space, micro and macro states, thermodynamic probability, statistical weight, assembly, ensemble, The most probable distribution: Maxwell-Boltzmann distribution, quantum statistics: The Bose-Einstein statistics and Fermi- Dirac Statistics. Thermodynamic probability (W) for the three types of statistics. Lagrange's undetermined multipliers. Stirling's approximation, Molecular partition function and its importance.

Applications to ideal gases: The molecular partition function and its factorization. Evaluation of translational, rotational and vibrational partition functions, the electronic and nuclear partition functions. for monatomic, diatomic and polyatomic gases.

## <u>UNIT – II</u>

Thermodynamic properties of molecules from partition function: Total energy, entropy, Helmholtz free energy, pressure, heat content, heat capacity and Gibb's free energy, equilibrium constant and partition function, Heat capacity of crystals and statistical thermodynamics, Third law of thermodynamics and entropy. Ortho- and para-hydrogen, statistical weights of ortho and para states, symmetry number. Calculation of equilibrium constants of gaseous solutions in terms of partition function, Einstein theory and Debye theory of heat capacities of monatomic solids.

#### **Basic Quantum Chemistry**

## <u>UNIT – III</u>

Operators in quantum mechanics. Introduction to angular momentum. Eignvalues and eignfunctions. Hermitian operator. Postulates of quantum mechanics. Time dependent and time independent Schrodinger wave equations.

#### <u>UNIT – IV</u>

Some analytically soluble problems (complete solutions) of particle in a one and three dimensional box, harmonic – oscillator, the rigid rotor, the hydrogen atom and the quantum mechanical tunnelling.

#### <u>UNIT – V</u>

**Photochemistry:** Photophysical processes of electronically excited molecules (Jablonski Diagram). Franck-Condon principle. Kinetics of Excimer and exciplex formation. Energy transfer from electronically excited molecules (Stern – Volmer mechanism). E- type and P- type delayed fluorescence.

#### **Suggested Reading:**

- 1. Physical Chemistry: P.W. Atkins
- 2. Theoretical Chemistry by S. Glasston
- 3. Statistical Chemistry by I. Prigogine
- 4. Quantum Chemistry An Introduction: H.L. Strauss
- 5. Introductory Quantum Chemistry: A.K. Chandra
- 6. Quantum Chemistry: A. Mcquarrie
- 7. Quantum Chemistry: I.N. Levine

#### SEMESTER-III (COURSE –XIII (A)) (INORGANIC CHEMISTRY SPECIAL THEORY - I)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible, every question will be subdivided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit.

#### UNIT-I

**Inorganic Photochemistry**: Basic principles, absorption, excitation, kasha rule, electronically excited state, its life-time and energy dissipation process. Photochemical behaviour of transition metal complexes, charge transfer spectraof crystalline and gasous alkali halides. Photochemistry of chromium(III) octahedral complexes,  $[Cr(H_2O)_6]^{3+}$  and  $[Cr(NH_3)_6]^{3+}$ . Photochemistry of cobalt(III) complexes,  $[Co(NH_3)_5X]^{2+}$  and  $[Co(en)_3]^{3+}$ .

## UNIT-II

**Inorganic Reactions and Mechanism:** Substitution reactions in octahedral complexes, acid hydrolysis reactions, base hydrolysis and anation reactions, substitution reaction, reactions occurring without rupture of metal-ligand bond. Substitution reactions of square planar complexes. Theories of trans-effect, labile and inert complexes. Mechanism of redox reactions.

## UNIT-III

**Polymeric Inorganic Compounds:** General chemical aspects (synthesis, properties and structure) of phosphazenes, borazines, silicones, sulphur- nitrogen cyclic compounds and condensed phosphates.

#### UNIT-IV

**Stability of Coordination Compounds** – Stability constants, stepwise formation constants, overall formation constants, relationship between stepwise and overall formation constants, factors affecting the stability constants (with special reference to metal and ligand ions), Difference between thermodynamic and kinetic stability. Determination of stability constants by:

(i) Spectrophotometric methods (Job's method, Mole ratio and slope ratiomethod).

(ii) Bjerrum's method

(iii) Polarographic method

#### UNIT-V

**Electronic Spectra – III (Electronic spectra of complex ions):** Selection rules (Laporte, orbital and spin selection rules), band intensities, band widths, spectra in solids, spectra of aqueous solutions of d1-d9 ions in Oh and Td environments, Evaluation of 10 Dq, Spectrochemical and Nephelauxetic series, charge- transfer spectra.

- 1. Instability Constants- Yttermiskii
- 2. Advanced Inorganic Chemistry- Cotton and Wilkinson
- 3. Inorganic Chemistry- T.Moeller
- 4. Concise Inorganic Chemistry- J.D.Lee
- 5. Introduction to Ligand Fields- B.N.Figgis
- 6. Modern Aspects of Inorganic Chemistry-H.J.Emeleus and A.G.Sharpe
- 7. Inorganic chemistry: A Unified Approach W.W.Porterfield
- 8. Inorganic Reaction Mechanism Edberg
- 9. Inorganic Reaction Mechanism BasoloavdPearsor

#### <u>SEMESTER-III</u> (COURSE – XIII (B)) (ORGANIC CHEMISTRY SPECIAL THEORY - I)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

#### <u>Unit-I</u>

Carbohydrates: Types of naturally occurring sugars: Deoxy-sugars, amino sugars, branched chain sugars. General methods of structure and ring size determination with particular reference to maltose, lactose, sucrose, pectin, starch and cellulose, photosynthesis of carbohydrates, metabolism of glucose, Glycoside- (amygdalin).

#### Unit-II

Amino acid, peptides and proteins: General methods of peptide synthesis, sequence determination. Chemistry of insulin and oxytocin. Purines and nucleic acid. Chemistry of uric acid, adenine, protein synthesis.

#### Unit-III

Vitamins: A general study, detailed study of chemistry of thiamine (Vitamin B1), Ascorbic acid (Vitamin C), Pantothenic acid, biotin (Vitamin H),  $\alpha$ -tocopherol (Vitamin E), Biological importance of vitamins.

#### <u>Unit-IV</u>

Enzymes: Remarkable properties of enzymes like catalytic power, specificity and regulation, Mechanism of enzyme action: Proximity effects and molecular adaptation, Chemical and biological catalysis, Transition state theory, orientation and steric effects, acid base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms (chymotrypsin, ribo nuclease, lysozyme and carboxypeptidase A). Fischer's lock and key and Koshland's induced fit hypothesis, Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition.

#### <u>Unit-V</u>

**Coenzyme Chemistry:** Cofactors as derived from vitamins, coenzymes, prosthetic groups, and apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate,  $NAD^+$ ,  $NADP^+$ , FMN, FAD, Lipoic acid, vitamin B<sub>12</sub>. Mechanisms of reactions catalyzed by the above coenzymes.

- 1. Bioinorganic Chemistry: A Chemical Approach to Enzyme Action, Herman Duags and C. Penny, and Springer-Verlag.
- 2. Understanding Enzymes, Trevor Palmer, Prentice Hall.
- 3. Enzyme Chemistry; Impact and Applications, Ed. Collin J Suckling, Chapman and Hall.
- 4. Enzyme Mechanisms Ed, M.I. Page and A. Williams, Royal Society Of Chemistry.
- 5. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford Univ. Press.
- 6. Immobilized Enzymes: An Introduction and Applications In Biotechnology, Michael D. Trevan, John Wiley.
- 7. Enzymatic Reaction Mechanisms. C. Walsh, W. H, Freeman.
- 8. Enzyme Structure and Mechanism, A. Fersht, W.H. Freeman.
- 9. Biochemistry the Chemical Reactions of Living Cells, D.E. Metzler, Academic Press.
- 10. Carbohydrates by N. Sharon.
- 11. Carbohydrates by Gutherie.
- 12. Carbohydrates by Pigman and Wolfrom.
- 13. The Nucleic Acids (Vol I-III) by Chargoff and Davidson.
- 14. Protein Structures and Functions by A. Light.
- 15. Chemistry of Natural Products Vol. I by K. Nakanishi.
- 16. Peptides and Amino Acids by R.H. Thomson.
- 17. The chemistry of Natural Products by P.S. Kalsi.

#### <u>SEMESTER-III</u> (COURSE –XIII C) (Physical Chemistry Special Theory - I)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible, every question will be divided into *Two* – *Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

# UNIT –I

Adsorption at solid – gas interface: Concept of ideal and non – ideal adsorption. Heat of adsorption. Types of adsorption isotherms. Single – layer adsorption – Langmuir adsorption isotherm and its derivation. Multilayer adsorption – B.E.T. theory and its kinetic derivation. Application of BET theory in its determination of surface area of the solid. Catalytic activities at surfaces: adsorption and catalysis.

## UNIT –II

Adsorption at solid – liquid interface: Gibbs adsorption equation. Isotherms of concentration and temperature change for the adsorption in solutions. Chromatographic adsorption: column chromatography and its theory. Theory of chromatography involving one solute and several solutes.

#### <u>UNIT –III</u>

Solution and Interfacial Behaviour of Surfactants: Definition and classification of surfactants. Solution properties of surfactants: micelle formation, critical micelle concentration (CMC), dependence of CMC on chain length of the surfactant, micelle shape and size. Thermodynamics of micelle formation, hydrophobic effect (a qualitative view only). Aggregation at high surfactant concentration (a qualitative aspect). to micelles. Surface tension and detergent., Practical application of surfactants.

## UNIT –IV

**Electrochemistry:** Quantitative treatment of Debye - Hückel and Debye-Hückel-Onsagar (D-H-O) theory of conductance of electrolyte solution their limitations and modifications. Pair-wise association of ions (Bjerrum and Fuoss treatment). Determination of association constant (KA) from Debye – Huckel Limiting Law. Extended Debye – Huckel Law. Qualitative treatment of ion – solvent interactions (ion solvation).

#### UNIT -- V

Chemistry of nano – materials: Definition and historical perspective. Effect of nanoscience and nanotechnology in various fields. Synthesis of nanoparticles by chemical routs and their caracterization techniques. Properties of nanostructured material: optical, magnetic and chemical properties. An overview of applied chemistry of nanometerials.

- 1. Physical Chemistry of Surfaces: A.W. Admson
- 2. Adsorption from Solutions: J.J. Kipling
- 3. Micelles (Theoretical and Applied Aspects): Y. Moroi
- 4. Foundation of Colloid Science Vol. I and II: R.J. Hunter
- 5. Physical Chemistry: P.W. Atkins
- 6. Frontiers in Applied Chemistry: A.K. Biswas

#### <u>SEMESTER III</u> (COURSE – XIV A) (INORGANIC CHEMISTRY PRACTICAL)

Time - 6 hr/week Max. Marks - 50

#### 50 Preparation of following compounds:

- 1. Tetrapyridine copper(II)persulphate
- 2. Dinitritotetrapyridine nickel(II)
- 3. Mercury (tetraisothiocyanato)cobaltate(II).
- 4. Potassium tris(oxalato)aluminate(III)
- 5. Sodium hexa(nitro)cobaltate(III)
- 6. Potassium tris(oxalato)cobaltate(III)
- 7. Hexa(ammine)cobalt (III)chloride

## Characterization of above compounds by the following techniques:

i) Elemental analysis
ii) Molar conductance values
iii) I.R. Spectral interpretation
iv) Thermal analysis
v) UV-Visible Spectra

- 1. A Text Book of Qualitative Inorganic Analysis A.I. Vogel
- 2. Synthetic Coordination Chemistry: Principles and Practice- J.A. Davies, C.M. Hockensmith, V.Y.Kukushkin and Y.N. Kukushkin.

#### SEMESTER III (COURSE – XIV B) (ORGANIC CHEMISTRY PRACTICAL)

Time - 6 hr/week Max. Marks - 50

A. Quantitative Analysis: Determination of the percentage/ number of hydroxyl groups in an organic compound by acetylation method. Estimation of amines/ phenols using bromate - bromide solution/ acetylation method. Determination of iodine and sponification values of an oil sample. Determination of DO, COD and BOD of water sample. B. Multistep Synthesis: Cannizzaro reaction: 4-chlorobenzaldehyde as substrate. Benzilic Acid Rearrangement: Benzaldehyde  $\rightarrow$  Benzoin  $\rightarrow$ Benzil  $\rightarrow$  Benzilic acid. Hofmann bromamide Rearrangement: Phthalic anhydride-> Phthalimide-> Anthranilic acid Beckmann Rearrangement: Benzene $\rightarrow$  Benzophenone $\rightarrow$  Benzophenone oxime  $\rightarrow$ Benzanilide. Skraup Synthesis: Preparation of quinoline from aniline. Synthesis using Phase Transfer Catalysis: Alkylation of diethyl malonate or ethyl acetoacetate and an alkyl halide.

Synthesis of p- nitro aniline

#### **Books Recommended:**

1. Experiments and Techniques in Organic Chemistry, D.Pasto, C. Johnson and M.Miller, Prentice Hall.

2. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Heath.

3. Systematic Qualitative Organic Analysis, H.Middleton, Adward Arnold.

4. Handbook of Organic Analysis-Qualitative and Quantitative, H.Clark, Adward Arnold.

5. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.

#### SEMESTER III (COURSE – XIV C) (Physical Chemistry Practical)

Time - 6 hr/week Max. Marks - 50

- 1. Solubility Measurements: Heat of solution of electrolytes by solubility measurements.
- 2. Heat of transfer Measurements: Heat of transfer for benzoic acid and I<sub>2</sub> between two immiscible solvents.
- 3. <u>Conductometric Measurements:</u> Precipitation, and acid base titration. Determination of relative strength of acids in the given mixtures of acids. Solubility of sparingly soluble salt.
- 4. <u>Construction of Phase Diagram</u>: Phase diagram for liquids, (benzene and methanol) and phase diagram for solids, (benzoic acid and cinnamic acid, benzoic acid and naphthalene and acetamide and salicylic acid).
- 5. <u>Colorimetric Measurements</u>: Verification of Beer Lambert's law for aqueous solutions of KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and CuSO<sub>4</sub> and construction of calibration plot to estimate the unknown concentration.
- 6. <u>Kinetic Measurement:</u> Acid hydrolysis of ethylacetate and Saponification of ethylacetate.

- 1. Senior Practical Physical Chemistry: B.D. Khosla, V.C. Garg and A. Khosla
- 2. Experimental Physical Chemistry: V. Athawale and P. Mathur.
- 3. Practical Physical Chemistry: B. Vishwanathan and P.S. Raghavan.
- 4. Practical in Physical Chemistry: P.S. Sindhu

#### SEMESTER-IV

#### (COURSE –XV A) (INORGANIC CHEMISTRY SPECIAL THEORY - II) (ADVANCED ORGANOMETALLICS)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit.

# <u>UNIT-I</u>

**Organometallic Compounds of transition elements:** Types of ligands and their classifications in organometallic compounds, 16 and 18 electron rule and its limitations. Hapto-nomenclature, synthesis, structure and bonding aspects of following organometallic compounds with carbon-  $\pi$  donor ligands: (a) Two electron donor (olefin and acetylenic complexes of transition metals): (b) Three electron donor ( $\pi$ -allyl complexes of transition metals): (c) Four electron donor (butadiene and cyclobutadiene complexes of transition metals): (d) Five electron donor cyclopentadienyl complexes of transition metals – metallocenes with special emphasis to ferrocenes): (e) Six electron donor [Benzene (arene) complex]. Fluxional Organometallic compounds (classification)

#### <u>UNIT-II</u>

**Homogeneous Transition metal catalysis:** General considerations, Reason for selecting transition metals in catalysis (bonding ability, ligand effects, variability of oxidation state and coordination number), basic concept of catalysis (molecular activation by coordination and addition), proximity interaction (insertion/inter-ligand igration and elimination, rearrangement). Phase transfer catalysis. Homogeneous hydrogenation of unsaturated compounds (alkenes, alkynes, aldehydes and ketones). Asymmetric hydrogenation (Olefins).

#### UNIT-III

**Some important homogeneous catalytic reactions:-** Ziegler Natta polymerization of ethylene and propylene, oligomerisation of alkenes by aluminumalkyl, Wackers acetaldehyde synthesis, hydroformylation of unsaturated compounds using cobalt and rhodium complexes, Monsanto acetic acid synthesis, carbonylation of alkenes and alkynes using nickel carbonyl and palladium complexes.

#### UNIT-IV

**Metal-metal bonding in carbonyl and halide clusters:-** Polyhedral model of metal clusters, effect of electronic configuration and coordination number, Structures of metal carbonyl clusters of three atoms  $M_3(CO)_{12}$  (M=Fe, Ru & Os), Four metal atoms (tetrahedra) [ $M_4(CO)_{12}$  {M= Co, Rh &Ir}] and octahedron of type  $M_6(CO)_{16}$  [M= Co & Rh], and halide derivatives of Rhenium (III) triangles, metal carbonyls involving bridged-terminal exchange and scrambling of CO group.

#### UNIT-V

**Transition Metal-Carbon multiple bonded compounds:-**Metal carbenes and carbines (preparation, reactions, structure and bonding considerations). Biological and industrial applications, and environmental aspects of organometallic compounds.

- 1. Principles of organometallic compounds Powell
- 2. Organometallic chemistry (an Introduction) Perkin and Pollar
- 3. Advanced Inorganic Chemistry Cotton and Wilkinson
- 4. Organometallic Chemistry-R.C.Mehrotra
- 5. Organometallic compounds of Transition Metal-Crabtree
- 6. Chemistry of the Elements Greenwood and Earnshaw
- 7. Homogeneous transition metal catalysis Christopher Masters
- 8. Homogeneous Catalysis Parshall
- 9. Principles and Application of HomogeneousCatalysis Nakamura and Tsutsui
- 10. Progress in Inorganic Chemistry Vol. 15 Lipard. (Transition metal clusters R.B.King)
- 11. Organotransition metal chemistry by S.G.Davis, Pergamon press 1982.
- 12. Principles and applications of organotransition metal chemistry by Ccollmen and Hegden

#### SEMESTER-IV (COURSE -XVI A) (INORGANIC CHEMISTRY SPECIAL THEORY - III) (MODERN TECHNIQUES OF CHEMICAL ANALYSIS)

Lectures: 60 Max. Marks: 80

Note: Ten questions will be set by the examiner selecting TWO from each unit. As far as possible, every question will be subdivided into Two – Three Parts. The students shall attempt FIVE questions selecting **ONE** from each unit.

#### UNIT-I

Spectrophotometry: i) Introduction, fundamental laws of photometry, the electromagnetic spectrum and spectrochemical methods, UV/Visible instrumentation, absorption spectra, Beer-Lambert's Law, deviation from Beer-Lambert's Beer's Law. ii) Photometric Titrations:-Simultaneous spectrophotometric determination, differential spectrophotometry, titration curves and applications to quantitative analysis. iii) Molecular Fluorescence Spectroscopy:- Theory, relaxation processes, relationship between excitation spectra and florescence spectra, florescencent species, effect of concentration on florescence intensity, instrumentation and

application of florescence methods.

#### UNIT-II

Atomic Spectroscopy: Theory of flame photometer, intensities of spectral lines, selection of optimal working conditions, applications of flame photometry to quantitative analysis. The Theory of Atomic Absorption Spectroscopy (AAS), Origin of atomic spectra, line width effects in atomic absorption, instrumentation and its application, Atomic emission spectroscopy (AES) and the detailed description of the techniques of inductively coupled plasma AES (ICP-AES) and its instrumentation. Chemical and spectral interferences encountered in both techniques and how to overcome them.

#### **UNIT-III**

Chromatographic methods:

Introduction, terminology and basic principleclassification of chromatographic methods. Chromatographic behavior of solutes. Column efficiency and resolution. Instrumentation, columns, solvent systems and detection methods and applications and comparison of Gas chromatography (GC) and High-Performance Liquid Chromatography (HPLC).

#### **UNIT-IV**

Polarographic Methods: General introduction: Theoretical measurements of classical polarography, polarographic measurements, polarograms, interpretation of polarographic waves, equation for polarographic waves, half-wave potential, effect of complex formation on polarographic waves, dropping mercury electrode (advantages and limitations), current variation with a dropping electrode, polarographic diffusion current, the ilkovic equation, effect of capillary characterization on diffusion current, diffusion coefficient temperature, kinetic and catalytic current, polarograms for mixtures of reactants, anodic waves and mixed anodic and cathodic waves, current maxima and its suppression, residual current, supporting electrolytes, oxygen waves, instrumentation and applications to inorganic and organic analysis.

#### **UNIT-V**

Thermoanalytical methods: (a) Thermogravimatric analysis: Introduction, Factors affecting thermogravimetric curves, Instrumentation, Applications to inorganic compounds (analysis of Ca and Mg in binary mixture, calcium oxalate, determination of Ca, Sr & Ba in the mixture, drying of sodium carbonate) and analysis of clays and soils, and determination of titanium content of non-stoichiometric sample of titanium carbide).

(b) Differential thermal analysis: Introduction, Factors affecting DTA curves, Instrumentation, Applications to inorganic compounds : Mixtures of lanthanum-cerium and praseodymium oxalate, CuSO4.5H2O, detection of organic contamination in ammonium nitrate, different magnesium carbonate samples and determination of uncalcined gypsum in plaster of paris. **Books Recommended:** 

- 1. Instrumental methods of analysis.-H.H.Willard, LL.Marritt and J.A.Dean
- 2. Fundamentals of Analytical Chemistry Skoog, West, Holler and Crouch.
- 3. Instrumental Methods of Chemcial Analysis-G.K.Ewring
- 4. Modern Polarographic Methods in Analytical Chemistry -A.M.Bond
- 5. Thermal Methods of Analysis-W.W. Wendlandt.

#### SEMESTER-IV (COURSE –XVII A) (INORGANIC CHEMISTRY SPECIAL THEORY - IV) (INORGANIC SPECTROSCOPY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible, every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit. **UNIT-I** 

*Infrared Spectroscopy:* Theory of IR absorption, Types of vibrations, Observed number of modes of vibrations, Intensity of absorption bands, Theoretical group frequencies, Factors affecting group frequencies and band shapes (Physical state, Vibrational Coupling, Electrical effects, Resonance, Inductive effects, Ring strain) Vibrational-rotational fine-structure. Experimental method.

Applications of IR to the following:

i) Distinction between

a) Ionic and coordinate anions such as NO<sup>3-</sup>, SO<sub>4</sub><sup>2-</sup> and SCN<sup>-</sup>

b) Lattice and coordinated water.

ii) Modes of bonding of ligands such as urea and dimethylsulphoxide.

# <u>UNIT-II</u>

**Nuclear Magnetic Resonance Spectroscopy:** Introduction, Chemical shift, Mechanism of electron shielding and factors contributing to the magnitude of chemical shift, Nuclear overhausser effect, Double resonance, Chemical exchange, Lanthanide shift reagents and NMR spectra of paramagnetic complexes. Experimental techniques (CW and FT). *Stereochemical non-rigidity and fluxionality:* Introduction, use of NMR in its detection in PF<sub>5</sub>, Ti(acac)<sub>2</sub>Cl<sub>2</sub>, Ti(acac)<sub>2</sub>Br<sub>2</sub>,

# $Ta_2(OMe)_{10}$ .

# <u>UNIT-III</u>

**Nuclear Quadrupole Resonance Spectroscopy:** Basic concepts of NQR (Nuclear electric quadrupole moment, Electric field gradient, Energy levels and NQR frequencies), Effect of magnetic field on spectra, Factors affecting the resonance signal (Line shape, position of resonance signal) Relationship between electric field gradient and molecular structure. Structural information of the following: PCI5, TeCl4, Na<sup>+</sup>GaCl4<sup>-</sup>, BrCN, and Hexahalometallates

# UNIT-IV

**Mössbauer Spectroscopy:** Introduction, Principle, Conditions for Mössbauer Spectroscopy, Parameters from Mössbauer Spectra- Isomer shift, Electric Quadrupole Interactions, Magnetic Interactions, MB instrumentation, Applications of MB spectroscopy in structural determination of the following:

- i) High spin Fe (II) and Fe (III) halides- FeF2, FeCl2.2H2O, FeF3, FeCl3.6H2O.
- ii) Low spin Fe(II) and Fe(III) Complexes- Ferrocyanides, Ferricyanides, Prussian Blue.
- iii) Iron carbonyls. Fe(CO)5, Fe2(CO)9 and Fe3 (CO)12
- iv) Inorganic Sn(II) and Sn(IV) halides.

# UNIT-V

**Electron Spin Resonance Spectroscopy:-**. Introduction, Similarities between ESR and NMR, Behaviour of a free electron in an external Magnetic Field, Basic Principle of an Electron Spin Resonance Spectrometer, Presentation of the spectrum, Hyperfine coupling in Isotropic Systems (methyl, benzene and Naphthalene radicals). Factors affecting the magnitude of g-values. Zero field splitting and Kramer's Degeneracy, Line width in solid state ESR, Double resonance technique in e.s.r. (ENDOR) Experimental method. Applications of ESR to the following:

- 1. Bis-Salicylaldiimine Copper(II)
- 2. CuSiF<sub>6</sub>.6H<sub>2</sub>O & (NH<sub>3</sub>)<sub>5</sub>Co-O.Co(NH<sub>3</sub>)<sub>5</sub>

- 1. Physical methods in Inorganic Chemistry R.S.Drago.
- 2. Modern Optical methods of Analysis Eugens D.Olsen
- 3. Infrared spectra of Inorganic and coordination compounds Kazuo Nakamoto
- 4. Introduction to Chemistry Donald L.Pavia and G.M.Lampman.
- 5. Fundamentals of Molecular Spectroscopy-C.N.Banwel
- 6. Spectroscopy in Inorganic Chemistry Rao & Ferraro Vol I & II
- 7. Advances in Inorganic and Radiation Chemistry Vol 6 & 8.
- 8. Quarterly reviews Vol 11 (1957)
- 9. Progress in Inorganic Chemistry Vol 8
- 10. Organic Spectroscopy-W. Kemp

#### SEMESTER-IV (COURSE –XVIII A) (INORGANIC CHEMISTRY SPECIAL THEORY - V) (BIO-INORGANIC CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible, every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit.

#### UNIT-I

(a) Metalloporphyrins: Porphyrins and their salient features, characteristic absorption spectrum of porphyrins, chlorophyll (structure and its role in photosynthesis). Transport of Iron in microorganisms (siderophores), types of siderophores (catecholate and Hydroxamato siderophores).

(b) Metalloenzymes: Definitions: Apoenzyme, Coenzyme, Metalloenzyme, structure and functions of Carboxy peptidases and Carbonic anhydrase.

## UNIT-II

**Oxygen Carriers:** a) *Natural oxygen carriers:* Structure of hemoglobin and myoglobin, Bohr effect, Models for cooperative interaction in hemoglobin, oxygen Transport in human body (-perutzmachanism), Cyanide poisoning and its remedy. Non-heme protiens (Hemerythrin & Hemocyanin).

**b)** *Synthetic oxygen carriers:* Oxygen molecule and its reduction products, model compounds for oxygen carrier (Vaska's Iridium cjomplex, cobalt complexes with dimethyl glyoxime and Schiff base ligands).

## UNIT-III

**Transport and storage of metals:** The transport mechanism, transport of alkali and alkaline earth metals, ionophores, transport by neutral macrocycles and anionic carriers, sodium/potassium pump, transport and storage of Iron (Transferrin & Ferritin).

## UNIT-IV

**Inorganic compounds as therapeutic Agents :-** Introduction chelation therapy, synthetic metal chelates as antimicrobial agents, antiarthritis drugs, antitumor, anticancer drugs (Platinum complexes), Lithium and mental health. **UNIT-V** 

Nitrogen fixation : A. Nitrogen molecule (MO picture) and its transition metal complexes, reactivity of coordinated dinitrogen, *in-vivo* and *in-vitro* nitrogen fixation, symbiotic and asymbiotic nitrogen fixation.

B. Nitrogen metabolism : Introduction, elementary idea about nitrogen nutrition in various forms (nitrate and ammonia nitrogen).

#### **Books Recommended:**

1. The Inorganic Chemistry of Biological processes - M.N.Hughes.

2. Bio Inorganic Chemistry - Robert Hay

3. Advanced Inorganic Chemistry (4th Edn) - Cotton and Wilkinson.

- 4. Topics in current chemistry (Inorganic Biochemistry) vol. 64 (1976) Davison and Coworkers.
- 5. General Biochemistry Fruton J.S. and Simmonds S.
- 6. Plant Physiology Robert N.Devlin.

7. Inorganic chemistry – James E. Huheey.

#### SEMESTER-IV (COURSE – XV B) (ORGANIC CHEMISTRY SPECIAL THEORY - II) (SYNTHETIC STRATEGY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

#### <u>Unit- I</u>

**Organic Reagents:** Reagents in organic synthesis: Willkinson catalyst, Lithium dialkyl cuprates (Gilman's reagents), Lithium diisopropylamide (LDA), 1,3-Dithiane (Umpolung) Dicyclohexylcarbobiimide (DCC), and Trimethylsilyliodide, DDQ, SeO<sub>2</sub>, Baker yeast, Tri-n-butyltinhydride, Nickel tetracarbonyl, Trimethylchlorosilane. Grubbs Catalysts.

#### <u>Unit-II</u>

**Oxidations:** Introduction, Different oxidative process. Aromatiztion of six membered ring, dehydrogenation yielding C-C double bond, Oxidation of alcohols, Oxidation involving C-C double bond, Oxidative cleavage of ketones, aldehydes and alcohols, double bonds and aromatic rings, Ozonolysis, Oxidative decarboxylation, Bisdecarboxylation, Oxidation of methylene to carbonyl, Oxidation of olefines to aldehydes and ketones

#### <u>Unit- III</u>

**Reductions:** Introduction, Different reductive processes. Reduction of carbonyl to methylene in aldehydes and ketones, Reduction of nitro compounds and oximes, Reductive coupling, Bimolecular reduction of aldehydes or ketones to alkenes, metal hydride reduction, Acyloin ester condensation, Cannizzaro reaction, Tishchenko reaction, Willgerodt reaction.

#### <u>Unit- IV</u>

**Rearrangements:** General mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Backmann, Hofmann, Curtius, Schmidt, Benzidine, Baeyer-Villiger, Shapiro reaction, Witting rearrangement and Stevens rearrangement.

#### <u>Unit- V</u>

**Disconnection Approach:** An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity cyclisation reactions, amine synthesis. Protecting Groups: Principle of protection of alcohol, amine, carbonyl and carboxyl groups. One Group C-C Disconnection: Alcohols and carbonyl compounds, regioselectivity. Alkene synthesis, use of acetylenes in organic synthesis.

#### **Books Recommended:**

1. Designing Organic Synthesis, S. Warren, Wiley.

2. Organic Synthesis- Concept, Methods and Starting Materials, J. Fuhrhop and G. Penzillin, Verlage VCH.

- 3. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.
- 4. Modern Synthetic Reactions, H.O. House, W. A. Benjamin.
- 5. Advanced Organic Chemistry-Reactions Mechanisms and Structure, J. March, Wiley.
- 6. Principles of Organic Synthesis, R. Norman and J.M. Coxon, Blakie Academic and Professional.
- 7. Advanced Organic Chemistry Part-B, F.A. Carey and R. J. Sundburg, Plenum Press.
- 8. Organomettalic Chemistry-A Unified Approach, R.C. Mehrotra, A. Singh.

#### <u>SEMESTER-IV</u> (COURSE – XVI B) (ORGANIC CHEMISTRY SPECIAL THEORY - III) (NATURAL PRODUCTS)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit.

#### <u>Unit- I</u>

**Terpenoids:** Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, biosynthesis and synthesis of the following representative molecules: Monoterpenoids: Citral, geraniol (acyclic),  $\alpha$ -terpeneol, menthol (monocyclic). Sesquiterpenoids: Farnesol (acyclic), zingiberene (monocyclic), santonin (bicyclic), Diterpenoids: Phytol and abietic acid.

#### <u>Unit- II</u>

**Carotenoids and Xanthophylls:** General methods of structure determination of Carotenes:  $\beta$ -carotene,  $\alpha$ - carotene,  $\gamma$ - carotene, lycopene and vitamin A. Xanthophylls: Spirilloxanthin, Capsorubin, Fucoxanthin. Carotenoid acids (Apocarotenoids): Bixin and Crocetin. Bio synthesis of carotenoids

#### <u>Unit- III</u>

Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, synthesis and biosynthesis of the following: Ephedrine, Coniine, Nicotine, Atropine, Quinine and Morphine.

#### <u>Unit- IV</u>

**Steroids:** Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Androsterone, Testosterone, Estrone, Progestrone. Biosynthesis of steroids

#### <u>Unit- V</u>

**Plant Pigments:** Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Anthocyanins (Cyanin and pelargonidin), polyphenols: Flavones (chrysin), Flavonols (quercitin) and isoflavones (daidzein) coumarin, Quinones (lapachol), Hirsutidin. Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.

#### **Books Recommended:**

1. Natural Products- Chemistry and Biological Significance, J. Mann, R.S. Davidson, J. B. Hobbs, D.V. Banthrope and J. B. Harborne, Longman, Essex.

- 2. Organic Chemistry Vol. II, I.L. Finar, ELBS.
- 3. Stereo selective synthesis- A Practical Approach, M. Nogradi, VCH.
- 4. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.
- 5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants From the Americas, Ed. Kurt Hostettmann,
- M.P. Gupta and A. Marston, Harwood Academic Publishers.
- 6. Introduction to Flavonoids, B.A.Bohm, Harwood Academic Publishers.
- 7. New Trends in Natural Product Chemistry, Atta-ur-Rahman M. I. Choudhary, Harwood Academic Publishers.
- 8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.

#### <u>SEMESTER-IV</u> (COURSE – XVII (B)) (ORGANIC CHEMISTRY SPECIAL THEORY - IV) (MEDICINAL CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit. **Unit-I** 

**Drug Design:** Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationships (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, bio-isosterism, spatial considerations. Theories of drug activity: occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship. Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-Chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Free-Wilson analysis, Hansch analysis relationships between Free-Wilson and Hansch analysis. Naming of drugs-Trade names and Generic names

#### <u>Unit- II</u>

**Pharmacokinetics and Pharmacodynamics:** Pharmacokinetics: Introduction to drug absorption, distribution, metabolism, elimination using pharmacokinetics. Importance of pharmacokinetic parameters in defining drug distribution and in therapeutics. Importance of pharmacokinetics in drug development process.

**Pharmacodynamics**: Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism, xenobiotics, biotransformation, Significance of drug metabolism in medicinal chemistry.

# <u>Unit- III</u>

Antibiotics and Antiinfective Drugs: Antibiotics: Historic development in the structural modifications of Penicillin antibiotics. Structure, SAR and biological action of antibiotics. Examples: penicillin: penicillin-G, penicillin-V, ampicillin, amoxycillin, chloramphenicol, cephalosporin, tetracycline and streptomycin. Sufonanmides: Structure, SAR and mode of action of sulfonamides, sulfonamide inhibition and probable mechanisms of bacterial resistance to sulfonamides. Examples: sulfodiazine sulfofurazole, Acetyl Sulfafurazole, Sulfaguanidine, Phthalylsulfo acetamide, Mafenide, Sulphonamide related compounds Dapsone.: Introduction and general mode of action of Local antiinfective drugs, Examples: sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, chloroquin and primaquin

#### Unit- IV

**Psychoactive Drugs:** Introduction, neurotransmitters-receptor interaction, CNS depressants and stimulants. SAR and Mode of action, Central Nervous System Depressant: **General anaesthetics, Sedatives & Hypnotics:** Barbiturates and Benzodiazepines. **Anticonvulsants:** Barbiturates, Oxazolidinediones, Succinimides, Phenacemide and Benzodiazepines. **Psycotropic Drugs:** The neuroleptics (Phenothiazines and butyrophenones), **antidepressants** (Monoamine oxidases inhibitors and Tricyclic antidepressants) and anti-anxiety agents (Benzodiazepines). Central Nervous System Stimulants: Strychnine, Purines, Phenylethylamine, analeptics, Indole ethylamine derivatives,

#### Unit- V

**Therapeutic Agents, SAR and Their mode of Action: Antineoplastic Agents:** Cancer chemotherapy, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antiobiotics and mitotic inhibitors. Biological action of mechlorethamine, cyclophosphamide, melphalan, uracil, and 6-mercaptopurine.

**Cardiovascular Drugs:** Antihypertensive and hypotensive drugs, antiarrrhythemic agents, vasopressor drug, Direct acting arteriolar dilators. Biological action of methyldopa, propranolol hydrochloride amyl nitrate, sorbitrate, verapamil, Atenolol. **Antihistaminic agents:** Ethylene diamine derivatives, amino alkyl ether analogues, cyclic basic chain analogues. **Antifertility agents:** General antifertility agents. HIV and anti AIDS drugs, **Diuretics:** Mercurial diuretic, Non mercurial diuretics (Thiazides, carbonic-anhydrase inhibitors, xanthine derivatives, pyrimidine diuretics and osmotic diureteics **Books Recommended:** 

1. An Introduction to Medicinal Chemistry, Graham L. Patrick.

- 2. Medicinal Chemistry: Principles and Practice Edited by F.D. King.
- 3. Textbook of Organic Medicinal and Pharmaceutical Chemistry, Edited by Charles O. Wilson, et al.
- 4. Introduction to Medicinal Chemistry, Alex Gringuage.
- 5. Principles of Medicinal Chemistry, William O. Foye, Thomas L. Lemice and David A. Williams.
- 6. Introduction to Drug Design, S.S. Pandeya and J. R. Dimmock, New Age International.
- 7. Burger's Medicinal Chemistry and Drug Discovery, Vol-1 Ed. M.E. Wolff, John Wiley.
- 8. Goodman and Gilman's Pharmacological Basis of Therapeutics, Mc Graw-Hill.
- 9. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
- 10. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley.

#### <u>SEMESTER-IV</u> (COURSE – XVIII (B)) (ORGANIC CHEMISTRY SPECIAL THEORY - V) (POLYMER CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting **TWO** from each unit. As far as possible every question will be divided into **Two – Three Parts**. The students shall attempt **FIVE** questions selecting **ONE** from each unit. **UNIT -I** 

**Chemistry of Polymerization:** Macromolecular Concept, Chain polymerization – Radical, Cationic and Anionic polymerization, Step Growth polymerization, Electrochemical-initiated polymerization, Metathetical polymerization, Group transfer polymerization, Co-ordination polymerization, Kinetics of chain and step growth polymerization. Concept of chain transfer, Concept of copolymerization, Graft and Block copolymers, Copolymer equation, Monomer reactivity ratio, Alfrey-price scheme.

#### UNIT- II

**Polymer synthesis:** Bulk, solution, suspension, polycondensation, interfacial condensation and emulsion techniques of polymer synthesis

**Polymer Characterization:** Average molecular weight concept. Number, weight and viscosity, average molecular weights, Polydispersity and molecular weight distribution, The practical significance of molecular weight. Measurement of molecular weights - End group, viscosity, light scattering, osmotic and ultra centrifugation methods. Analysis and testing of polymers - Chemical analysis, Spectroscopic methods, Thermal Analysis, XRD and SEM.

## Unit III

**Stereoisomerism in polymers:** Types of stereoisomerism in polymers, Monosubstituted ethylenes (Site of steric isomerism, Tacticity), Disubstituted ethylenes (1,1-disubstituted ethylenes, 1,2- disubstituted ethylenes), Stereoregular polymers: Significance of stereo-regularity (isotactic, syndiotactic, and atactic polypropenes), Cis- and trans-1,4-poly-1,3-dienes, Cellulose and amylose.

**Morphology and order in crystalline polymers**: Configuration of polymer chains. Crystal structures of polymers, Straininduced morphology, Crystallization and melting, Polymer structures and physical properties - crystalline melting point, Tm, Effect of chain flexibility and other steric factors, entropy and heat of fusion, Glass transition temperature, Tg, Relationship between Tm and Tg, Effect of molecular weight, diluents, chemical structure, chain topology, branching and crosslinking on polymer properties.

## UNIT- IV

**Polymer Reactions:** General introduction to the polymer reactions, Vulcanization, Chemical and radiation crosslinking, Graft co-polymerization, Methods of Graft Copolymerization. Polymer as carriers or supports, polymeric reagents, polymeric substrates, Merrifield resins, polymeric supports as catalysts and drug carrier.

# UNIT-V

**Commercial and Specialty Polymers:** Applications of polyethylene, polyvinyl chloride, polyamides, polyesters, polyurethanes, phenolic and epoxy resins and Silicone polymers. Applications of starch, gelatin, pectin and chitosan in polymer industry. Biodegradable polymers (lactic and glycolic acid based). Biomedical applications of polymers,

- 1. Molecular Mechanics, U. Burkert and N.L. Allinger, ACS Monograph 177, 1982.
- 2. Organic Chemist's Book of Orbitals. L. Salem and W.L. Jorgensen, Academic press.
- 3. Mechanism and Theory in Organic Chemistry, T.H.Lowry and K.C. Richardson, Harper and Row.
- 4. Introduction to Theoretical Organic Chemistry and Molecular Modeling, W.B. Smith, VCH,
- 5. Physical Organic Chemistry, N.S. Isaacs, ELBS/Longman.
- 6. Supramolecular Chemistry; Concepts and Perspectives, J.M. Lehn, VCH.
- 7. The Physical Basis of Organic Chemistry, H.Maskill, Oxford Univ. Press.
- 8. Textbook of Polymer Science, F.W. Billmeyer Jr. Wiley.
- 9. Polymer Science, V.R. Gowarikar, N.V. Visvanathan and J. Sreedhar, Wiley Eastern.
- 10. Functional Monomers & Polymers, K. Takemoto, Y. Inaki and R.M. Ottanbrite.
- 11. Contemporary Polymer Chemistry, H.R. Alcock and F.W. Lambe, Prentice Hall.
- 12. Physics & Chemistry of Polymers, J.M.G. Cowie, Blakie Academic and Professional.

#### SEMESTER-IV Course-XV C (Physical Chemistry Special Theory-II) (Quantum Chemistry)

Lectures:60 Max. Marks:80

**<u>NOTE</u>**: Ten questions will be set by the examiner selecting TWO from each unit. As far as possible, each question will be sub-divided into two – Three parts. The student shall attempt FIVE questions in total, selecting ONE question from each unit.

#### (UNIT-I)

Time-independent perturbation theory for non-degenerate states. First order correction to the energy and wave-function. Application to particle in one-dimensional box, ground state helium atom (without spin consideration) and harmonic oscillator. First order perturbation for degenerate states. Effect of perturbation on ground and excited state hydrogen atom (Stark effect).

#### (UNIT-II)

Variation theory for ground and excited state energy and wave function. Linear and non-linear variation functions. Application of variation method to ground state helium atom, hydrogen atom, one dimensional harmonic oscillator and particle in one dimensional box. Basic concept of Hellmann-Feynman theorm.

#### (UNIT-III)

Many -Electron Atoms: Concept of spin and Pauli exclusion principle. Slater determinants. Hartree Self Consistent –Field Method and Hartree –Fock Self Consistent –Field Method. Electron correlation and configuration interaction. Condon-Slater rules. Concept of Koopman's theorm.

#### (UNIT-IV)

Quantum Mechanical Treatments of Molecular Systems: The Born-Oppenheimer Approximation. The linear combination of atomic orbital (LCAO)-approximation. Molecular orbital and Valence –Bond treatments with respect to  $H_2$  and  $H_2^+$ . Basic concept of Density Functional Theory

#### (UNIT-V)

Huckel Molecular Orbital Theory of conjugated  $\pi$  - electron Systems (conjugated linear and cyclic hydrocarbon systems). Application to ethylene, allyl systems (radical, cation and anion), Butadiene, cyclobutadiene and benzene and their physical representations.

- 1. Quantum Chemistry: An Introduction By H.L. Strauss
- 2. Quantum Chemistry By D.A. McQuarri
- 3. Quantum Chemistry By I.N. Levine
- 4. Molecular Quantum Chemistry By P.W. Atkin
- 5. Fundamental of Quantum Chemistry By T.E. Peacock
- 6. Elementary Quantum Chemistry By F.L. Pilar

#### SEMESTER-IV (COURSE –XVI C) (PHYSICAL CHEMISTRY SPECIAL THEORY - III) (SOLID STATE CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible, every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

# <u>UNIT - I</u>

X-ray Diffraction & Crystal Structure: X-rays Diffraction by crystals. The Laue equations and Bragg's law. Definitions related to crystal structure. Crystallographic direction and crystallographic phases. X-ray diffraction experiments: The powder method and the single crystal method. Reciprocal lattice. Structure factor and its relation to intensity and Electron density.

## <u>UNIT - II</u>

Bonding in crystals: Ionic crystals, lattice energy of ionic crystals, metallic crystals. Band theory. Imperfections: Point defects (Schottky and Frankel defects). Thermodynamic derivation of these defects. Theories of Bonding: Free electro theory (a qualitative treatment) Zone theory; allowed energy zones, Brillioun zones, k – space, Fermi surfaces and density states.

#### <u>UNIT - III</u>

Properties of crystals: Electrical properties of metals; conductors and non – conductors, conductivity in pure metals. Hall effect. Thermal properties: Theories of specific heat. Electrical properties of semiconductors: Band theory, intrinsic and extrinsic semiconductors. Electrons and holes. Temperature dependence and mobility of charge carriers. Optical properties: Dielectric properties: Piezoelectricity, Ferro electricity, Ionic conductivity and electric breakdown.

#### <u>UNIT – IV</u>

Superconductivity: occurrence of superconductivity, destruction of superconductivity by magnetic fields (Meissner effect). Thermodynamic effects of superconducting species (entropy, thermal conductivity and energy gap). Theoretical survey (thermodynamics of superconducting transition, London equation, coherence length). BCS theory of superconductivity.

#### <u>UNIT - V</u>

Solid State Reactions: General principles: experimental procedures, kinetics of solid state reactions, vapour phase transport methods, interaction or ion exchange reaction, electrochemical reduction methods, preparation of thin films, growth of single crystal.

- 1. Introduction to Solids: Azaroff
- 2. Solid State Chemistry and its applications: West
- 3. Solid State Chemistry: Charkrabarty
- 4. Solid State Chemistry: N.B. Hannay
- 5. Solid State Physics: Kiittal

#### <u>SEMESTER-IV</u> (COURSE –XVII C) (PHYSICAL CHEMISTRY SPECIAL THEORY - IV) (BIOPHYSICAL CHEMISTRY)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible, every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

# <u>UNIT – I</u>

Cell membrane and its structure: The Cell Membrane, lipids in biological membranes, phospholipids, sphingolipids, glycolipids, cholesterol, gangliosides, lipoproteins,types and arrangements of proteins in membranes. Danielli and Davson model, Fluid Mosaic Model, permeability of cell membrane. Bio-Energetics: Thermodynamic Considerations: standard free energy change in bio-chemical reactions, exergonic, endergonic reactions, High energy molecules, hydrolysis of ATP and its synthesis from ADP.

#### <u>UNIT – II</u>

Statistical mechanics in biopolymers chain configuration of macromolecules, statistical distribution end – to - end dimensions, Polypeptide and protein structures and protein folding. calculation of average dimensions for various chain structures. Neurobiophysics: neurons, synapse, physics of membrane potential, neurotransmitters: Serotonin, GABA.

## <u>UNIT – III</u>

Mechanism of Membrane Transport: Transport through cell membrane, active and passive transport (chemi-osmotic theory) systems, Irreversible thermodynamic treatment of membrane transport, Donnan effect in Osmosis, its dependence on pH difference across the membrane, Bio-mechanics: striated muscles, contractile proteins, mechanical properties of muscles and role of calcium.

## <u>UNIT – IV</u>

Biomolecular Interactions: Interactions between biomolecules (proteins), Interaction of biomolecules with small ligands, independent ligand binding sites, the Scatchard plot, forces involved in the stability of proteins, hydrophobic interactions, hydrogen bonding, electrostatic interactions, electron delocalization, van der Waal's forces weak interactions crucial to macromolecular structure and function, blood –the buffering system.

#### UNIT -- V

Protein molecules: Protein sequence and structure (primary structure), secondary structure: Ramachandran plot, ( $\alpha$ -helix,  $\beta$ -strand,  $\beta$ -sheet, turns and loops), torsion angles, tertiary structure (ion-ion, ion-dipole and dipole-dipole interactions), quaternary structure, globular and fibrous proteins, structure of heamoglobin and myoglobin and their physiological roles, Protein folding and refolding, Protein misfolding, Chaperones and chemical factors (Intra and intermolecular interactions) leading to folding/refolding/misfolding. Brain diseases associated with it, structure of virus.

- 1. Physical Chemistry of Macromolecules: S.F.Sun
- 2. The Enzyme Molecules: W. Ferdinand
- 3. Outlines of Biochemistry: E.E. Conn and P.K. Stumph
- 4. Biochemistry: Zubay
- 5. Principles of Biochemistry: A.I. Leninger
- 6. Physical Biochemistry: D. Friefelder
- 7. Biophysics: Volkenstein
- 8. Biophysical Chemistry (Vol. I-III): Schimell and Cantour
- 9. Biophysics : Vasantha Pattabhi, N.Gautam
- 10. Biophysical Chemistry: Gurtu & Gurtu

#### SEMESTER-IV (COURSE –XVIII C) (PHYSICAL CHEMISTRY SPECIAL THEORY - V) (CHEMISTRY OF MACROMOLECULES)

Lectures: 60 Max. Marks: 80

*Note:* Ten questions will be set by the examiner selecting *TWO* from each unit. As far as possible, every question will be divided into *Two – Three Parts*. The students shall attempt *FIVE* questions selecting *ONE* from each unit.

# <u>UNIT – I</u>

Introduction to Macromolecules, (classification and importance). Synthetic and natural polymer. Polymerization (condensation and addition reactions). Molecular forces and chemical bonding in macromolecules and their effects on the physical properties. Polymer solutions, criteria for polymer solubility, conformations of dissolved polymer chains. The Amorphous, Semicrystalline and Crystalline States of Polymers.

## <u>UNIT – II</u>

Thermodynamics of polymer solutions, ideal solutions, regular solutions, lattice model of solutions (Flory – Huggins Theory), Flory – Krigbaum theory for dilute polymer solutions. Fractionation of polymers by different techniques, theory of swelling of cross – linked / network polymers. Structure determination techniques: X-ray crystallography, NMR, Microscopy: TEM, SEM, STEM, AFM (qualitative treatment only)

#### <u>UNIT – III</u>

Chain conformation of macromolecules: statistical thermodynamics of interpenetrating random coiling polymers in solution with application to phase separations, swelling of networks, depression of melting point. The isolated chain molecule in dilute solutions analyzed for mass or size by static methods (osmometry, light scattering, neutron scattering) and by dynamic methods (intrinsic viscosity, size exclusion chromatography, sedimentation).

## <u>UNIT – VI</u>

Rheology and Mechanical Properties of Polymers: Brief introduction to rheology and mechanical properties of polymers, phenomena of viscous flow, kinetic theory of rubber elasticity, amorphous polymers and practical importance of their aggregation states, viscoelasticity (experimental and dynamic method), The glassy state and glass transition temperature. Applications of polymers in Structural Polymers and Composites, Packaging Materials and Coatings, Transparent and Optical Materials, Biological and Medical Materials, Fluid Modifiers and Suspension Stabilizers

#### <u>UNIT – V</u>

- 1. Mechanical strength of polymers: Mechanical strength and life time of polymer mechanism of polymer fracture, effect of various factors on the mechanical properties of polymers (effect of size and shape, effect of fillers, effect of cross linked density).
- 2. Polyelectrolytes: The water soluble charged polymers and their applications. Ionomers (ion containg polymers) conducting polymers solid polymer electrolytes, mechanism of conductivity. Polymers in combating environmental pollution and as chemical reagents.

- 1. Text Book of Physical Chemistry: G.M. Barrow
- 2. Text Book of Polymer Chemistry: Billmeyer
- 3. Polymer Chemistry: P.J. Flory
- 4. Physical Chemistry of Polymers: A Tagger
- 5. Physical Chemistry of Macromolecules: C. Tanford
- 6. Introduction to Polymer Science: V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar
- 7. Principles of Polymer Science: P. Bhadur and N.V. Sastry

#### <u>SEMESTER - IV</u> COURSE – XIX (A) (INORGANIC CHEMISTRY PRACTICAL - SPECIAL)

Time: 12 hrs/week Max. Marks: 75

Preparation of the following compounds and a study of the important properties *viz*. Molar conductance, magnetic sussceptibility, electronic and infrared spectra.

#### 1. Stannic iodide

- 2. Bis(acetylacetonato) oxovanadium (IV)
- 3. Mercuration of phenol.
- 4. Hexa ammine nickel (II) chloride.
- 5. Lead tetraacetate
- 6. Cis- and trans-  $[Co(en)_2Cl_2]Cl$

# INSTRUMENTAL ANALYSIS:

# A) Conductometric Titrations:

- i) Differential behaviour of acetic acid to determine the relative acid strength of various acids.
- ii) Strong acid-strong base titration in acetic acid.
- iii) Potassium acetate- pyridine titration in acetic acid.

# **B)** Potentiometric Titrations.

- 1. Neutralisation reactions:
- i) Sodium hydroxide-hydrolchloric acid.
- ii) Sodium hydroxide-Boric acid

iii) Acetic acid and hydrochloric acid-sodium hydroxide.

- 2. Oxidation-Reduction Reactions.
- i) Ferrous-dichromate
- ii) Ferrous-Ceric
- iii) Iodine-Thiosulphate
- 3. Precipitation Reactions:
- i) Silver nitrate-sodium halides.
- ii) Chloride-Iodide mixture.

# C) Colorimetric Analysis:

- 1) Verification of Beer's law for KMnO4, K2Cr2O7 solutions and determination of the conc. of KMnO4, K2Cr2O7.
- 2) Colorimetric determination of Iron (II) with o-Phenanthroline method.
- 3) Determination of traces of manganese (in steel samples) colorometrically by oxidation to permanganic acid with potassium periodate.
- 4) Spectrophotometric determination of pK value of an indicator (acid dissociation

constt. of methyl red)

- 5) Simultaneous determination of chromium (as  $Cr_2O_7^{2-}$ ) and manganese (as  $MnO_4^{-}$ ) in mixture.
- 6) Simultaneous determination of Fe(II) and Fe(III).
- 7) Photometric titration (simple illustrations)
- 8) Determination of stability constant of a complex by spectrophotometric method.
- (D) pH metric -titrations
- 1) Acid base titrations.
- 2) Mixtures of acids with a base.

# E) Polarography/Pulse polarography:

- 1) Determination of half wave potentials of cadmium, zinc and manganous ions in potassium
- chloride solution.
- 2) Investigation of the influence of dissolved oxygen.
- 3) Differential pulse polarographic determination of copper and zinc.
- 4) Determination of formation constant of a complex metal ion by polarography/pulse polarography.

# (F) Cyclic voltammetry:

1. Determination of  $E^{\circ}$  and n values of  $[Fe(CN)_6]^{3-1}$   $[Fe(CN)_6]^{4-1}$  couple.

2. Study of electrode mechanism of cyclic voltammetry.

# (G) Flame Photometry: Determination of sodium, potassium and calcium

- 1. A Text Book of Quantitative Inorganic Analysis- A.I. Vogel
- 2. Chemistry Experiments for Instrumental Methods: D.T. Sawyer, W.R. Heinemanand J.M. Beebe.
- 3. Inorganic Synthesis- R.A. Rowe and M.M. Jones (1957)5, 113 116.

#### <u>SEMESTER - IV</u> COURSE – XIX (B) (ORGANIC CHEMISTRY PRACTICAL - SPECIAL)

Time: 12 hrs/week Max. Marks: 75

Extraction of Organic Compounds from Natural Sources: Isolation of Caffeine from tea leaves, casein from milk (the students are required to try some typical color reactions of proteins), lactose from milk (purity of sugar should be checked by TLC and PC and  $R_f$  value reported). Isolation of diosgenin from Fenugreek seeds (Methi seeds), lycopene from tomatoes and  $\beta$ - carotene from carrots.

(B) Paper Chromatography: Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of  $R_f$  values.

#### (C) Spectroscopy:

Identification of some organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR and MS) Multistep Synthesis Synthesis of Vacor Synthesis of Indigo Preparation of polyacrylamide from acrylamide Preparation of polyacrylic acid from acrylic acid

- 1. Experiments and Techniques in Organic Chemistry, D.Pasto, C. Johnson and M.Miller, Prentice Hall.
- 2. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C.Heath.
- 3. Systematic Qualitative Organic Analysis, H.Middleton, Adward Arnold.
- 4. Handbook of Organic Analysis-Qualitative and Quantitative, H.Clark, Adward Arnold.
- 5. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
- 6. Laboratory Experiments in Organic Chemistry, R. Adams, J. R. Johnson and C. F. Wilcox. The Macmillan Limited, London.

#### <u>SEMESTER - IV</u> COURSE – XIX (C) (Physical Chemistry Practical - SPECIAL)

Time: 12 hrs/week Max. Marks: 75

- 1. <u>Viscosity Measurements</u>: Verification of the Jones Dole equation for simple electrolytes in water and in aqueous mixtures of organic solvents.
- 2. <u>Conductometric Measurements:</u> Determination of Walden's product in case of simple electrolytes.
- 3. <u>Potentiometric Titration</u>: Titration of HCl with NaOH, determination of dissociation constant of acetic acid and phosphoric acid. Oxidation reduction titration.
- 4. <u>Flamephotometric Measurements</u>: Estimation of concentration of Ca<sup>+2</sup>, Na<sup>+</sup> and K<sup>+</sup> ions and in the given aqueous solution at ppm level.
- 5. <u>Determination of Molar Mass:</u> (i) Cryoscopic and Rasts's methods.
- 6. Determination of molar mass of polymer by viscosity measurement.
- 7. <u>Colometery Measurements</u>: Determination of composition and free energy of formation of ferric ions salicylicacid complex using Job's continuous method.
- 8. <u>Polarimetry Measurements:</u> Determination of specific and molecular rotation, percentage of tow optically active substances, kinetics of acid catalysed inversion of cane sugar and comparison of strengths of two acids.

- 1. Senior Practical Physical Chemistry: B.D. Khosla, V.C. Garg and A. Khosla
- 2. Experimental Physical Chemistry: V. Athawale and P. Mathur.
- 3. Practical Physical Chemistry: B. Vishwanathan and P.S. Raghavan.
- 4. Practical in Physical Chemistry: P.S. Sindhu
- 5. Senior Practical Physical Chemistry: B.D. Khosla, V.C. Garg and A. Khosla

#### **SEMESTER - IV**

#### (COURSE – XX ) (SEMINARS FOR ALL THREE SPECIALIZATIONS)

Time: ½ hr Max. Marks: 25

Every candidate will have to deliver a seminar of 20-30 minutes duration on a topic (not from the syllabus) which will be chosen by him / her in consultation with the teacher of the department. The seminar will be delivered before the students and teachers of the department. A three member committee (one coordinator and two teachers of the department of different specializations) duly approved by the departmental council will be constituted to evaluate the seminar. The following factors will be taken into consideration while evaluating the candidate.

(i) Expression

(ii) Presentation

(iii) Depth of the subject matter and answers to the questions.

# **ANNEXURE-I**



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# HIMACHAL PRADESH UNIVERSITY DETAILS OF SYLLABI M.A./M.Sc. (Mathematics) w.e.f. July 2006

Semester – I		Semester - III	
M101	Real Analysis-I	M301	Complex Analysis-I
M102	Advanced Algebra-I	M302	Topology
M103	Ordinary Differential Equations	M303	Analytic Number Theory
M104	Operations Research-I	M304	Operations Research-II
M105	Fluid Dynamics	M305	Mathematical Statistics
Semester – II		Semester – IV	
M201	Real Analysis-II	M401	Complex Analysis-II
M202	Advanced Algebra-II	M402	Functional Analysis
M203	Partial Differential Equations	M403	Advanced Discrete Mathematics
M204	Classical Mechanics	M404	Differential Geometry
M205	Solid Mechanics	M405	Magneto Fluid Dynamics

# **Duration: Two Years (Four Semesters)**

# Note:

- 1. M.A/M.Sc. (Mathematics) is a Two Years Post-Graduate degree course divided into Four Semesters. Maximum Marks for each paper will be of 60 marks.
- 2. Each paper will be divided into three sections. Nine questions will be set in all. Each section will contain three questions. The candidates will be required to attempt five questions in all selecting at least one question (but not more than two questions) from each section.

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Mathematics) First Semester Course

MIUI Keal Analysis-I

# Section –I

# The Riemann-Stieltjes Integral

Definition and existence of Riemann-Stieltjes integral, Properties of the Integral, Integration and differentiation. The Fundamental theorem of calculus. Integration of vector ó valued functions. Rectifiable curves.

# Section – II

# **Sequences and Series of Functions**

Pointwise and uniform convergence, Cauchy Criterion for uniform convergence. Weierstrass M-Test. Abeløs and Dirichletøs tests for uniform convergence. Uniform convergence and continuity. Uniform convergence and Riemann ó Stieltjes integration. Uniform convergence and differentiation. Weierstrass approximation Theorem. Power series, Uniqueness theorem for power series. Abeløs and Taylorøs Theorems.

# Section – III

# **Functions of Several Variables**

Linear Transformations. Differentiation. Partial derivatives. Continuity of partial derivatives. The contraction Principle. The Inverse Function Theorem. The Implicit Function Theorem, Derivatives in an open subset of  $R^n$ , Chain rule, Derivatives of higher orders, The Rank Theorem. Determinants, Jacobians.

# **Text Book**

1. Walter Rudin, Principles of Mathematical Analysis (3<sup>rd</sup> Edition), McGrawHill, Kogakusha, 1976, International Student Edition, (Chapter 6: §§ 6.1 to 6.27, Chapter 7: §§ 7.1 to 7.18, 7.26 ó 7.32, Chapter 8: §§ 8.1 to 8.5, Chapter 9: §§ 9.1 to 9.41).

# **Reference Books**

- 1. T.M. Apostol, Mathematical Analysis, Narosa publishing House, New Delhi, 1985.
- 2. I.P. Natanson, Theory of Functions of a Real Variable, Vol. I, Frederick Ungar Publishing Co., 1961.
- 3. S. Lang, Analysis-I, Addison ó Wesley Publishing Company, Inc. 1969.


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Mathematics) First Semester Course

M102 Advanced Algebra-I

# Section –I

The Sylow Theorems, Applications of Sylow Theory, Direct products, The classification of finite abelian groups, the Jordan-Hölder Theorem, Composition factors and chief factors, Soluble groups & Examples of soluble groups.

# Section – II

Definition and Examples of Rings, Some Special Classes of Rings, Homomorphisms, Ideals and Quotient Rings, More Ideals and Quotient Rings and The Field of Quotients of an Integral Domain.

Euclidean Rings, a Particular Eudclidean Ring, Polynomial Rings, Polynomials over the Rational Field, Polynomial Rings over Commutative Rings.

# Section – III

Unitary Operators, Normal Operators, Forms on Inner Product Spaces, Positive Forms, More on Forms, Spectral Theory.

### Text Books

- John F. Humphreys, A Course in Group Theoryø Oxford University, Press, 1996 (§§ 11-18).
- 2. I.N. Herstein, -Topics in Algebraø, Second Edition), John Wiley & Sons, New York (§§ 3.1 to 3.11).
- 3. Kenneth Hoffman & Ray Kunze, -Linear Algebraø Second Edition, Prentice-Hall of India Private Limited, New Delhi (§§ 8.4, 8.5, 9.1 to 9.5).



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Mathematics) First Semester Course

# **M103 Ordinary Differential Equations**

# Section –I

## **Existence and Uniqueness Theory**

Some Concepts from Real Function Theory. The Fundamental Existence and Uniqueness Theorem. Dependence of Solutions on Initial Conditions and on the Funcition f. Existence and Uniqueness Theorems for Systems and Higher-Order equations.

# The Theory of Linear Differential Equations

Introduction. Basic Theory of the Homogeneous Linear System. Further Theory of the Homogeneous Linear System. The Nonhomogeneous Linear System. Basic Theory of the nth-Order Homogeneous Linear Differential Equation. The nth-Order Nonhomogeneous Linear equation.

### Section – II

### Sturm-Liouville Boundary-Value Problems

Sturm-Liouville Problems. Orthogonality of Characteristic Functions. The Expansion of a Function in a Series of Orthonormal Functions.

### Strumian Theory

The separation theorem, Sturmøs fundamental theorem Modification due to Picone, Conditions for Oscillatory or non-oscillatory solution, First and Second comparison theorems. Sturmøs Oscillation theorems. Application to Sturm Liouville System.

### Section – III

### Nonlinear Differential Equations

Phase Plane, Paths, and Critical Points. Critical Points and paths of Linear Systems. Critical Points and Paths of Nonlinear Systems. Limit Cycles and Periodic Solutions. The Method of Kryloff and Bogoliuboff.

### **Text Books**

- S.L. Ross, Differential Equations, Third Edition, John Wiley & Sons, Inc., (Chapter 10: §§ 10.1 to 10.4; Chapter 11: §§ 11.1 to 11.8; Chapter 12: §§ 12.1 to 12.3; Chapter 13: §§ 13.1 to 13.5).
- 2. E.L. Ince, Ordinary Differential Equations, Dover Publication Inc. 1956 (Chapter X: §§ 10.1 to 10.6.1)

### Reference

- 1. W. Boyce and R. Diprima, Elementry Differential Equations and Boundary value Problems, 3<sup>rd</sup> Ed. New York, (1977).
- 2. E.A. Coddington, An Introduction to Ordinary Differential Equations, 2<sup>nd</sup> Ed. Prentice Hall of India Pvt. Ltd., Delhi, (1974).



Mathematics) First Semester Course

# M104 Operations Research-I

# Section –I

Hyperplane and hyperspheres, Convex sets and their properties, convex functions. Linear Programming Problem (LPP): Formulation and examples, Feasible, Basic feasible and optimal solutions, Extreme points. Graphical Methods to solve L.P.P., Simplex Method, Charnes Big M Method, Two phase Method, Degeneracy, Unrestricted variables, unbounded solutions, Duality theory, Dual LPP, fundamental properties of Dual problems, Complementary slackness, Dual simplex algorithin, Sensivity analysis.

# Section – II

Integer programming: Gomoryøs Method, Branch and Bound Method.

**Transportation Problem (TP)**: Mathematical formulation, Basic feasible solutions of T.Ps by North ó West corner method, Least cost-Method, Vogeløs approximation method. Unbalanced TP, optimality test of Basic Feasible Solution (BFS) by U-V method, Stepping Stone method, degeneracy in TP.

Assignment Problem (AP): Mathematical formulation, assignment methods, Hungarian method, Unbalanced AP.

# Section – III

Goal programming Problem (GPP): formulation of G.P. Graphical Goal attainment method, simplex method for GPP.

**Game theory**: Two-person, zero-sum games, The maximin ó minimax principle, pure strategies, mixed strategies, Graphical solution of 2xn and mx2 games, Dominance property, General solution of m x n rectangular games, Linear programming problem of GP.

## **Network Techniques**

Shortest path model, Dijkastra algorithm, Floydøs algorithm, Minimal Spanning tree, Maximal flow problem.

# **Text Books**

- 1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co. 14<sup>th</sup> Edition 2004 (Scope as in relevant sections of Chapters 3 to 13 and 19).
- 2. Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons 12<sup>th</sup> Edition, 2004 (Scope as in relevant sections of Chapters 0, 02 to 08 & 10, 11 & 17).
- 3. R. Panneerselvam, Operations Research, Prentice Hall of India Pvt. Ltd., 2004 (Chapters 5: §§ 5.1 to 5.4).

# **Reference Books**

- 1. G. Hadley, Linear Programming, Narosa Publishing House (2002).
- 2. H.A. Taha, Operations Research: An Introduction, Prentice Hall of India Pvt. Ltd., 7<sup>th</sup> Edition, 2004.
- 3. J.K. Sharma, Operations Research, Macmillan India Pvt. Ltd. 2003.



Mathematics) First Semester Course

# M105 Fluid Dynamics

## Section –I

Continuum hypothesis, Newtonøs Law of Viscosity, Some Cartesian Tensor Notations, General Analysis of Fluid Motion, Thermal Conductivity, Generalised Heat conduction.

## Fundamental Equations of Motion of Viscous Fluid

Equation of State, Equation of Continuity, Navier ó Stokes (NS) Equations (equation of Motion, Equation of Energy, Streamlines & Pathlines, Vorticity and Circulation (Kelvinøs Circulation Theorem).

# Section – II

Dynamical Similarity (Reynoldøs Law), Inspection Analysis- Dimensional Analysis, Buckingham ó - Theorem, and its Applications óproducts and coefficients, Non-dimensional parameters and their physical importance.

### **Exact Solutions of the N S Equations**

Steady Motion between parallel plates (a) Velocity distribution, (b) Temperature Distribution, Plane Couette flow, plane Poiseuille flow, generalized plane Couette flow.

Flow in a circular pipe (Hagen-Poiseuille flow (a) velocity distribution (b) Temperature distribution.

### Section – III

Flow between two concentric Rotating Cylinders (Couette flow): (a) Velocity distribution (b) Temperature distribution.

Flow due to a plane wall suddenly set in motion, flow due to an oscillating plane wall. Plane Couette flow with transpiration cooling.

Steady Flow past a fixed sphere: Stokes equation and Oseenøs equation of flow.

Theory of Lubrication. Prandtlø boundary layer equations, the boundary layer on a flat plate (Blassius equation), Characteristic boundary layer parameters.

### **Text Books**

- 1. J.L. Bansal, Viscous Fluid Dynamics, Oxford and IBH Publishing Co. Pvt. Ltd., (1977), (Scope as in relevant sections of Chapters 1 to 6).
- 2. F. Chorlton, Textbook of Fluid Dynamics, CBS Publishers & Distributors (2000) (Scope as in relevant sections of Chapters 1, 2, 3, 6 & 8).

### **Reference Books**

- 1. G.K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press (1970).
- 2. C.S. Yih, Fluid Mechanics, McGraw-Hill Book, Company.



athematics) Second Semester Course

# M201 Real Analysis-II

### Section –I

#### Lebesgue Measure

Introduction. Outer measure. Measurable sets and Lebesgue measure. A nonmeasurable set. Measurable functions. Littlewoodø three principles.

### Section – II

#### The Lebesgue Integral

The Riemann integral. The Lebesgue integral of a bounded function over a set of finite measure. The integral of a nonnegative function. The general Lebesgue integral. Convergence in measure.

#### Section – III

#### **Differentiation and Integration**

Differentiation of monotone functions. Functions of bounded variation. Differentiation of an integral. Absolute continuity. Convex functions.

### The Classical Banach Spaces

The  $L^{p}$  spaces. The Minkowski and Hölder inequalities. Convergence and completeness. Approximation in  $L^{p}$ . Bounded linear functionals on the  $L^{p}$  spaces.

## **Text Book**

1. H.L. Royden, Real Analysis, Third Edition, Prentice-Hall of India, Private Limited, New Delhi ó 110 001 (1995), (Chapter 3 to 6).



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## M202 Advanced Algebra-II

### Section -I

# Modules

Definition and examples, Submodules and direct sums, homomorphisms and quotient modules, Completely reducible modules, Free modules.

# Section – II

# **Field Theory**

Irreducible polynomials and Eisenstein criterion, Adjunction of roots, Algebraic extensions, Algebraically closed fields, Splitting fields, Normal extensions, Multiple roots, Finite fields, Separable extensions.

# Section – III

# Galois Theory and its Applications

Automorphism groups and fixed fields, Fundamental theorem of Galois theory, Fundamental theorem of algebra, Roots of unity and cyclotomic polynomials, Cyclic extensions, Polynomials solvable by radicals, Symmetric functions, Ruler and compass constructions.

### **Text Book**

1. P.B. Bhattacharya, S.K. Jain & S.R. Nagpaul, *Basic Abstract Algebraø*, Second Edition, Cambridge University Press (Chapter 14 (§§ 1 to 5), Chapter 15 to Chapter 18).

# M.A./M.Sc. (Mathematics) Second Semester Course



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Section – I

# **Fundamental Concepts**

Classification of Second Order Partial Differential Equations. Canonical Forms: Canonical Form for Hyperbolic Equation, Canonical Form for Parabolic Equation, Canonical form for elliptic equation. Adjoint Operators.

# **Elliptic Differential Equations**

Occurrence of the Laplace and Poisson Equations: Derivation of Laplace Equation, Derivation of Poisson Equation. Boundary Value Problems (BVPs). Some Important Mathematical Tools. Properties of Harmonic Functions. Separation of Variables.

# Section – II

# **Parabolic Differential Equations**

Occurrence of the Diffusion Equation. Boundary Conditions. Elementary Solutions of the Diffusion Equation. Dirac Delta Function. Separation of Variables Method. Solution of Diffusion Equation in Cylindrical Coordinates. Solution of Diffusion Equation in Spherical Coordinates. Maximum-Minimum Principle and its Consequences.

# Section – III

### Hyperbolic Differential Equations

Occurrence of the Wave Equation. Derivation of One-dimensional Wave Equation. Solution of One-dimensional Wave Equation by Canonical Reduction. The Initial Value Problem; DøAlemberts Solution. Vibrating String ó Variables Separable Solution. Forced Vibrations ó Solution of Nonhomogeneous Equation. Boundary and Initial Value Problem for Two-dimensional Wave Equation ó Method of Eigenfunction. Periodic Solution of Onedimensional Wave Equation in Cylindrical Coordinates. Periodic Solution of One-dimensional Wave Equation in Spherical Polar Coordinates.

### **Text Book**

1. K. Sankara Rao, Introduction to Partial Differential Equations, Prentice Hall of India Private Limited, New Delhi, 1997 (Scope as in relevant sections of Chapters 1 to 4).

# M.A./M.Sc. (Mathematics) Second Semester Course



#### Section-I

Generalized Coordinates. Constraints. Work and potential energy. Generalized forces. The Principle of virtual work. Introduction to Lagrangeøs equations. Lagrangeøs Equations for a particle in a plane. The Classification of Dynamical Systems. Lagrangeøs equations for any simple Dynamical system. Lagrangeøs equations for Non-holonomic systems with moving constraints. Lagrangeøs equations for impulsive motion.

# Section-II

Hamiltonøs Principle. Stationary Values of a function. Constrained stationary values. Stationary Value of a definite integral. The Brachistochrone problem. Hamiltonøs equations. Derivation of Hamiltonøs equations. Ignorable coordinates. The Routhian function. Section-III

The form of Hamiltonian function. Modified Hamiltonøs principle. Principle of least action. The Hamiton-Jacobi equation. Lagrange and Poission Brackets. Calculus of Variation. Invariance of Lagrange and Poission Brackets under canonical transformation.

# **Text Books**

- 1. Principle of Mechanics, John L. Synge and Byron A. Griffith, McGraw Hill, International Edition (§§ 10.6, 10.7, 15.1 & 15.2), Third Edition.
- Classical Dynamics, Donald. T. Green ó Wood, Prentice ó Hall of India, 1979, (§§ 4.2, 4.3, 5.2 & 6.3).
- Classical Mechanics, K. Sankara Rao, Prentice-Hall of India, 2005 (§§ 6.7, 6.8, 7.5 & 7.6).

# M.A./M.Sc. (Mathematics) Second Semester Course



#### Section-I

Analysis of Strain ó Affine transformation, Infinitesimal Affine deformations, Geometrical interpretation of the components of Strain. Strain Quadric of Cauchy, Principal Strains. Invariants. General Infinitesimal Deformation. Equation of compatibility. Finite deformation.

Analysis of Stress ó Stress Tensor. Equations of Equilibrium. Transformation of coordinates. Stress Quadric of Cauchy. Principal stress and Invariants. Maximum normal and shear stresses, Mohrøs circle Diagram.

### Section – II

Equations of Elasticity ó Generalized Hookeøs law. Stress ó Strain relations for a medium having one plane elastic symmetry, three orthogonal planes symmetry and for homogeneous isotropic media. Elastic-moduli for isotropic media. Equilibrium and Dynamic equations for an isotropic solids. Strain energy function and its connection with Hookeøs law. Unique solution of Boundary value problem. Derivation of Navierøs equations and Beltrami-Michal compatibility equations.

### Section – III

Statement of problem. Extension of beams by longitudinal forces. Beam stretched by its own weight. Bending of beams by terminal couples. Torsion of a circular shaft. Plane stress. Plane strain.

### Text Book

1. I.S. Sokolnikoff, Mathematical Theory of Elasticity, Tata McGraw-Hill Publishing Company Ltd, 1977, (Chapter I, II, III, IV: §§29 ó 33 and Chapter V: §§ 65-67).

### **Reference Books**

- 1. S. Timoshenko and N.Goodier, Theory of Elasticity, McGraw-Hill, New York 1970.
- 2. A.E. Love, A Treatise on the Mathematical Theory of Elasticity, Cambridge University Press, London, 1963.
- 3. Y.C. Fung, Foundations of Solid Mechanics, Prentice-Hall, New Delhi, 1965.
- 4. I.H. Shames, Introduction to Solid Mechanics, Prentice-Hall, New Delhi, 1975.
- 5. S.Valliappan, Continuum Mechanics, Oxford and IBH Publishing Company, New Delhi, 1981.

# M.A./M.Sc. (Mathematics) Third Semester Course

# M301 Complex Analysis-I



#### Section – I

Analytic functions. Polynomials and rational functions. The exponential and the trignometric functions. The periodicity. The logarithm. Sets and elements. Arcs and closed curves, Analytic functions in region.

Conformal mapping, length and area. The linear group, the cross ratio, symmetry, oriented circles, family of circles. The use of level curves, a survey of elementary mappings, elementary Riemann surfaces.

# Section- II

Line integrals, rectifiable arcs, line integral as function of arcs, Cauchyøs theorem for a rectangle, Cauchyøs theorem in a disk. The index of a point with respect to a closed curve. The integral formula. Higher derivatives.

Sequences, Series, Uniform convergence, Power series and Abeløs limit theorem. Weierstrassøs theorem, the Taylorøs series and the Laurent series.

Removable singularities. Taylorøs theorem, zeros and poles. The local mapping and the maximum principle.

## Section – III

Chains and cycles, simple connectivity, Homology, the general statement of Cauchyøs theorem. Proof of Cauchyøs theorem. Locally exact differentials and multiply connected regions. The residue theorem, the argument principle and evaluation of definite integral.

### **Text Books**

 Lars V. Ahlfors, Complex Analysis, McGraw Hill Int. Ed. (1979).
Section-I: Chapter-1 §§ 1.1 - 1.5 and §§ 2.1 ó 2.4. Chapter-2 §§ 1.1 ó 1.4, 3.1 ó 3.4. Chapter-3 §§ 1.1, 2.1 ó 2.4, 3.1 ó 3.5 and 4.1 ó 4.3.
Section-II: Chapter-4 §§ 1.1 ó 1.5, 2.1 ó 2.3, 3.1 ó 3.4. Chapter ó 2 §§ 2.1 ó 2.5. Chapter ó 5 §§ 1.1 ó 1.3 and
Section-III: Chapter-4 §§ 4.1 ó 4.7, 5.1 ó 5.3.

### Reference

1. John B. Conway, Function of One Complex Variable, (Second Edition), Narosa Publishers.

# M.A./M.Sc. (Mathematics) Third Semester Course

# M302 Topology

### Section - I



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Fartial ofdered sets and fattices.

### **Metric Spaces**

Open sets, closed sets, convergence, completeness, Baireøs category theorem, continuity.

# **Topological Spaces**

The definition and some examples, elementary concepts, Open bases and open subbases, weak topologies, the function algebras C(X, R) and C(X, C).

# Section - II

### Compactness

Compact spaces, products of spaces, Tychonofføs theorem and locally compact spaces, compactness for metric spaces, Ascoliøs theorem.

### Separation

 $T_1$ -spaces and Hausdorff spaces, completely regular spaces and normal spaces, Urysohnøs lemma and Tietzeøs extension theorem, the Urysohn imbedding theorem, the Stone-Cech compactification.

# Section - III

# Connectedness

Connected spaces, the components of a space, totally disconnected spaces, locally connected spaces.

### Aproximation

The Weierstrass approximation theorem.

# **Text Book**

1. G.F. Simmons, Introduction to Topology and Modern Analysis, International Student Edition, McGraw Hill Book Company, Inc. 1963, Chapter1: §§ 8; Chapter 2: §§ 9-15; Chapter3: §§ 16-20; Chapter 4: §§ 21-25; Chapter 5: §§ 26-30); Chapter 6: §§ 31-34 and Chapter 7: 35.

# M.A./M.Sc. (Mathematics) Third Semester Course

# M303 Analytic Number Theory

### Section – I

# **Divisibility Theory in the Integers**



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## Primes and their Distribution

The Fundamental Theorem of Arithmetic. The Sieve of Eratosthenes and The Goldbach Conjecture.

# The Theory of Congruences

Basic Properties of Congruence, Special Divisibility Tests and Linear Congruences. Section – II

# Fermat's Theorem

Fermatøs Factorization Method, The Little Theorem and Wilsonøs Theorem.

# **Number – Theoretic Functions**

The Functions and , The Möbius Inversion Formula, The Greatest Integer Function and An Application to the Calendar.

# **Euler's Generalization of Fermat's Theorem**

Eulerøs Phi-Function, Eulerøs Theorem and Some properties of the Phi-Function, An Application to Cryptography.

# Section – III

# **Primitive Roots and Indices**

The Order of an Integer Modulo *n*, Primitive Roots for Primes, Composite Numbers Having Primitive Roots and The Theory of Indices.

# The Quadratic Reciprocity Law

Eulerøs Criterion, The Legendre Symbol and Its Properties, Quadratic Reciprocity and Quadratic Congruences with Composite Moduli.

# Text Book

1. David M. Burton, õElementary Number Theoryö, (Fifth Edition) International Edition, McGraw Hill, (Chapter 2<sup>nd</sup> to 9<sup>th</sup>).

# M.A./M.Sc. (Mathematics) Third Semester Course

# **M304 Operations Research-II**

# Section – I

# **Queueing Theory**



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bing problem, Transient and steady states, Probability Poisson process (pure birth process), Properties of possions

arrivals, Exponential process, Markovian property, Pure death process, Service time distribution, Erlang service time distribution, Solution of Queueing Models.

# **Dynamic Programming**

Decision Tree and Bellmanøs principle of optimality, Concept of dynamic programming, minimum path problem, Mathematical formulation of Multistage Model, Backward & Forward Recursive approach, Application in linear programming.

# Section – II

**Non-Linear Programming Problems (NLPP)**: Formulation of a NLPP, General non-linear NLPP, Constrained optimization with equality constraint, Necessary and sufficient condition for a general NLPP (with one constraint), with m(<n) constraints, constrained optimization with inequality constraints (Kuhn ó Tucker conditions), Saddle point problem, saddle point and NLPP, Graphical solution of NLPP, Verification of Kuhn ó Tucker conditions, Kuhn ó Tucker conditions with Non-negative constraints.

# Section – III

### Quadratic programming

Quadratic programming; Wolfeøs Modified Simplex method, Bealeøs Method.

# Separable Programming

Separable Programming, Piecewise linear approximation, Separable programming algorithm.

### Simulation

Definition, Types of simulation, Event type simulation, Generation of random numbers, Monte ó Carlo Simulation.

# **Text Books**

- 1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co. 14<sup>th</sup> Edition 2004 (Scope as in relevant sections of Chapters 17,23, 27 to 30 and 33).
- 2. Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons 12<sup>th</sup> Edition, 2004 (Scope as in relevant sections of Chapters 13,20,23,24 and 25).

### **Reference Books**

- 1. J.K. Sharma, Operations Research, Macmillan India Pvt. Ltd. 2003.
- 2. M.S. Bazara, H.D. Sherali and C.M. Shetty, Non-Linear Programming, Theory and Algorethms, 2<sup>nd</sup> Ed., John Wiley & Sons, Inc.

# M.A./M.Sc. (Mathematics) Third Semester Course

# **M305** Mathematical Statistics

### Section – I

### **Distributions of Random Variables**



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### Section – II

#### Some Special Distributions

The Binomial, trinomial, and Multinomial Distributions, the Poisson Distribution, The Gamma and Chi-square Distributions, the normal distribution, and the bivariate normal distribution.

Sampling theory, Transformations of variables of the Discrete type, Transformations of the variables of the continuous type. The t and F distributions.

#### Section-III

Extensions of the change-of-variable Technique, Distributions of order statistics, the moment generating function Technique, The distribution of  $\overline{\chi}$  and  $nS^2/2$ , Expectations of Functions of Random variables, Limiting Distributions, Stochastic Convergence, Limiting Moment Generating Functions, The Central limit Theorem, some theorems on limiting Distributions.

### Test Book

1. Robert V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics, Forth Edition, Macmillan Publishing Co., Inc., New York, 1989, (Chapter 1 to 5).

#### Reference

1. Feller, W.: Introduction to Probability and its Applications, Wiley Eastem Pvt. Ltd. Vol. 1, (1972).

# M.A./M.Sc. (Mathematics) Fourth Semester Course

# M401 Complex Analysis-II

### Section –I

#### Harmonic functions



Click Here to upgrade to Unlimited Pages and Expanded Features erties of harmonic function, The mean value property, , Poissonøs formula, Schwarzøs theorem, The reflection

principle. A closer look at marmonic functions, Functions with the mean value property, Harnackøs principle. The Dirichletøs problem; Subharmonic functions, Solution of Dirichletøs problem.

#### Section – II

### Partial fractions and factorization

Partial fractions, infinite products, canonical products, the Gamma functions, Stirlings formula. Entire functions; Jensenss formula, Hadmardss theorem. The Riemann zeta functions; The product development. Extension of  $\zeta(s)$  to the whole plane. The functional equation. The zeros of the zeta function.

# Section – III

Simply periodic functions, Representation by exponentials, The Fourier development, Functions of finite order. Doubly periodic functions, The period module, unimodular transformations, The canonical basis, General properties of elliptical functions. Analytic continuations, The Weierstrass theory, germs and sheaves, Sections and Riemann surfaces, Analytic continuations along arcs, Homotopic curves, The Monodromy theorem, Branch points. Algebraic functions, The resultant of two polynomials, Definition and properties of algebraic functions, Behaviour at the critical points. Picardøs theorem.

### Text Books

Lars V. Ahlfors, Complex Analysis, Int. Ed. McGraw-Hill Book Co. (Third Edition), (1979).
Section I: Chapter 4: §§ 6.1 - 6.5; Chapter 5: §§ 2.2 to 2.4, 3.1, 3.2, 4.1 & 4.2. Section

**II:** Chapter: 6 §§ 3.1, 3.2, 4.1, 4.2, 5.1-5.3. **Section III:** Chapter- 7: §§ 1.1 ó 1.3, 2.1-2.4, & Chapter 8: §§ 1.1-1.7, 2.1-2.3,3.1.

### Reference

1. John B. Conway, Function of One Complex Variable, (Second Edition), Narosa Publishers.

# M.A./M.Sc. (Mathematics) Fourth Semester Course

# **M402** Functional Analysis

Section - I

### **Banach Spaces**



upgrade to gos and Expanded Features amples, continuous linear transformations. The Hahnping Theorem, the Closed Graph Theorem, the Uniform boundedness Theorem, the natural embedding of N in N\*\*, reflexivity.

#### Section - II

#### **Hilbert Spaces**

The definition and some simple properties, orthogonal complements, orthonormal sets, the conjugate space H\*, the adjoint of an operator, self-adjoint normal and unitary operators, projections.

#### Section - III

#### Spectral Theory of Linear Operators in Normed Spaces

Spectral Theory in Finite Dimensional Normed Spaces. Basic Concepts. Spectral Properties of Bounded Linear Operators. Further Properties of Resolvent and Spectrum. Use of Complex Analysis in Spectral Theory. Banach Algebras. Further Properties of Banach Algebras.

#### Text Books

- 1. G.F. Simmons, Introduction to Topology and Modern Analysis, International Student Edition, McGraw Hill Book Company, Inc. 1963, (Chapter 9: §§ 46-51 and Chapter10: §§ 52-59).
- 2. E. Kreyszig, Introductory Functional Analysis with Applications, John, Wiley and Sons, Wiley Classics Library Edition Published, 1989 (Chapter 7).

### M.A./M.Sc. (Mathematics) Fourth Semester Course

M403 Advanced Discrete Mathematics

#### Section -I

#### **Boolean Algebras**

Logic, Propositional Equivalences, Predicates and Quantifiers. Partial Ordered Sets, Lattices and Algebraic Systems, Principle of Duality, Basic Properties of Algebraic Systems defined by Lattices, Distributive and Complemented Lattices, Boolean Lattices and Boolean



> blean Algebras, Boolean Functions and Boolean Expressions, Vircuits.

#### тие гидеопноте г гистрие

Pigeonhole principle: Simple form, Pigeonhole principle: Strong form, A theorem of Ramsey.

## **Permutations and Combinations**

Two basic counting principles, Permutations of sets, Combinations of Sets, Permutations of multisets, Combinations of multisets.

### Section – II

#### **Generating Permutations and Combinations**

Generating permutations, Inversions in permutations, Generating combinations, Partial orders and equivalence relations.

# The Binomial Coefficients

Pascaløs formula, The binomial theorem, Identities, Unimodality of binomial coefficients, The multinomial theorem, Newtonøs binomial theorem.

#### The Inclusion-Exclusion Principle and Applications

The inclusion-exclusion principle, Combinations with repetition, Derangements, Permutations with forbidden positions.

# **Recurrence Relations and Generating Functions**

Some number sequences, Linear homogeneous recurrence relations, Non-homogeneous recurrence relations, Generating functions, Recurrences and generating functions, Exponential generating functions.

#### Section – III

#### **Introduction to Graph Theory**

Basic properties, Eulerian trails, Hamilton chains and cycles, Bipartite multigraphs, Trees, The Shannon switching game.

#### **Digraphs and Networks**

Digraphs and Networks.

#### More on Graph Theory

Chromatic number, Plane and planar graphs, A 5-color theorem, Independence number and clique number, Connectivity.

#### Text Books

- 1. C.L. Liu, 'Elements of Discrete Mathematics', Tata McGraw-Hill, Second Edition, (§§ 12.1 to 12.8 & 12.10)
- 2. Richard A. Brualdi, Introductory Combinatorics, third Edition, (Chapter 2 to 7 and Chapter 11 to 13).

#### Reference

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw-Hill, Fourth Edition.

### M.A./M.Sc. (Mathematics) Fourth Semester Course

# **M404 Differential Geometry**

### Section –I



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# Section – II

Surfaces, Tangent plane, Normal, Curvilinear co-ordinates First order magnitudes, Directions on a surface, The normal, second order magnitudes, Derivatives of n, Curvature of normal section. Meunierøs theorem, Principal directions and curvatures, first and second curvatures, Eulerøs theorem. Surface of revolution.

# Section – III

Gaussés formulae for  $\vec{r}_{11}$ ,  $\vec{r}_{12}$ ,  $\vec{r}_{22}$ , Gauss characteristic equation, Mainardi ó Codazzi relations, Derivalives of angle  $\omega$ , Geodesic property, Equations of geodesics, Surface of revolution, Torsion of Geodesic, Bonnetés theorem, vector curvature, Geodesic curvature,  $\kappa_g$ .

# Text Book

1. Differential Geometry of Three Dimension, C.E. Weatherburn, Khosla Publishing House, 2003 (§§ 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 34, 41, 42, 43, 46, 47, 48, 49, 50, 52, 53).

### Reference

1. Introduction to Differential Geometry, T.J. Willmore, Oxford University.

# M.A./M.Sc. (Mathematics) Fourth Semester Course

# M405 Magneto Fluid Dynamics

Section – I

**Fundamental Equations** 



d Fages and Expanded Features Reynoldys number. Anvenys rneorem and its consequences. Magnetic energy equation. Mechanical equations and effects.

### Magnetohydrostatics

Magnetohydrostatic, Force Free magnetic fluids (Basic equations, boundary conditions & magnetic energy, general solution when is constant).

#### Section – II

#### **Steady States**

Pressure balanced magnetohydrostatic configurations. Toroidal magnetic field. Steady laminar motion. General solution of a vector wave equation.

#### Magnetohydrodynamic Waves

Aflven waves, Magnetohydrodynamic waves in compressible fluid. Reflection and refraction of Alfven waves. Dissipative effects.

#### Section – III

#### Stability

Indroduction. Linear Pinch. Method of small Oscillations. Energy principle. Virial Theorem. Marginal stability ó Bénard problem with a magnetic field.

### Turbulence

Introduction, spectral analysis. Homogeneity and Isotropy. Kolmogorfføs principle. Hydromagnetic turbulence. Inhibition of trubulence by a magnetic field.

### **Text Book**

1. An Introduction to Magneto Fluid Dynamics by V.C.A. Ferraro & C. Plumpton. Clarendon Press, Oxford  $2^{nd}$  Edition, 1966, (Chapter 1: §§ 1.1 to 1.7, Chapter 2: §§ 2.1, 2.1 (1,2,3), 2.3, 2.4; Chapter 4: §§ 5.1 to 5.6, Chapter 6: §§ 6.1, 6.3 to 6.7).

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