B.Sc. Part-II Exam. 2011 **Prospectus No. 2011122**

संत गाडगेबाबा
अमरावती विद्यापीठ
SANT GADGE BABA
AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका

विज्ञान स्नातक भाग-२ परीक्षा, २०११

(त्रिवर्षीय अभ्यासक्रम)

PROSPECTUS
OF
B.Sc. Part-II Examination, 2011
(Three Year Degree Course)

2010

Visit us at www.sgbau.ac.in

(Price-Rs. 13/-)

PUBLISHED BY

D. K. Joshi
Registrar
Sant Gadge Baba
Amravati University
Amravati - 444602

SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances/Direction.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Inprovement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.
Ordinance No. 109	:	Recording of a change of name of a University student in the records of the University.
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.
Direction No. 20/2010	:	Reassessment of Answer Book on their Demand

D. K. Joshi
Registrar
Sant Gadge Baba
Amravati University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be boradly based on the following pattern.

(1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.

(2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.

(3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.

(4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.

(5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

SYLLABUS
Prescribed for
B.Sc. Part-II Examination
1. MATHEMATICS
(W.E.F. 2004-2005 SESSION)

PAPER-IV
ADVANCED CALCULUS

Unit-I : **Sequence :** Theorems on limits of sequences, Bounded and monotonic sequences. Chauchy's Convergence Criterion.
Series : Series of non-negative terms, convergence of Geometric series and the series $\sum 1/n^p$. Comparison test. Cauchy's Integral test, Ratio test, Root test. Alternating series. Leibnitz's theorem. Absolute and conditional convergence.

Unit-II : Limit and continuity of functions of two variables. Algebra of limits & continuity, continuity of composite function. Partial differentiation. Euler's theorem on homogeneous functions.

Unit-III : Envelopes, Evolutes, Maxima and Minima. Saddle points of functions of two variables. Lagrange's Multiplier method. Taylor's theorem for function of two variables. Jacobians.

Unit-IV : Beta and Gamma function, double integral (definition and existence), Evaluation of double integral. Change of order of integration in double integral. Triple integral as a natural extension of double integral. Dirichlet's integral.

Unit-V : Directional derivative, gradient, divergence and curl. Expansion formulae for gradient, divergence and curl. Surface and volume integral.
Theorem of Guass, Greens and Stoke's theorem and problems based on these theorems.

References :

1) T.M.Karade, Maya S. Bende, "Lectures on Vector Analysis and Geometry", Sonu-Nilu Publication, Nagpur.
2) Murrey, R. Spiegel, Vector Analysis, Sctraum Publihsing Company, New York.
3) Shanti Narayan, A Text Book of Vector Calculus, S.Chand and Company, New Delhi.
4) Gabriel Klambaur, Mathematical Analysis, Marcel Dekkar, Inc.New York, 1975.

5) Gorakh Prasad, Differential Calculus, Pothishala Pvt., Ltd. Allahabad.
6) Murray R.Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
7) Gorakh Prasad, Integral Calculus, Pothishala Pvt., Ltd. Allahabad.
8) S.C.Malik and Arora, Mathematical Analysis, Wiley Estern Ltd. New Delhi.
9) O.E.Stanaitis, An Introduction to sequences, Series and improper integrals, Holden-Dey, Inc. SAn Francisco, California.
10) Earl D.Rainville, Infinite Series, The Macmillan Company, New York.
11) N.Piskunov, Differential and Integral Calculus, Peace Publishers, Noscow.
12) Shanti Narayan, A course of Mathematical Analysis, S.Chand and Company, New Delhi.
13) P.K.Jain and S.K.Kaushik, An Introduction to Real Analysis, S.Chand & Co., New Delhi.
14) D.Somasundaram and B.Choudhary, A First course in Mathematical Analysis, Narosa Publishing House, New Delhi.
15) T.M.Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi.
16) R.R.Goldberg, Real Analysis, Oxford & I.B.H.Publishing Co., New Delhi.
17) N.Ch.S.N. Iyengar, Vector Analysis, Anmol Publications, Pvt.Ltd., New Delhi.
18) N.Saren and S.N.Nigam, Introduction to vector Analysis, Pothishala Pvt.Ltd. Allahabad.
19) T.M.Karade, J.M.Salunke, A.G.Deshmukh, M.B.Bendre, "Lectures on Advanced Calculus" - Sonu-Neelu Publication Nagpur.

*****

PAPER-V
DIFFERENTIAL EQUATIONS

Unit-I : **Series solutions of differential equations -** Power series method. Bessel and Legendre equations. Bessel and Legendre functions and their properties, recurrence and generating relations. Orthogonality of functions. Sturm-Liouville problem. Orthogonality of eigen-functions. Reality of eigenvalues. Orthogonality of Bessel functions and Legendre polynomials.

Unit-II : **Laplace Transformation -** Linearity of the laplace transformation. Existence theorem for Laplace transforms. Laplace transforms of derivatives and integrals. Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using

the Laplace transformation. Fourier transform, Sine & Cosine transform. Inverse fourier transform. Application to ordinary and partial differential equations.

Unit-III : Partial differential equations of the first order. Lagrange's solution. Some special types of equations which can be solved easily by methods other than the general method. Charpit's general method of solution. Jacobi's method.

Unit-IV : Partial differential equations of second and higher orders. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients. Monge's methods.

Unit-V : **Calculus of Variations -** Variational problems with fixed boundaries - Euler's equation for functionals containing first order derivative and one independent variable Extremals functionals dependent on higher order derivatives. Functionals dependent on more than one independent variable. Variational problems in parametric form. Invariance of Euler's equation under coordinates transformation.

References :

1) T.M.Karade, Lectures on Differential Equations, Sonu Nilu Publication, Nagpur.
2) Erwin Kreyszig. Advanced Engineering Mathematics, John Wiley & Sons, Inc, New York, 1999.
3) D.A.Murray, Introductory Course on Differential Equations. Orient Longman, (India), 1967.
4) A.R.Forsyth. A Treatise on Differential Equations. Macmillan and Co. Ltd.London.
5) Ian N., Sneddon, Elements of Partial Differential Equations. McGraw-Hill Book Company, 1988.
6) Francis B.Hilderbrand. Advanced Calculus for Applications. Prentice Hall of India Pvt.Ltd., New Delhi. 1977.
7) Jane Cronin. Differential equations, Marcel Dekkar, 1994.
8) Frnak Ayres. Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
9) Richard Bronson, Theory and Problems of Differential Equations. McGraw Hill Inc, 1973.
10) A.S.Gupta, Calculus of Variations with Applications. Prentice-Hall of India, 1997.

11) B.Courant and D.Hilbert. Methods of Mathematical Physics. Vols.I & II. Wiley - interscience, 1953.
12) I.M.Gelfand and S.V.Fomin. Calculus of VAriations, Prentice-Hill. Englewood Cliffs (New Jersey), 1963.
13) A.M.Arthurs. Complementary Variational Principles. Clarendon Press. Oxford, 1970.
14) V.Komko, Variational Principles of Continum Mechanics with Engineering Application, Volume-I. Reidel Publication, Dordrecht. Holland, 1985.
15) J.I.Oden and J.N.Reddy, Variational Methods in Theoretical Mechanics, Springer Verlag, 1976.
16) I.N.Sneddon. Fourier Transforms.
17) Goel & Gupta, Integral Transforms, Pragati Prakashan, Merut.

PAPER-VI
MECHANICS

Statics :

Unit-I : Analytical conditions of equilibrium of Coplanar forces. Virtual work, Catenary.

Unit-II : Forces in three dimensions. Poinsot's central axis. Wrenches. Null lines and planes.

Dynamics :

Unit-III : Velocities and accelerations along the coordinate axes, radial and transverse directions and along tangential normal directions. Projectile.

Unit-IV : Motion in resisting medium. Motion of particles of varying mass. Constraints. D'Alembert's principle and Lagrange's equations.

Unit-V : Reduction to the equivalent one - body problem. Virial theorem. Central Orbits. Kepler's laws of motion.

References :

1) T.M.Karade, Maya S.Bendre, Lectures on Mechanics, Sonu-Nilu Publication Nagpur.
2) S.L.Loney, Statics MacMillan and Company, London.
3) R.S.Verma, A Text Book on Statis, Pothishala Pvt.Ltd. Allahabad.
4) S.L.Loney, An Elementary Treatise on the Dynamics of a Particle & of rigid bodies, Cambridge University Press, 1956.
5) H.Goldstein, Classical Mechanics (2nd Edition) Narosa Publishing House, New Delhi.
6) S.L.Loney, An Elementary Treatise on Statics, Kalyani Publishers, New Delhi.- Ludhiana

7) D.K.Daftari, V.N.Indurkar, Elements of Static, Published by Dattsons, J. Nehru Marg, Nagpur.
8) M.A.Pathan, A Modern Text Book of Static, Pragati Prakashan, Meerut.

******

2. GEOLOGY

(Effective from the Session 2004-2005)

The examination in Geology at the end of Second year shall comprises of three papers and a practical examination as follows :

Paper IV : Earth Processes and Resources.
Paper V : Mineralogy and Petrology.
Paper VI : Earth's History.

Practical :

Each theory paper will be of three - hour duration and carry 40 marks. Practical examination will be of Three-hour duration and carry 30 marks. The distribution of marks for practical will be as follows:

A]	a)	Megascopic Minerals and Ores	:	5 Marks
	b)	Microscopic Minerals	:	2 Marks
	c)	Megascopic Rocks	:	5 Marks
	d)	Microscopic Rocks	:	3 Marks
	e)	Graphic Plotting of Petrochemicals	:	2 Marks
	f)	Identification of Fossils	:	3 Marks
B]	Sessional		:	2 Marks
C]	Field work, Report and Viva-voce		:	8 Marks
		Total	:	30 marks.

The following syllabus is prescribed on the basis of two lectures per paper (i.e.six lectures per week for three papers) and six practical periods per batch per week (i.e.two practical of three periods per batch). Candidate must pass separately in practical and in total of theory papers.

Paper - IV
Earth Processes and Resources:

UNIT-I : Ore forming minerals: metallic and non-metallic, Ore, Ore mineral, Gangue, grade of ores and non metallic minerals, assay value and tenor of ore. Factors controlling

mineral availability. Distribution of minearal deposits in space and time. Metallogenic provinces and Epochs. Broad outline of ideas regarding classificatons of Mineral deposits.

UNIT-II : Processes of formation of ores: Magmatic concentration, Hydrothermal Deposits, Contact metasomatic depostis, Secondary enrichment, Sedimentary deposits, Replacement and bacterial percipitation. Colloidal deposition. Residual concentration deposits. Oxidation and Supergene sulphide enrichment. Evaporates and Metamorphism as ore forming process.

UNIT-III : Mineralogy, Uses, Geological occurrences, orgin and Geographical distribution in India of the mineral deposits like iron, manganese, chromium, copper, lead, zinc, gold & aluminum.

UNIT-IV : Mineralogy, Uses, Geological occurrences, origin and Geographical distribution in India of the Non-metals related to refractory, fertilizer, cement, chemical and gemstone industry and minerals like asbestos, barite, gypsum, mica, graphite, talc, magnesite.

UNIT-V : Conventional and non-conventional energy resoureces Coal, petroleum, atomic minerals; and water, sun, wind, hot springs and sea waves.

Paper-V
Mineralogy and Petrology

UNIT-I : Rock forming minerals-silicates, oxides and sulfides: Chemical and physical proprties and systematic classification of the following rock forming mineral groups: Quartz, Feldspar, Felspathoids , Zeolites, Pyroxenes, Amphiboles, Micas, Olivine, Garnet and Aluminous Silicates.

UNIT-II : Classification of Igneous Rocks. rock associations in time and space. Concept of rock series.
Mineralogical characteristics of acid igneous, alkaline, basic igneous and ultra-mafic rocks..

UNIT-III : Phase rule and phase equilibria: Concept of system, phases and component. Basic principles of phase equilibrium in one component, two component and three component silicate systems. Phase equilibria and their applications in petrology.

UNIT-IV : Equilibrium and non equilibrium reactions in metamorphic processes, compostion - paragenetic diagrams; projective analysis; Metamorphism of pelitic, acidic, basic and calcareous rocks. metasomatism.

UNIT-V : Primary features and mineralogy of sedimentary rocks. Classification of Sedimentary Rocks, Residual, Clastic, Chemical and organic sedimentary depostis. Aeolean, glacial, fluvial, lacustrine, near-shore and deep-sea environmental deposits. Concept of sedimentary facies.

Paper VI
Earth's History.

UNIT-I : Ontogeny and variation in fossil assemblages. Applications of palaeontolgic data in palaeoecology, evolution, stratigraphy and palaeogeographic and palaeoclimatic reconstruction. Basic ideas about micropalaeontoogy and microfossils.

UNIT-II : Classification, diagnostic morphological characters, environment and geological distribution of Mollusca, (bivalvia, gastropoda and cephalopoda). Brachiopoda, Echinodermata (Echinoidea and Crinoidea),

UNIT-III : Classification, diagnostic morphological characters, environment and geological distribution of Foraminifera, Graptoloidea, Anthozoa, and Trilobita. A brief study of vertebarates and Plant fossil of Gondwana Periods.

UNIT-IV : Lithostratigraphic classification of Indian subcontinent. Classfication, geographic distribution, lithologiccal characteristics, fossil contents and economic importance of the following: Archean ;supergroup of peninsular India, Dharwar Supergroup. Sausar Group. Sakoli Group, Dongargarh Supergroup, Arawali Supergroup, Cuddapah Supergroup, Kaladgis, Pakhals, Penganaga Formation, Delhi Supergroup, Vindhyan Supergroup, Kurnool Supergroup, Chattisgarh Supergroup.

UNIT-V : Classification, geographic distribution, lithological characteristics, fossil contents and economic importance of the following: Paleozoic succession of Spiti Valley, Gondwana Supergroup, Triassic of Spiti, Jurassic of Kutch, Rajasthan and Spiti. Cretaceous of Narmada Valley, Trichinopoly, Spiti, and Lameta Formation. Deccan Traps. Tertiary of Assam. Siwalik

Group. Karewa Formation of Kashmir. Stratigraphy of Maharashtra.

Practical :

1. Study of physical and optical properties of rock and ore forming minerals as listed in theory papers.
2. Preparation of maps showing distribution of important ores and other economics minerals in India.
3. Study in morphological characteristics of important fossil phyla designated in theory paper.
4. Exercises in showing the major stratigraphic and litho tectonic units in hand drawn map of India.
5. Megascopic and Microscopic study of major Igneous, Sedimentary and Metamorphic Rocks.
6. Laboratory exercises in grahic plots for petrochemistry and interpretation of paragenetic diagrams.

Geological Field Training :

Every students should attend a field work for a minimum of one week and submit field diary, geological specimens and report.

Books Recommended for B.Sc. - II : Geology.

Petroogy :

1. G.W.Tyrell (1998) Principles of Petrology B.I.Publications Pvt.Ltd., New Delhi.
2. F.H.Hatch, A.K.Wells and M.K.Wells (1984) petrology of Igneous Rocks. CBS Publishers, New Delhi.
3. A. Hall (1987) Igneous Petrology. Longman ELBS.
4. S.R. Nockolds, R.W.O.B., Knox, G.A.Chinner (1978) Petrology for Students. Cambridge University Press, London.
5. F.J.Turner & J. Verhoogen (1987) Igneous and Metamorphic Petrology, CBS.
6. A.Philipotts (1992) Igneous and Metamorphic Petrology. Prentice Hall.
7. E.G.Ehlers and H.Blatt (1981) Petrology : Igneous, Sedimentary and Metamorphic. CBS Publishers, New Delhi.
8. F.J.Pettijohn (1957) Sedimentary Rocks. Oxford and IBH Pub.Co., New Delhi.
9. M.E.Tucker (1988) Sedimentary petrology : An Introduction . ELBS.
10. N.W.Gokhale (1998) Fundamentals of Sedimentary Rocks. CBS Publishers.

11. J.D. Collinson and D.B. Thompson (1994) Sedimentary Structures. CBS Pub.
12. B.W.D.Yardley (1989) An Introduction to Metamorphic Petrology. Longman ELBS.
13. F.J. Turmer (1980) Metamorphic Petrology. Mc Graw Hill, New York.
14. W.W.Moorhous (1985) The study of Rocks in Thin Sections. CBS Publishers.
15. H.Williams, F.J.Turner and C.M.Gilbert (1985) Petrography: An Introduction to the Study of Rocks in Thin Sections. CBS Publishers.

Mineralogy :

1. H.F.Read: Rutley's Elements of Mineralogy.
2. Berry, L.G.., Mason, Brian and Dietrich, R.V. (1985) Mineralogy. CBS Publishers.
3. Dana, E.S. and Ford, W.E.(1949) A Text Book of Mineralogy. Wiley Eastern Ltd.
4. Deer, W.A.Howie, R.A. and Zussman J. (1992) : An Introduction to the Rock-Forming Minerals, Longman Scientific and Technical.
5. Smith: Minerals and Microscopes.
6. Roger and Kerr: Optical Mineralogy.

Economic Geology :

1. Jensen, M.L.and Bateman, A.M.(1981) Economic Mineral Deposits. John Wiley and Sons, New York.
2. Sen, A.K.and Guha, P.K. (1993) A Handbook of Economic Geology. Dynamic Printers, Kolkata.
3. Banerjee, D.K. (1992) Mineral Resources of India. The World Press Pvt.Ltd., Kolkata.
4. Sharma, N.L.and Ram, K.S.V. (1964) Introduction to India's Economic Minerals , Dhanbad Publishers.
5. Deb, S. (1980) Industrial Minerals and Rocks of India. Allied Publishers, New Delhi.
6. Krishnaswamy, S. (1979) India's Mineral Resources. Oxford and IBH Pub. Co., New Delhi.
7. Babu, T.M. (1994) Tin in India. Geological Society of India, Bangalore.
8. Babu, T.M.(1998) Diamonds in India. Geological Society of India, Bangalore.
9. Radhakrishnan, B.P.and Curtis, L.C.(1999) Gold in India. Geological Society of India, Bangalore.
10. Deshpande, G.G. (1998) Geology of Maharashtra. Geological Society of India, Bangalore.

Palaeontology :

1. E.N.K. Clarkson (1986) Invertebrate Palaeontology and Evolution. ELBS Allen and Unwin, London.
2. H.H. Swinnerton (1973) Fossils. Willieam Collins Son's and Co.Ltd.
3. R.R.Shrock & W.H.Twenhofel (1999) Principles of Palaeontology. CBS Publishers.
4. Henry Woods (1985) Invertebrate Palaeontoogy. CBS Publishers.
5. R.C.Moore, C.G.Lalicker & A.G.Fisher (1997) Invertebrate Fossils. CBS Publishers.
6. W.C.Stearn and R.L.Carroll (1989) Palaeontology ; The record of life. John wiley and Sons Inc., New York.
7. C.A.Arnold (1947) An Introduction to Palaeobotany. McGraw Hill, New York.
8. R.M.Black (1970) The Elements of Invertebrate Palaeontology. Cambridge University Press.
9. M.A.Koregave (1998) Fundamentals of Invertebrate Palaeontology. Book World Enterprises, Mumbai.

Indian Stratigraphy :

1. Ravindra Kumar (1985) Fundamentals of Historical Geology and Stratigraphy of India. Wiley Eastern Ltd., New Delhi.
2. M.S.Krishnan (1982) Geology of Inida and Burma. CBS Publishers.
3. D.N.Wadia (1998) Geology of India. Tata McGraw Hill, India.
4. G.G.Deshpande (1998) Geology of Maharashtra Geological Society of India, Bangalore.

*****

3. STATISTICS

(Implemented fom the session 2004-2005)

The examination in Statistics will comprise of two theory papers and a practical examination. Each theory paper will be of three hours duration and carry 60 marks. The practical examination will be of three hours duration and carry 30 marks. The distribution of marks for practical will be as follows :

Practical		5 marks
Viva voce		5 marks
Practical problems		20 marks
Total	:	30 marks

The following syllabus is prescribed on the basis of three lectures per week per paper and 6 practical periods per batch per week. Each theory paper has been divided into 5 units. There shall be one question on every unit

with internal choice for each. Out of five questions three shall be of the short answer type and two shall be of long answer type. Each short answer type question should contain three to four questions each carrying not more than four marks. Long answer type questions should consist of questions each carrying more than four marks.

The college imparting instructions in Statistics should provide a 12 digit desk model electronic calculator to every student for the practical work. The calculator should not have any trignometric, exponential, logarithmic or statistical function.

Paper-III

Statistical Methods

UNIT-I : **Sampling from a Distribution :** Definition of a random sample, drawing random samples from standard distributions (Binomial, Poisson, Normal, Exponential). Concept of a statistic and its sampling distribution. Independence of sample mean and variance in random sampling from a normal distribution (without derivation), sampling distributions - Chisquare, t,F.

UNIT-II : Sampling disbributions of sum of Binomial, Poisson and mean of normal distribution.

Estimation : Point and interval estimate of a parameter, unbiasedness, consistency, efficiency and sufficiency. Concept of bias and standard error of an estimate, standard errors of sample mean and sample proportion.

Testing of Hypothesis : Concept of hypothesis, null and alternative hypothesis, types of errors; p-values, level of significance, power of a test.

UNIT-III : **Applications of Sampling distributions :** Testing for the mean and variance of univariate normal distribution, testing of equality of two means and testing of equality of two variances of two univariate normal distributions. Introduction to Bivariate normal distribution. Testing for the significance of sample correlation coefficient in sampling from a bivariate normal distribution and for the equality of means and equality of variances in sampling from a bivariate normal distribution.

UNIT-IV : **Large Sample Tests :** Statement of Central Limit Theorem. Use of central limit theorem for testing and interval estimation of single mean and single proportion, difference of two means and two proportions. Fisher's z-transformation and its uses.

Pearson's Chisquare test for goodness of fit and for homogeneity for standard distributions, contingency table and test of independence in contingency table.

UNIT-V : **Non-Parametric Tests :** Definition of order statistics, Non parametric tests, sign test for univariate and bivariate distributions, Wilcoxon-Mann-Whitney test, Run test, median test, Spearman's rank correlation test, Kolmogorov-Smirnov Test (one sample & two samples).

References :

1) Freund J.E. (2001) : Mathematical Statistics, Prentice Hall of India.
2) Goon A.M., Gupta M.K., Dasgupta B. (1991) : Fundamentals of Statistics, Vol.1, World Press, Calcutta.
3) Hodges J.L. and Lehman E.L. (1964) : Basic Concepts of Probability and Statistics, Holden Day.
4) Mood A.M., Graybill F.A. and Boes D.C. (1974) : Introduction to the Theory of Statistics, McGraw Hill.
5) Bhat B.R., Srivenkatramana T. and Rao Madhava K.S. (1997) : Statistics : A Beginner's Text, Vol.-II, New Age International (P) Ltd.
6) Rohatgi V.K. (1967) : An Introduction to Probability Theory and Mathematical Statistics, John Wiley & Sons.
7) Snedecor G.W. and Cochran W.G. (1967) : Statistical Methods, Iowa State University Press.
8) Gupta S.C. and Kapoor V.K. : Fundamentals of Mathematical Statistics, Sultan Chand.
9) J.D.Gibbons : Non-parametric Statistical Inference.
10) Sydney Siegel : Introductory text for Non-parametric Methods.

PAPER-IV

APPLIED STATISTICS

UNIT-I : **Indian Applied Statistical System :** Present official statistical system in India, methods of collection of official statistics, their reliability and limitations, principal publications containing such statistics on the topics - population, agriculture, industry, trade, price, labour and employment, transport and communications, banking and finance.

UNIT-II : **Demographic Methods :** Sources of demographic data - Census, register, adhoc survey, hospital records, demographic profiles of Indian census.

Measurement of Mortality : Crude death rate, specific death

rate, age-specific death rate, infant mortality rate, standardised death rates (direct and indirect method).

UNIT-III : **Complete Life Table :** It's main features, various elements of life table and their relations, construction of life table, probability of dying, used of life table, stationary and stable population.
Measurement of Fertility : Crude birth rate, general fertility rate, total fertility rate, specific fertility rate, age-specific fertility rate, measurement of population growth, crude rate of natural increase and vital index, GRR and NRR.

UNIT-IV : **Economic Statistics :** Index number - It's definition, applications of index numbers, price relatives and quantity relatives, volume relatives, link and chain relatives. Problems involved in computation of index numbers, use of averages, simple aggregate and weighted average methods, Laspeyre's, Drowbish-Bowley, Marshall - Edgeworth, Walsch's Passche's and Fisher's index numbers, Time and Factor reversal test, consumers price index (cost of living index number).

UNIT-V : **Time Series Analysis :** Concept of time series, economic time series, its different components and illustrations, additive and multiplicative models, determination of trend, analysis of seasonal fluctuations, construction of seasonal indices.
Demand Analysis : Static laws of demand and supply, price elasticity of demand, income elasticity and cross elasticity of demand. Pareto's Law of Income distributions.

References :

1. Croxton F.E. and Cowden D.J. (1969) : Applied General Statistics, Prentice Hall of India.
2. Goon A.M., Gupta M.K., Dasgupta B. (1986) : Fundamentals of Statistics, Vol.II, World Press Calcutta.
3. Guide to current Indian Official Statistics : Central Statistical Organisation, Govt. of India, New Delhi.
4. Saluja M.P. : Indian Official Statistical Systems, Statistical Publishing Society, Calcutta.
5. Shrivastava O.S. (1983) : A Textbook of Demography, Vikas Publishing.
6. Gupta S.C. and Kapoor V.K. : Fundamentals of Applied Statistics, Sultan Chand.
7. Gupta and Mukhopadhyay P.P. : Applied Statistics, Central Book Agency.

LIST OF PRACTICALS :

1) Drawing random samples from Binomial Poisson, Normal and Exponential Distributions.
2) Test of significance based on t-test.
3) Test of significance based on Chi-Square test.
4) Test of significance based on F-test.
5) Testing of significance of sample correlation coefficient and use of Z-transformations.
6) Testing of equality of means and variances in sampling from a bivariate normal distribution.
7) Large Sample test for single means and difference of means.
8) Large Sample test for single proportion and difference of proportions.
9) Chi-square test for goodness of fit.
10) Chi-square test for Independence of attributes in contigency tables.
11) Non - Parametric Test : Sign test for univariate and Bivariate distributions.
12) Non - Parametric Test : Wilcoxon-Mann-Whitney test.
13) Non - Parametric Test : Run test.
14) Non - Parametric Test : Median test.
15) Non - Parametric Test : Kolmogorov - Smirnov Test.
16) Computation of various measures of mortality.
17) Standardised death rate by direct and indirect method.
18) Construction of life table.
19) Computation of various measures of fertility.
20) Computation of G.R.R. and N.R.R.
21) Computation of index number by simple aggregate and Weighted average method.
22) Construction of price and quantity index numbers by Laspeyre's, Passche's and Fisher's method.
23) Applications of time reversal test and factor reversal test.
24) Construction of cost of living index numbers.
25) Measurement of linear trend by -
    i) Graphical Method
    ii) Method of Semi averages.
    iii) Method of least squares.
    iv) Method of moving averages.
26) Measurement of seasonal variations by -
    i) Method of simple avarages.
    ii) Ratio to trend method.
    iii) Ratio to moving average method.

iv) Method of link relative.

27) Estimation of price elasticity of demand, income elasticity of demand and cross elasticity of demand.

*****

List of Equipments and instruments required for a batch of students in the under graduate statistics laboratory.:

For B.Sc.-I, B.Sc.-II and B.Sc.Final :

1)	Twelve digits desk model electronics calculator	- 25
2)	Biometrica tables Vol.-I and Vol.-II	- 05 each
3)	Seven figure logarithmic tables	- 10
4)	Statistical Tables (Compiled)	- 10
5)	Random number tables	- 10
6)	A mathematical typewriter	- 01
7)	A duplicating machine	- 01
8)	Personal Computer	- 05
9)	Printer	- 01
10)	Statistical posters and charts	- 01

11) Software packages, Like Ststat, Stat Lab., SPSS/OR other useful packages may be provided in laboratory for practical purpose.

*****

4. GEOGRAPHY

The Examination in Geography will comprise two theory papers and one practical. Theory papers shall be of three hours duration and shall carry 60 marks each. The practical examination shall be of four hours duration and shall carry 30 Marks.

The following syllabus is prescribed on the basis of 3 lectures per paper per week two practicals of three periods each.

PAPER-III
GEOMORPHOLOGY

Unit-I : 1. Meaning and scope of Geomorphology. Relations with the other branches of geography.
2. Origin of the earth. A review of some of the most accepted views on the origin of the earth.

Unit-II : 1. Interior of the earth. Seismological evidence.
2. Diastrophism and Volcanism.

Unit-III : 1. Relief features of the earth. Changing nature of the relief features. Forces brining changes, Endogenetic and Exogenetic forces.
2. Types of rocks. Their role in shaping and affecting the work of denudation forces.

Unit-IV : 1. Denudation through weathering. Types of weathering and their role in geomorphic processes.
2. Denudation through errosion : Agents of erosion : The work of streams and the evolution of valleys.

Unit-V : 1. Concept of the cycle of erosion. Adjustment of streams to Structures.
2. The valley glacies : Their work and the resulting land forms.

Unit-VI : 1. Process of arid erosion and the arid land forms. The work of streams in arid and semi aride regions.
2. The work of under ground water and the chief features of lime stone topography.

Note : There will be one question on each unit. Each question will have an alternate choice.

PAPER-IV
(ASIA WITH SPECIAL REFERENCE TO INDIA)

Unit-I : 1. Asia-Geographical position, Structural built relief and drainage.
2. Asia-weather conditions, climate and climatics regions.

Unit-II : 1. Asia-Soils vegetation and population.
2. Asia-Agriculture.

Unit-III : 1. Asia-Mineral and Power, Resourcesiron ore, Banscite, Manganes, Tin, Petrolium and hydro-electricity.
2. Asia Industries :
i) Iron and Steel.
ii) Textile cotton, Silk and Wool.

Unit-IV : 1. India-Geographical position, structural built, relief and drainage.
2. India-weather conditions, climate and climatic regions.

Unit-V : 1. India-Soils, Vegetation and population.
2. Inida-Agriculture.

Unit-VI : 1. India-Mineral and Power Resources.

Iron Ore, Banscite, Manganese, tin, Coal, petroleum and Hydro-electricity.

2. Indian Industries.
   - i) Iron & Steel
   - ii) Cotton Textiles
   - iii) Jute

Note : There will be one question on each unit. Each question will have an alternate choice.

PRACTICAL

1. Advanced study of contours, Construction of at least ten exercises, Drawing of longitudinal and transverse profiles.
2. Reading of topographical maps of the Survey of India. Maps at least four.
3. Identification of following rocks and minerals.
   (1) Granite (2) Delerite (3) Basalt (4) Sandstone (5) Shale (6) Limestone (7) Conglomerate (8) Breccua (9) Slate (10) Marble (11) Quartizite (12) Laterite (13) Quartz (14) Feldspar (15) Mica (16) Augite (17) Tale (18) Gypsum (19) Calcite (20) Apatite.
4. Construction, merits demerits and choice of the following projections.
   1. Gnomomics projection, the polar case.
   2. Stereographic projection, the polar case.
   3. Zenithal Equidistant projection, the polar case.
   4. Zenithal Equal Area projection, the polar case.
   5. Simple Cylindrical Projection.
   6. Cylindrical Equal Area Projection.
   7. Simple Conic Projection with one standard parallel.
   8. Simple conic projection with two standard parallel.
   9. Bonne's Modified Conical Projection.
   10. The polyconic projection.
5. Surveying by prismatic compass.
   1. Open and close traverse.
   2. Correction of bearings.
   3. Plotting and distribution of error.

STATISTICAL METHOD

6. Study of Central tendencies Mean, Mode and Media.
7. Study Tour - Visit to mines or Agro based Industry.

Note : As per decision of academic council in its meeting held on 16.1.90 maximum number of examinees in Geography practical examination up

to B.A/B.Sc. level shall not exceed 40 examination per day.

Plan For Practical Examination.

1.	Contours	5 Marks
2.	Topographical maps	4 Marks
3.	Projection	5 Marks
4.	Surveying	5 Marks
5.	Statistical Methods	4 Marks
6.	Practical Records	
	Viva Voce identification of rocks and field report	7 Marks.
	Total :	30 Marks

Note : The following certificate will be necessary attached to the Practical Record Note Book of the Examinee when submitted before commencement of the Practical Examination of the subject.

CERTIFICATE

Name of College_____

This to certify that this Practical Record is the bonafied Practical works of Shri/ Kumari/Shrimati _____

During the Academic Year _____

Dated : Signature of the teacher who taught the examinee.

1.
2.
3.

Head of the Department

In the absence of the above certificate marks for Practical Records shall not be awarded to the examinee.

PAPER-III

BOOKS RECOMMENDED :

1. Worcester P.G. : A Text Book of Geomorphology Von Nostrand.
2. Monkhuse F.J. : The Priciples of Physical Geography, University.
3. Strahler A. : Physical Geography John Wiley.
4. Thornbury W.D. : Priciples of Geomorphology.
5. Holmas A. : Priciples of physical Geology. Thomas Nelson, London.

6. Lobeck A.K. : Geomorphology.

PAPER-IV

BOOKS RECOMMENDED

1. Dobby E.H.G. : South East Asia, University of London Press.
2. Cressey G.B. : Aisa's Lands and peoples, Mc Graw Hill.
3. Stamp L.D. : Asia
4. Ginsburg N.(Ed.) : The Pattern of Asia Prentice Hall.
5. Gananathan V.S. : Economic Geography of India, National book Trust.
6. Robinson, Monsson Asia, University of London Press.
7. Spali OHK & ATA Lear - Month : India and Pakistan.
8. Brown J.C. & A.K. Dey : India's mineral Wealth.
9. Choudhari M.R. : Iron & Steel Industry in India.
१०. प्रा. सुरेश दाते व संजीवनी दाते-आशिया, नरेंद्र प्रकाशन पुणे-२
११. प्रा. सुरेश दाते व संजीवनी दाते-भारत का सामान्य व प्रादेशिक भुविज्ञान, नरेंद्र प्रकाशन पुणे-२.

PRACTICALS BOOKS RECOMMENDED :

1. Streers J.A. : Map Projections.
2. Granier B.J. : Practical Work in Geography.
3. Singh R.L. & Dutta P.K. : Elements of Practical Geography Students Friends.

* * *

5. MICROBIOLOGY

(Implemented from the session 2004-05)

The examination in Microbiology shall comprise of two theory papers and one practical. Each theory paper is divided into five units. There shall be one question from each unit with internal choice. Examinees should attempt all five questions. Theory paper is of three hours duration and shall carry 60 marks each. Each practical examination (each batch of students) will last for at least two consecutive days with minimum five working hours each day. The syllabus is based on six theory periods and six practical periods per week.

Paper III

(Molecular Biology and Genetic Engineering)

Unit I- Gene Multiplication and expression:

a) Replication of DNA- Modes of replication, (Conservative, Semiconservative and Dispersive). Experiment of Meselson and Stahl to prove semiconservative mode of replication, general features.

Mechanism of replication with enzymes involved, models of replication: Knife and fork, rolling circle.
DNA repair- light and dark.

b) Genetic code- Characteristic features of genetic code.
c) Out line of Protein synthesis- Transcription and translation.

Unit II- Gene and Gene Mutation:

a) Concept of gene – Definition of Gene and experiment of Avery Macleod, McCarty in brief to prove gene as the genetic material. Definition of Muton, recon, cistron, gene within gene, split gene.
b) Gene regulation- Mechanism of Lac operon.
c) Mutation- Definition, Random Vs. Directed mutation, rate of mutation, Effect of Mutation on Phenotype, How does mutation act? types of mutations- Base pair substitution, frame-shift mutation, point, missense, nonsense, silent.
d) Genetic suppressions:- Intragenic (Intracodon suppression, reading frame Suppression) and extragenic suppression, (Non sense and Missense Suppression).
e) Molecular basis of spontaneous and induced mutation Spontaneous mutation (Tautomerism), Induced Mutation (Chemical Mutagens) e.g. Base analogue, Nitrous Oxide, Hydroxylamine, Acridine dyes, Physical mutagens e.g. X-rays, Gamma rays, U.V. light.

Unit III- Genetic recombination:

a) Transformation: History in brief, Experiment of Griffth, Avery, MacLeod and McCarty to prove Genetic Transformation. Mechanism of Transformation.
b) Transduction: Mechanism of Transduction. Generalized and Restricted Transduction (Definition and differences). Comparision between Transformation and Transductions.
c) Conjugation : Discovery of Conjugation :- Experiment of Lederberg and Tatum. Experiment of Davis, Nature and Function of F-Plasmid. Various Mating types:-

$F^+ \times F^-$

F^+ ----> Hfr

Hfr ----> $F^{'}$.

Unit IV- Tools and techniques of genetic engineering:

a) Preparation of pure samples of DNA(Isolation of Genomic and Plasmid DNA from bacteria), Enzymes for splicing (Restriction endonucleases),

Range of DNA manipulating enzymes (Nucleases, ligases, polymerases, DNA modifying enzyme, Topo isomerases), Analysis of DNA fragment size (By agarose gel electrophoresis), Joining of DNA molecules (DNA Ligase), Vectors and their types (Plasmid, Cosmid and Viruses).

b) Introducing γ DNA into host cell, competent cells, transduction of cells, identification of transformed cell.(e.g. Antibiotic resistance gene in Plasmid) Selection of clones. Direct (colony hybridization) and Indirect (southern blotting).

c) Definition and application of gene mapping, DNA sequencing and PCR.

d) Introduction to expression of cloned genes, construction of gene library cells for cloning, Expression of prokaryotic and eukaryotic genes.

Unit V- Applications of Genetic engineering:

a) Health care biotechnology;
   i. Production of Hormones- Insulin.(only biotechnology concept)
   ii. Production of Interferon.(only biotechnology concept)
   iii. Production of vaccines: conventional vaccines, BCG, Salk, Diphtheria, toxoid, ATC., outline of recombinant vaccines (hepatitis)(only biotechnology concept)
   iv. Hybridoma technology and monoclonal antibodies.(only biotechnology concept)
   v. Gene therapy. (Replacement of mutant gene and corrected gene)

b) Agricultural biotechnology(Basic concept only)
   i. Protoplast fusion.
   ii. Bioinsecticide and biopesticides,
   iii. Development of disease free plant.

c) Industrial Biotechnology,
   i. Biopolymers(Xanthan and Dextran).
   ii. Biosensors(Glucose).

d) Ethics and hazards of biotechnology.

Paper IV

(Immunology and Clinical Microbiology)

Unit I- Epidemiology:

a) Definition, classification and scope of epidemiology.

b) Infection- Types of infection and modes of transmission.

c) Normal flora of human body,

d) Infection process,
Pathogenicity and virulence,
Microbial adherence and invasiveness.
Microbial virulence factors, toxins, enzymes, H_2O_2, NH_3, Microbial Iron chelators aggressins.

e) Control of communicable diseases.

Unit II- Immune system,

a) Organs and cells of immune system,

b) General Nonspecific factors- Physiological barriers, Natural cellular factors, Natural humoral factors.

c) Immunity- Definition and classification,

d) Innate immunology- species, Racial, Individual, Herd immunity.

e) Acquired immunity- Active and passive immunity,

f) Antigens- Definition, types and factors determining antigenicity, Bacterial antigens.

g) Antibodies- Definition, Structure, classification, Properties and differences, monoclonal antibodies.

h) Antigen Antibody reactions- Agglutination, Precipitation, Complement fixation, Toxin-antitoxin neutralization, ELISA and RIA.

i) Hypersensitivity : Definition and types (I to V).

Unit III-Pathogenic Bacteria:

Study of following organisms with respect to their morphology, cultural and biochemical properties, antigenic structure, pathogenesis, lab. diagnosis, and prophylaxis:

i. Staphylococcus aureus.
ii. Streptococcus pyogenes.
iii. Neisseria maningitidis/ Neisseria gonorrhoeae.
iv. Clostridium tetani.
v. Salmonella typhi.
vi. Mycobacterium tuberculosis.
vii. Corynebacterium diptheriae.
viii. Vibrio cholerae

Unit IV- Other Pathogenic organisms:

a) Viruses-
   i. AIDS
   ii. Hepatitis
   iii. Polio
   iv. Rabies

b) Rickettias-
   i. R. prowazekii
   ii. R. rickettsii
   iii. R. burnetii
   iv. R. quintana
c) Protozoa- *E. histolytica*
d) Fungi-*C. albicans*

Unit V- Antimicrobial chemotherapy:

a) Basic principles of chemotherapy,
b) Drug- microbe- host interaction,
c) Major antimicrobial agents.
d) Basic mechanism of antibiotic action,
e) *In vitro* drug susceptibility tests,Cup, disc, Dilution – Broth and agar methods.
f) General principles and clinical use of antimicrobial drugs.

Practicals

1. Study of enzymes:
   a) Amylase
   b) Catalase
   c) Gelatinase
   d) Urease
   e) Coagulase
   f) Lecithinase
   g) Oxidase

2. Biochemical Tests:
   a) Fermentation of various sugars,
   b) Hydrogen Sulphide production,
   c) Indole production,
   d) Methyl Red test,
   e) Voges Proskauer Test,
   f) Citrate Utilization,
   g) Nitrate reduction Test.

3. Isolation and Identification of following bacteria:
   a) Staphylococcus aureus,
   b) Salmonella typhi,
   c) E. coli.

4. Laboratory cultivation of following pathogens:
   a) M. tuberculosis,

   b) C. diphtheriae,
   c) V. cholerae,
   d) Cl. tetani.

5. Serological Tests:
   a) Widal
   b) Pregnancy test
   c) VDRL

6. Antibiotic sensitivity by Disc method.
7. Methods of anaerobic cultivation,
8. Clinical investigations.
   a) Blood grouping and Cross matching,
   b) TLC, DLC,
   c) Hemoglobin estimation,
   d) Test for carbohydrates and Protein in Urine,
   e) Blood glucose and cholesterol,

9. Cultural examination of Urine, Blood, Sputum, Stool, Pus, CSF.
10. Isolation of pathogenic fungi,
11. Molecular Biology practicals,
   a) Isolation of plasmid DNA,
   b) Isolation of genomic DNA from *E. coli*
   c) Ligation
   d) Transformation
   e) Conjugation
12. Study Tour.

DISTRIBUTION OF MARKS
for practical examination

1.	Enzymestudy/ Molecular Biology Practical……	04
2.	Serological Tests: Blood grouping/ VDRL/ Widal/ Pregnancytest ……..	03
3.	Identification and Antibiotic sensitivity test of the organisms ……	08
4.	TLC/ DLC/ Hemoglobin Estimation/ Test for carbohydrates and proteins in urine/ Blood cholesterol and Blood glucose/ Isolation of Pathogenic fungi ……	03
5.	Spotting.……	05
6.	Viva-voce.……	05
7.	ClassRecord / Study tour report……..	02
	Total	30

Books Recommended For Paper III :-

1. Recombinant DNA.:-James. D. Watson, John. Tooze, David.Kutz
2 Introduction to Genetic Engineering:- Nicholas
3. An Introduction to Genetic Analysis:- David Suzuki, Anthony. Griffths
4. Biochemistry.:- Lehninger
5 Microbiology.Vol 1&2. :- Powar & Daginawala
6 Molecular Biology of the Cell.:- J. D. Watson, D. Bray
7 The DNA Story:- J. D. Watson
8 Genetics of Prokaryotes.:- Srivastava et.al
9 Genes:- Pramod Kumar
10. Genetic Engineering and its Applications -Joshi P.
11 Gene Transfer and Expreesion a Laboratory Manual :- Michael Kriegler
12 Concept in biotechnology:- D. Balasubramanium
13 Essential Genetics:- Daniel. Hartl.

Books Recommended For Paper IV :-

1.	Medical Bacteriology	:	Dey N.C. & Day T.K.
2.	Medical Microbiology Vol. I & II	:	Cruickshank K.R.
3.	Text Book of Microbiology	:	Ananthanarayan R. & C.E. Panikar
4.	Medical Parasitology	:	Dey N.C. & Dey T.K.
5.	Dorland's Pocket Medical Dictionary		
6.	Microbiology	:	Zinsser W.
7.	Preventive & Social Medicine	:	Park & Park
8.	General Microbiology & Immunity	:	S.G.Wilson. Vol. I & II
9.	Medical Microbiology	:	R. Anantnarayan
10.	Fundamental Priciples of Bacteriology	:	A.J.Salle.
11.	Microbes & Diseases of Man (Helminthology)	:	W.C.Deb.
12.	Microbiology	:	B.D.Davis, R.Dulbecoco, H.N.Eisen, H.S.Ginsburg.
13.	Parasitology	:	K.D.Chatterjee
14.	Text Book of Medical Microbiology	:	H.L.Chopra.

PRACTICALS :

1. Microbes in Action : Seely, Wandermark, Tarporewala, Bombay.
2. Medical Microbiology Vol.II : R.Cruickshank.
3. A mannual of Microbiological : A.J.Salle.
   Methods.
4. Microbiological Methods : Collins
5. Difco mannual :

* * *

List of Instruments/Equipments With Specification required for B.Sc. I, II and Final Microbiology Laboratory

Sr. No.	Name	Make	Specification	Quantity required
1.	Autoclave a. Portable	Yarco/Wiswo or any Std. make	Pressure gauge 0-30 psi size 350X325 mm. Double Walled Non-Electrical	1.
2.	b. Vertical	Wiswo/Yarco	Electrically operated or any std. make coil 2000 Watts. Double walled. mild steel body.	1.
			S.basket. cord & plug to work on 220 V. pressure control switch chamber size.	2.
3.	Hot-air oven	Yarco/Tempo/ Lab.Hosp. or any make	Double walled. Thermostat, Temp. regulator. Size 45X45X45 cm.	2.
4.	Incubator	Yarco/Tempo/Lab. Hosp. or any std. make	Double walled Insulated Temp. regulator size Temp. upto 60 C	2.

			with termostat sensitivity +0.5 C size 45X45X45cm	
5.	Refrigerator	Godrej/Kelvina-tor/BPL/std. any std. or make	Double/Tripple door with 250/300 Lit. capacity having separate freezer.	1.
6.	Serological Water bath	Yarco/Tempo/Lab Hosp or any std.	Double walled -Thermo regulated. Max. Temp. upto 80 C.Size 12X12 X12" with Cover.	1.
7.	Magnetic Stirrer with hot plate	Yarco/Tempo/Remi Lab.Hosp./or any std. make	2 Lit. Capacity with 500 Wt. temp. regulated hot plate.	1.
8.	Cyclo-Mixer	Remi/Tempo/or any std. make	For one test tube only	1.
9.	Centrifuge	Remi R-8c/Yarco or any std make	With replaceable swing out rotorheads one to hold 8-16 tubes of 15 ml capacity Another head to hold 4 tubes of 50-100 ml. capacity.	1.
10.	pH Meter	Systronics/Elico J.Mitra/or any std. make	Digital With glass electrade pH scale from 0 to 14. Resistant to temp change.	1.
11.	Colorimeter	Erma/Elicol Systronics or any std. make	Digital.Single cell with either glass or quartz cuvetters. Visible range with coloured filters.	1.
12.	Distillation Assembly	Remi/Tempo/Lab. Hosp or any std. make	2 Lits./hr. Capacity with metal condensor	1.

13.	Single pan Electrical balance	Systronics/K.Roy contac or any std. make	Digital 125 gram capacity. Sensitivity 0.01 gm	1.
14.	Mixer	Sumit/Jyoti/or any std make	With 3 Jars and Timer	1.
15.	Single pan balance (triple beam)	National/Remi/ or any std. make	III gram Capacity	2.
16.	Anaerobic Jar	Dynomicro/or any std. make	Capacity 10 Petri dishes Complete set.	1.
17.	Rotary shaker Hozt. Table top	Yarco/Tempo/Remi or any std. make	Flask Capacity 36 flask or 250 ml. Mechanical Variable speed motion size 24X24" platform.	1.
18.	Automatic Pipette washer	Kumar/Modern or any std. make	Stainless steel 1 ml, 5 ml,10 ml. Capacities	1.
19.	Over head Projector	Metzer/photophone or any std. make	Complete with screen 72X50" Glass screen 16X16".	1.
20.	Membrane Filter Assembly	Yarco/Tempo/or any std. make	With Vacuum pump 0.5 h.p. Filter funnel Adaptor, Filtering Flask. memberane filters 0.45 mm and 0.22 mm, for 125 filters compl set	1.
21.	Microscope a.Monocular	Olympus/Metzer/ Labo. or any std. make	Straight, with mechanical stage, mirror, objectives 10X, 45X & 100X. Eye piece 5X, 10X & 15X.	20

22.	b.Binocular	Olympus/Metzer/ Labo. or any std. make	Inclined with Mechanical Stage, Mirror, Lighting arrangment.objectives 10X, 45X, 100X. Eye piece 5X, 10X and 15X.	5
23.	Oil Immersion lens	Olympus/Meopta Labo/or any std. make (preferably Imported.)	Original (Imported) with good spring load.	20
24.	Autolet	Ames or any std. make	With laoncet holder. lancet cover end cap.	2
25.	Laminar Air-flow (Hozt.) (to be inst-lled in Asc-eptic room)	Micro filt/or any std make	Complete with U.V. light HEPA filter stainless steel top. Side glass Window pressure 25mm w.g. at rated flow D.O.P. efficiency 99.97% blower 1/4 hp.Size 3'X2', 4'X2'.	1.
26.	Ultra-violet Light (to be Fitted in Asceptic Room)	Amtrex/Videocon or std. make	15 Watts/30 Watts of variable length .	1.
27.	Air-Condi-tioner(tobe-Installed in Asceptic Room)	Amtrex/Videocon or any std. make	Window Room A/C at list 1.5 ton capaciy special filter for dust free air 4 way air distribution Noiseless standard compressors.	1.
28.	Asceptic room	10'X10' Totally enclosed with air-conditioner	Dimension 10'X10' with Air-conditioner and U.V. light	1.
29.	B.O.D. Incubator	Toshiba/Kumar/ Remi or any std. make.	Chamber size 45"x45"x45x digital Temp range 5 C-60 C sensitivity	1.

			+ 0.5. 230 Volts. double walled Aluminium/ stainless steel.	
30.	Teaching aids Epidiscope	Metzer/Photophone or any std. make	500 W. Imporated Halogen illumina-tion both for Diascopic projection with powerful and Noiseless colling system. An astigmatic lenses and Reflecting mirrors.	1.
31.	Slide Projector	Metzer/ Photophone	300 W. Imported Projection bulb Noiseless cooling system.Slide carrier for slides 2"x2" and film strip carries with mask for 35 mm A best quality projection lenses B German lenses 85 mm f.2.8 coated lens.	1.
32.	Video Cassettes	Indian/ Imported	Practical Microbiology each Applied Microbio-logy, (Environment, food, Industrial and medical Microbiology)	
33.	V.C.R. & T.V. set	National/ Sony/Philips/ Videocon or any std. make	Recording & playing facility T.V. 21" with remote control.	1 each
34.	Computer with printer and legal softwars.	Intel pentium or any standard make.	Current configuration	1

6. BIOCHEMISTRY
(Effective from the session 2004-05)

The examination in Biochemistry will comprise of two theory papers and one practical. Theory papers shall be of three hours duration and shall carry 60 marks each. The practical examination shall be of six hours duration in one day and shall carry 30 marks.

The following syllabus is prescribed on the basis of 3 lectures per paper per week and two practicals of three periods each on consecutive days.

PAPER-III
INTERMEDIARY METABOLISM

Unit-I : **Carbohydrate Metabolism :** Glycogen synthesis in liver and muscles, Glycolysis, Glycogenolysis, Tricarboxylic acid cycle, HMP pathway, Gluconeogenesis, Glyoxalate bypass.

Regulation of Glycolysis and TCA cycle, Mitochondrial ETC and Oxidative Phosphorylation, Photosynthetic ETC and cyclic and non-cyclic photophosphorylation.

UNIT-II : **Lipid Metabolism :** Introduction, hydrolysis of triacylglycerols, transport of fatty acids into mitochondria, β-oxidation of saturated fatty acids, ATP yield from fatty acid oxidation, Biosynthesis of saturated and unsaturated fatty acids. Metabolism of ketone bodies, oxidation of unsaturated and odd chain fatty acids. Biosynthesis of triglycerides and important phospholipids, glycolipids, sphingolipids and cholesterol; Regulation of cholesterol metabolism.

UNIT-III : **Amino acid Metabolism :** General reactions of amino acid metabolism; transmination, oxidative deamination and decarboxylation. Urea cycle, Degradation and biosynthesis of amino acids, like Glycine, Serine, Threonine, Cysteine, Methionine, Leucine, Phenylalanine and Tyrosine.

UNIT-IV : **Nucleotide Metabolism :** Sources of the atoms in the purine and pyramidine molecules. Biosynthesis and degradation of purines and pyrimidines. Regulation of purine and pyrimidine biosynthesis.

UNIT-V : **Porphyrin Metabolism :** Biosynthesis and degradation of porphyrines. Production of bile pigments.

PAPER-IV
ENZYMOLOGY

Unit-I : Brief account of the historical development of enzymology, general characteristics, nomenclature, IUB enzyme classification, definitions with examples of holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site, metallo enzymes, units of enzyme activity, marker enzymes, iso enzymes, monomeric and oligomeric enzymes, multienzyme complexes, enzyme specificity.

UNIT-II : Isolation, Purification and crystallisation of enzymes. Test for homogeniety, Enzyme assay.

UNIT-III : **Enzyme Kinetics :** Factors affecting enzyme activity; enzyme concentration, substrate concentration, pH and temperature. Derivation of Michaelis-Menton equation for uni-substrate reactions. K_m and its significance. Line Weaver-Burk plot and its limitations. Bi-substrate reactions - brief introduction to sequential and ping-pong mechanisms with examples.

Kinetics of zero and first order reactions. Significance of energy of activation and free energy.
Reversible and Irreversible inhibition, competitive, non-competative and uncompetitive inhibitions, determination of K_m and V_{max} in presence and absence of inhibitor. Allosteric enzymes.

UNIT-IV : **Enzyme Catalysis :** Role of cofactors in enzyme catalysis : NAD/NADP, FMN/FAD, coenzyme A, biotin, cobamide, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzyme functions. Acid-base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory. Mechanism of action. (Lock & Key hypothesis, Induced fit model.)

UNIT-V : **Industrial and Clinical Applications of Enzymes :** Immobilization of enzymes and their industrial applications. Production of glucose from starch, cellulose and dextran; use of lactase in dairy industry; production of glucose-fructose syrup from sucrose; use of proteases in food, detergent and leather industry; medical application of enzymes; use of glucose oxidase in enzyme electrodes.

Practicals : **(Note : A minimum of 10 experiments to be performed from the following)**

1. Estimation of blood glucose by GOD/POD method.
2. Isolation of glycogen from liver and estimation by GOD/POD method.
3. Demonstration of effect of temperature on enzyme catalysed reaction.
4. Estimation of Vit-C by dye method.
5. Determination of achromatic point of salivary amylase.
6. Demonstration of urease activity (quantitatively) on urea.
7. Estimation of DNA by Diphenylamine reagent.
8. Estimation of RNA by Orcinol reagent.
9. Estimation of cholesterol in given sample by Libermann-Burchard reagent.
10. Seperation of chlorophylls by column chromatography.
11. Estimation of inorganic phosphorus by Fiske-Subbarow method.
12. Estimation of amino acid by Ninhydrin method.
13. Estimation of protein by Folin-Lowry method.
14. Demonstration of immobilization of enzyme.
15. Study tour shall be compulsory for all students.

DISTRIBUTION OF MARKS FOR ANNUAL PRACTICAL EXAMINATION :

Q.1	Long Experiment	10
Q.2	Short Experiment	05
Q.3	Short Experiment	05
Q.4	Viva-Voce	04
Q.5	Class Record & Work, Study tour.	06

BOOK RECOMMENDED FOR PAPER-III

1. Essentials of Food & Nutrition by M.Swaminathan Vol.I &II.
2. Advance Text Book of Food & Nutrition Vol.I & II by M.Swaminathan.
3. Textbook of Food & Nutrition by M.Swaminathan.
4. Handbook of Food & Nutrition by M.Swaminathan.
5. Text Book of Food & Nutrition by A.N.Ghei & Ghei.

FOR PAPER-IV

6. Human Physiology Vol.I & II by C.C. Chatterjee.
7. Textbook of medical physiology by A.C.Guyton.
8. Handbook of Human Physiology by Dr. Vidya Ratan.

9. Human Physiology by Basky-Khodorow Vol.I & II.
10. Human Physiology by Vander, A.J.Sherman, J.H & Luciano D.S.
11. Text book of Physiology and Biochemistry by Bell, Davidson and Sarborangh.
12. General Endocrinology by Turner C.D.

LIST OF INSTRUMENTS/EQUIPMENTS/GLASS-WARE AND SPECIFICATION REQUIRED FOR (BIOCHEMISTRY) LAB.

Instruments/Equipments

Sr. No.	Name	Make	Specification	Quantity requried.
1.	Photoelectric Colorimeter	Erma Japan Elico, Speocol Cistronic Amil J.Mitra Instrumentation or any one	Single cell with either glass or quartz, cuvettes visble range with coloured fileters.	1
2.	pH Meter	Elico, Cistronic J.Mitra	with glass electrode pH Scale from 0 to 14 Resistant to temp change.	1
3.	Table centrifuge	"Remi Model R-8c" Tempo.	with replaceble swing out rotor heads. One to hold 8-16 tuber of 15 ml capacity Another head to hold 4 tuber of 50-100 capacity.	1
4.	Incubator	Tempo. Lab. Hosp.	Double walled insulated Double doors. (Inner glass door) Tempo. upto 60 C with thermostat.	1

			Sensitivity +0.5 C Size : 455x605x455 mm	
5.	Hot air Oven	Yarco Tempo. Lab.Hosp.	Doubled walled Thermostat temprature regulator Size : 45x45x45 cm	1
6.	Refrigerator	Voltas, Godrej, Allwyn, Kelvinator or any make	Double door with 300 Lit. Capacity having separate freezer	1
7.	Serological water bath	Tempo. Lab.Hosp. Yarco or any make	Double walled Thermoregulated Mix.Temp.upto 80^0C Size : 12x15x12 cm with cover.	1
8.	Magnetic Stirrer with out plate	Tempo Remi Lab.Hosp. Yarco or any make.	2 Lit. Capacity with 500 Wt. temp. regulated hot plate	
9.	Metal water Disti-llation plant	Remi Tempo Lab.Hosp.	2Lits/Hr. Capacity with metal condensor	1
10.	Thin Layer Chromato graphy Assembly	— — — —	Chamber of Glass Tank Spreader Glass Plates Stage for glass plates.	1
11.	Hot Plate	Tempo. Remi. Lab.Hosp. or any make	Round with 3 way control switch 100 Watts.	2
12.	Mixer	Remi Sumit and/ or any make	3 jars and timer.	1

13.	Single Pan Balance (Tripple beam)	National Scientific Work VARANASI	100 gm. capacity	2
14.	One Pan Electric Balance	Instruments works. VARANASI	100 gm. Capacity Accuracy upto 4th decimal of gm.	1
15.	Cyclo-Mixer	Vortex Remi	For one test tube only.	1
16.	Laboratory Microscope	Olympus or any make	Monacular Medical microscope with sliding stage.	4
17.	Fingure pricking needle.	Auto Let Japan	with Disposible Needler.	2
18.	Haemometer Sahil's	GDR make or Top	with Comparator Glass, Tube and Hb pipettes.	2
19.	Neubauer's Counting Chambers		with Bright rullings.	4
20.	RBC Pipettes	GDR or England make or any make		25 Nos.
21.	WBC Pipettes	-do-		25 Nos.
22.	Lab.Cell Counter.	any make		5 Nos.

GLASS WARE :-

Sr. No.	Name	Make	Specification	Quantity requried.
1.	Test Tubes	Borosil/Corning/Vensil	20 ml capacity	1000 Nos.
2.	Centrifuge	Borosil/Corning./Vensil	15 ml Capacity	100 Nos.
3.	Follin-Wu Tubes	Corning/ Borosil/Vensil	25 ml capacity with bulb	50 Nos.
4.	Nesseler's Tubes	Corning/ Borosil/Vensil	25 ml capacity with 12.5 ml mark	50 Nos.
5.	Boiling Tubes (Hard glass)	Corning/ Borosil/Vensil	50 ml capacity	60 Nos.
6.	K.T.Tubes	Borosil/ Corning/Vensil	5 ml capacity	20 Nos.
7.	Burettes	Emkay or any make	10 ml capacity with stop clock	20 Nos.
8.	Microburettes	Borosil/Emkay	10 ml capacity	10 Nos.
9.	Pipettes	Corning/ Borosil/Vensil	10 ml capacity with graduation	20 Nos.
			5 ml capacity with graduation zero at tip.	20 Nos.
			2ml cpacity with graduation zero at tip	20 Nos.
			1 ml capacithy (graduated)	20 Nos.
			0.2 ml capacity (graduated)	20 Nos.
			0.1 ml capacity with graduation zero at tip.	20 Nos.

10.	Measuring	Corning/ Borosil/ Vensil	1000ml graduated	1 No.
			500 ml graduated	1 No.
			100 ml capacity graduation.	5 Nos.
			50 ml capacity with graduation	5 Nos.
			10 ml capacity graduation.	3 Nos.
11.	Standard Volumetric Flasks	Corning/ Borosil/ Vensil	1 Lit. Capacity	3 Nos.
			500 ml capacity	5 Nos.
			250 ml capacity	12 Nos.
			100 ml capacity	20 Nos.
12.	Beakers	Corning/ Borosil/ Vensil	1 Lit. Capacity	5 Nos.
			500 ml capacity	30 Nos.
			250 ml capacity	30 Nos.
			100 ml capacity	50 Nos.
			50 ml capacity	50 Nos.
13.	Conical Flasks	Corning/ Borosil/ Vensil	500 ml capacity	30 Nos.
			250 ml capacity	30 Nos.
			100 ml capacity	30 Nos.
			50 ml capacity	30 Nos.
14.	Reagent bottle	Emkay	2 Lit. Capacity	5 Nos.
			1 Lit. Capacity	5 Nos.
			500 ml capacity	100 Nos.
			250 ml capacity	100 Nos.
15.	Dropping Bottle	Emkay	100 ml Capacity	10 Nos.
16.	Flate Bottom Round Flask	Emkay	500 ml capacity	20 Nos.
17.	Funnels	Emkay	2.5" diameter	20 Nos.
			3" diameter	20 Nos.
			6" diameter	3 Nos.
18.	Glass	Tubing	1/2mm	1 kg.
19.	Glass	Rods	1/2 mm	1 kg.

MISCELLENIOUS :

Sr. No.	Name	Make	Specification	Quantity requried.
1.	Pipettes bulb	Any make	Able to hold any pipettes from 0.1 ml to 10 ml capacity Rubber or Palstic	5 Nos.
2.	Test Tube Stands	Tarson	To hold 12 Tubes	20 Nos.
3.	Burette stands	— —	Metal rod and base with tarson clamp.	20 Nos.
4.	Rubber Crock		To fit in conical flasks of all capacity	20 each
5.	Procelain Glazed tiles		6 x 6"	20 Nos.
6.	Mortor and Pestal	—	6" diameter	1 Nos.

7. Computer Science

(Implemented from the Session 2005-06)

The Examination in Computer Science will comprise of two theory papers and a practical examination. Each theory paper will be of three hours duration and carry 60 marks. The practical Examination will be of 6 hours duration and carry 30 marks.

The distribution of marks in practical examination is given as :-

Program writting / execution (on group A & B)	20 marks
Practical / Record	04 marks
Viva-voce	06 marks
Total :	30 Marks

Each unit of theory paper will carry two questions with internal options to solve any one question.

The syllabus is based on 6 theory periods and six practical periods per week.

Candidates are required to pass seperately in theory and practical.

In case of programming langugae standard ANSI version of languages is to be followed.

Paper-III

Object Oriented Programming With C++

Unit-I : OOP paradigm : features of oop, advantages and application of oops, comparision with structured programming languages. Introduction to C++, structure of C++ program, tokens, keywords, identifiers, basic data types & user defined data types. Constants and variables, declaration of variables, dynamic initialization of variables, types of symbolic constants.

Unit-II : **Operators :** Scope resolution operators, member dereferencing operators, implicit & explicit conversions. **Control Structures :** if, switch, do---while, while & for statements. Functions : Functions prototype, function calling and returning & their types, inline functions, default arguments, const arguments, function overloading.

Unit-III : **Classes and Objects :** Data abstraction and Encapsulation, Data Hiding, class specification, defining objects, accessing class member, defining member functions, Nesting of member function, friend functions, passing objects as arguments, Returning objects from functions. **Constructors :** Defining constructor, parameterized constructor, multiple constructors in a class, constructor with default argument, copy constructor, destructor.

Unit-IV : **Dynamic Objects :** Introduction, dynamic binding, arrays of objects, pointers to objects, this pointer, dynamic constructor. **Operator Overloading :** Defining operators overloading, overloading. Unary, binary & assignment operators, rules for overloading operators.

Unit-V : **Inheritence :** Introduction, derived classes, single inheritance, multiple inheritance, multilevel inheritance. Hierarchical & Hybrid inheritance. Templates : function, class, members and function

templets.

Unit-VI : **Virtual functions and Polymorphism :-** Introduction, pointers to derived class, defination of virtual functions, pure virtual functions. Rules for virtual functions.
Working with files : Introduction, Hierarchy of file stream classes, opening and closing of files, file modes, file pointers and their manipulations, file input / output with fstream class.

Books Recommended :-

1) Object oriented programming with C++ :- E.Balguruswamy, TMH.
2) Mastering C++ :- K.R. Venugopalan
3) Programming with C++ - Robert lafore
4) Programming with C++ - R.S.Nisar Ali

Paper-IV
Networking and Web Designing

Unit-I : Basic elements of communication system : Network concept, advantages, goals, network topologis : star, ring, completely connected N/W, Hybrid N/W, multi-point n/w, LAN, WAN, OSI model.

Unit-II : HTML : Introduction, Need of HTML, HTML tags and attributes : Adding tags, include attributes <HTML>, <HEAD>, <TITLE>, <BODY>, <P>, <Br>, <HR>, Heading tags, table tags, <A>, <LINK>, <IMG>, <ROWSPAN>, <COLSPAN>, <MARQUEE>, <BLOCKQUOTE>, list tag, Attributes : allign, background colour, text color.

Unit-III : Style sheet, advantages of style sheet, CSS : Introduction, CSS style sheet properties : Units, classes and ID attributes; properties : Text, font, colour, background, border, display, height, line, margin, width; CSS with HTML.

Unit-IV: Introduction to XML : History of Markup languages, design goal of XML documents, simple XML document, logical structure of XML elements. Components of XML document : The document prolog, and document instance, CSS with XML.

Unit-V : Document Type Defination (DTD) : Introduction, need of DTD, what is DTD?, declaring elements, element content models, declaring attributes, attribute types, internal and external DTD; entities and their types.

Unit-VI: XML Schemas : Introduction, features, comparision with DTD, Linking schema and XML document. Namespace its declaration, default and prefix namespace, scope of namespace. Namespace and attributes, namespaces and elements. Application of namespaces.

Books Recommended :

1) Computer Fundamental and Networking : P.K.Sinha.
2) Local Area Network : Keiser, TMH Publication.
3) Computer Networks, Andrew S. Tenenbaum, PHI Publication.
4) Mastering XML, Ann Navarro, Chuck White, Linda Burman, BPB Publications.
5) Teach yourself XML in 21 days, BPB Publications.
6) XML unleashed, BPB Publications.
7) Teach yourself XML in 24 hours, BPB Publications.
8) Applied XML solutions, BPB Publications.
9) Inside XML, BPB Publications.

Practicals :

Group A : Minimum 16 practicals based on C++ covering all aspect of syllabus.

AND

Group B : Minimum 16 practicals based on XML covering all aspects of syllabus.

Study Tour : Study tour may be arranged to computer Industry or software development organisation or software technology park or IT park.

List of Equipments :- (Minimum requirement) For Computer Science for B.Sc. Part-I, II, III.

I) Hardware :-

a) Computer Terminals : 10 Nos.
Desirable configuration : Computer with latest configuration.
b) Printer (DMP) - 2 Nos.
Desirable configuration :- 24 pin- 132 / 80 columns.
c) Inkjet Printer - 1 No.

II) Accessories :-

1) Floppy boxes, 1.44 MB or 1.2 MB - 2 Boxes.
2) Printer ribbon (Cartridge)

3) Printer Stationary - 5000 sheet.
4) Stabilizer / UPS
5) Internet facility.

III) Softwares legal version based on syllabus.

IV) Other accessories be available based on syllabus.

******

8. ENVIRONMENTAL SCIENCE

(Implemented revised syllabi from the Session 2007-08)

The syllabus is based on 6 theory periods and 6 practical periods per week.

The examination shall consists of two theory papers and one practical. Each paper is divided into five units. There shall be one question on each unit with internal choice. Examination shall be of three hours duration and carry 60 marks. The practical examination shall be of four hours duration and carry 30 marks.

PAPER-IV
ENVIRONMENTAL CHEMISTRY

UNIT-I : Fundamentals of Environmental Chemistry :-
Stoichiometry, Gibb's Energy, Chemical Potential, Chemical Equillibria, Acid base reaction, Solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, radionucleotides, composition and properties of Water.

UNIT-II : A) Introduction to surface chemistry - Coagulation, flocullation, adsorption, ion exchange, absorption, and its application in the Environment.
B) Chemistry of Biological important elements - The role of macro and micro elements on life processes - Carbon, Nitrogen, Sulphur, Phosphorous, Hydrogen, Oxygen, Sodium, Potassium, Calcium, Magnesium.

UNIT-III : A) Chemistry of Biomolecules - Proteins, amino acids, fatty acids, lipids, sugars.
B) Enzymes, Defination, Nomenclature and Properties.

UNIT-IV : A) Toxicology - Introduction and basic concepts. Evaluation of toxicity, rates of exposure, acute, sub-acute and chromic toxicity.
B) Toxic agents in Environment - Pesticides, agrochemicals, drugs,

four additives, atmospheric toxicants.

UNIT-V : A) Chemical Composition of Air - Classification of Elements, Chemical Speciafication Particles, Ions and radicles in the atmosphere. Thermochemical and Photochemical Reactions.
B) Soil Chemistry - Inorganic and Organic Components of Soil. Nitrogen, pathways, and NPK in Soil.

PAPER-V
ENVIRONMENTAL BIOLOGY

UNIT-I : Auctecology of Species :-
- Bouyancy - Defination, adaptive devices to remain floating. Swim bladder in fishes.
- Mimicry - Defination, types, colour change mechanism with respect to environmental changes.
- Biological rhythms - Defination, cireadian & cireannual rhythm. Endogeneous & exogeneous rhythum.

UNIT-II : Adaptations of Animals with reference to -
A) Osmoregulation - Defination, osmoregulation in fresh & marine water animals. Nature & role of Biological membrane, contractile vacuule of Amoeba.
Desert Adaptations - Adaptations with reference to desert xerocoles.
B) Aquatic Adaptations - Hydrocoles, Sec.Hydrocoles.

UNIT-III : A) Planktons - Defination, classification, zooplanktons, Phytoplanktons & their composition, qualitative & quantitative estimation of planktons. Beneficial & Harmful effects, control measures.
B) Bio-indicators & their role in Environment.
i) Indicators of Pollution
ii) Indicators of Climate
iii) Indicators of Soil Condition

UNIT-IV : Role of Environmental Factors on following plant processes-
i) Uptake of Water & Salts - Soil Water, Conc. of soil solution, soil aeration, interaction of ions, soil pH.
ii) Transpiration - Humidity of Air, temperature, wind velocity, light, atmospheric pressure, water content of soil.
iii) Photosynthesis - Light, CO_2, temperature, H_2O, O_2, and mineral elements in soil.

Energy Sources :- Classification, reneuable and non reneuable

conventional - Coal, Hydrogeothermal nuclear and petroleum, its smart description and their inpact.

UNIT-V : Water Microbiology :-

A) Water borne pathology, sources of micro-organisms to water borne pathogens (Bacterial, viral, protozoans & Helminths), Diseases caused by water bourne pathogens, significance of bacteriological analysis, indicators of real pollution.

B) Biodiversity - Defination, Scope, types, Biodiversity loss, Global Diversity, India as a mega diversity nation, bio-diversity hot spots.

PAPER-VI
ENVIRONMENTAL EDUCATION, HEALTH, & ENERGY RESOURCES

Unit-I : Human Rights and Environmental Ethics - Concepts and principles of human rights.Environmental Ethics - Code and conduct, theories of moral responsibilities towards environment (Anthropogenic, Biocentric and Ecocentrism.

UNIT-II : Environmental Education :- Defination, objectives, types.
Ecotourism - Concept through nature education for the sustainability.
Movements - Chipco, Narmada Bachao, Tehri Dam movements.

UNIT-III : Environmental Health Hazards :- Effects of Environmental Pollutants on Human Health. Occupational Hazards and Diseases (Asbestosis Fluorosis, etc.). Prevention of occupational diseases. Concept of good house keeping and safety regulation.

UNIT-IV : Energy Resources - Defination, classification and types.
Conventional Resources - Coal - Classification & compostion, Energy Content. Petroleum, Natural Gas, Hydrogeothermal, Nuclear - its short process description.Environmental Implication of Energy use.

UNIT-V : Non Conventional Energy Sources - Solar-Thermal Energy Conversion and Electrical Conversion (Solar Collectors and Photovoltites, solar ponds), wind, tidal-OTEC, biogas, alcohol - Its process discription. Impact of energy utilization on Environment. Energy Resource Conservation.

Experiments based on Papers :

1) To study the process of coagulation by using Alum & $PeCl_{3.}$
2) To study the process of adsorption by using adsorbent.
3) To study the process of Ion exchange by using resins.
4) Determination of Amylase activity on starch.
5) To study the effect of temperature on the activity of Enzymes.
6) Estimation of LC50 in fishes.
7) Seperation of metal ion by paper chromatography.
8) Analysis of water for bacteriological - MPN.
9) To estimate settalable particulate material in your area.
10) Measurement of noise level noise level meter.
11) Determination of Path of Water.
12) Comparative rate of photosynthesis under variable conditions of CO_2, light, temperature.
13) To study effect of light, temperature, humidity & wind velocity on transpiration.
14) Quantitative analysis of Phytoplanktons & Zooplanktons.
15) Qualitative analysis of Phyto & Zooplanktons.
16) Collection of water sample and its preservation for bacteriological analysis.

Practical Syllabus for Spotting :-

1) Identification of Phytoplanktons : Members of cyanophyceae, chlogophyceae, Bacillariophyceae, Xanthophyceae, Diatons.
2) Identification of Zooplanktons : Protozoans, Crustaceans, Daphnia, Rotifers, Copepods.
3) Adaptations of Plants - Study of Adaptation of Plants growing in different batitats.
   i) Hydrophytes, ii) Xerophytes.

Note :- • Visit to water works / pond Ecosystem / Lake / River. Students should submit a detailed report.
- Visit to Thermal Power Station.
- Visit to wind mills.
- Visit to Hydro Electric Power Station.

Distribution of Marks :-

Q.1 Any one Experiment on Environmental Pollution / Chemistry. - 06
Q.2 Any one Experiment on Environmental Biology - 06
Q.3 Preparation of temporary slide of phytoplanks / Zooplanktons from given water sample. - 04

Q.4 Spotting
Spot No.1 : Phytoplanktons
Spot No.2 : Zooplanktons
Spot No.3 : Any one experiment of Plant Adaptation - 03
Q.5 Practical Record and field diary. - 02
Q.6 Field Diary - 03
Q.7 Viva-Voce. - 06

Books Recommended :-

1) Ecology and Environment :- P.D.Sharma
2) Animal Physiology & Ecology - P.S.Verma & V.K.Agrawal
3) Environmental Chemistry :- B.K.Sharma
4) Water and Hydrology - Peter B.Black
5) Physico Chemical Examination of Water, Sewage & Industrial effluent - N.Manivaskam
6) Text Book of Environmental Chemistry - O.D.Tyagi & M.Mehra.
7) Environmental Management of Toxic & Hazardous Waste - M.Arora.
8) Chemicals in the Environment - Y.Miab & M.Satake
9) Environmental Chemistry - A.K.Ok
10) Report of the Panel on Food and Agriculture by WHO, 1992.
11) Report of the Panel on Industry by WHO, 1992.
12) Principles of Toxicology - Cassarett & Doulls
13) Essentials of Toxicology - Loouis T.A., Leae Fabiger
14) Environmental Biology - K.C.Agrawal
15) Chemical and Biological Methods for Water Pollution Studies - Trivedi & Goel.
16) Fundamental of Environmental Pollution - Kanna K.
17) Environmental Chemistry - De A.K.
18) A text book of Environmental Chemistry - Dara, S.S.
19) Air Pollution - Kudesia, V.P.
20) A Text Book of Environmental Chemistry & Pollution Control - Dara, S.S.
21) Environmental Pollution & Control - Bhatiya, S.C.
22) A Text Book of Environment - Agrawal K.M.
23) Fundamentals of Air Pollution - Raju
24) Air Pollution & Control - Muralikrishna
25) Air Pollution - Rao M.N.
26) Chemical Methods for Environmental Analysis - Rameth R.
27) Environmental Chemistry by Dara
28) Text Book of Marine Ecology by N.Balkrishnan Nair & D.M.Thania.

29) Perspectives on Environment by I.R.Manners, M.W.Micksell

* * *

9/10.INDUSTRIAL CHEMISTRY / INDUSTRIAL CHEMISTRY (VOCATIONAL)

There shall be the following papers and practicals for B.Sc.II Examination.

There shall be three compulsory papers in theory each of 3 hrs. as stated below and practical examination duration shall be of 6-8 hrs. Every examinee shall offer the following three papers of 40 marks each and practical examination of 30 marks.

Paper-IV
Material Science

Unit I

(A) Classification of materials : (briefidea) crystalline & amorphous, conducting, semiconducting & insulating material.

(b) Metals and Alloys

(i) Properties of metals (mechanical & electrical properties)

(ii) Types of alloys - ferrous & non ferrous alloys : composition, Properties and applications of following.

(a) Mild steel, carban steel, Mn & V-steels, Stainless steel.

(b) Copper, brass, bronze, gunmetal

(c) Al, alloys with Mg.

(d) Ni, monel, cupra nickel, invar.

(e) Ti & its important alloys.

Unit II **Ceramics, Refractories & Glasses**

(A) Creamics : Introduction, types, raw materials, manufacturing processes, properties & applications.

Refractories : Introduction, classification & manufacture, Properties applications of fire clay bricks & high alumina bricks.

(B) Glasses : Introduction, types, Composition, manufacture (raw material, batch process) properties and applications.

Unit III **Cement**

Introduction Types of cement, raw material in the manufacturing process, wet & dry process, setting & hardening of cement, Properties of cement specification & Testing of cement (tensile, compression, fineness, sp. gravity)

Analysis of cement : Determination of moisture, Ca by complexometry & SiO_2 gravimetrically. Blending of cement.

Unit IV **Polymer**

Introduction, classification (Natural -artificial, Inorganic-organic, Thermosetting-themoplastics), classification of polymerisation processes (addition & condensation polymerisation mechanism not expected) manufacture & application of polyethelene, polystyrene, Polyvinyl chloride (PVC) Polyester (PET), nylons, Teflon.

Phenol-formaldehyde & urea-formal dehyde,resins. Properties and Industrial applications of polymers.

Unit V **Corrosion & Passivity.**

(A) Corrosion- Introduction, Types of corrosion (Galvanic, open-air,under-water & under ground) Mechanism of corrosion, factors affecting corrosion.

Passivity : Introduction, chemical & mechanical passivity oxide film theory of passivity.

(B) Methods adopted for preventing corrosion (metal coating processes)

(i) Galvonization of Iron.

(ii) Nickel Plating.

(C) Oil Paints & Varnishes :Introduction, manufacture & their applications in prevention corrosion.

Paper-V

Unit Processes in Organic Chemical Manufacture

Unit I **Nitration and Amination**

(A)Nitration : Introduction, Nitrating agents; Kinetics and thermodynamic of nitration of

(i) Benzene to nitrobenzene and m-dinitrobenzene.

(ii) Chlorobenzene to O & p-nitrochloro benzenes.

(iii) Acetanilide to p-nitroacetanilides &

(iv) Paraffins.

Continuous and batch nitration.

(B) Amination by reduction : Methods of reduction by metal, acid, hydrogen, sulphide, alkalisulphite, metal hydrides, sodium metal, cathodic reduction, Manufacture of aniline, m-nitroaniline & p-aminophenol.

Unit II **Halogenation & Sulphonation**

(A)Halogenation : Introduction, kinetics and reagents of halogenation, Nuclear and side chain aromatic halogenation. Manufacture of chlorobenzene, chloral, monochloroacetic acid and dichlorofluoromethane.

(B)Sulphonation : Introduction, sulphoning agents, factors affecting sulphonation. Sulphonation of benzene, alkyl benzene and naphthalene. Batch and continuous sulphonation.

Unit III **Oxidation and Hydrogenation**

(A) Oxidation : Introduction, various oxidising agents, mechanism and kinetics of oxidation, liquid and vapour phase oxidation, Manufacture of banzoic acid, maleic anhydride, acetaldehyde and acetic acid.

(B) Hydrogenation : Introduction, Kinetics and thermodynamics, various catalysts used for hydrogenation. Hydrogenation of vegetable oil and manufacture of methanol from carbon monoxide and hydrogen.

Unit IV **Alkylation and Aminolysis**

(A) Alkylation : Introduction, alkylating agents, thermodynamics and mechanism of alkylation. Manufactures of alkylbenzene (for detergent manufacture), ethylbenzene, phenyl ethyl alcohol.

(b) Aminolysis : Introduction, aminating agents, factors aftecting aminolysis,

Unit V **Esterification and Hydrolysis**

(A) Esterification : Introduction, Kinetics and thermodynamics of esterification. Esterification of organic acids using unsaturated

compounds. Manufacture of ethyl acetate, vinyl acetate and cellulose acetate.

(B) Hydrolysis : Introduction, Kinetics, thermodynamics and mechanism of hydrolysis and various hydrolysis agents.

Paper-VI

Industrial Pollution and Control Measures

Unit I **Water Pollution Due to Industrial Effluents.**

Classification of Water : Sea Water, Surface Water (River, Lake Pond) and ground water (Well, Tube Well, Stream) ; their properties in brief.

Water quality parameters : pH, Hardness, alkalinity, acidity, TDS, DO, COD and BOD. IS and WHO standards of water quality.

Inorganic Pollutants e.g. Heavy metals, Pb, Hg, As Cd Cr, Ni, Cu mineral acids, alkalis, nitrates, Sulphides fluorides, phosphates etc and their sources (Inorganic based industries).

Organic Pollutants, e.g. Phenols, detergents, dyes, pesticides oils, greases etc. and their sources (organic based industries); Effects of these pollutants on water quality.

Water Pollution Monitoring : Methods of Collection of water samples from water bodies and industrial effluents and assessment of water qualities like pH, DO, Hardness, BOD. Determination of Phenol and fluorides in water. **Case studies** - water Pollution due to paper and sugar industries.

Unit II **Water and Waste Water Treatment.**

(A) **Water Treatment**

Methods for water treatment : Sedimentation, filtration, coagulation, steralisation.

(B) **Waste Water Treatment**

Industrial and sewage waste water Treatments : Primary secondary and tertiary treatment.

Biological Methods : Aerobic, anaerobic, trickling filter & activated sludge.

Chemical Methods for Inorganic Chemicals : Precipitation, electrodialysis, ion-exchange, evaporation & adsorption.

Unit III **Air Pollution Due to Industries.**

Classification of Air Pollutants - Primary and Secondary pollutants e.g. oxides of carbon, sulfur, nitrogen, hydro carbon and particulates.

Industries as source of air Pollution - Steel industries, Fertilizer industries, Thermal power plants, refineries, paper and pulp industries, metallurgical and mining operations.

Methods of control of Air Pollution - Electrostatic precipitators, scrubbing, filters mist eliminator.

Harmful effects of air pollutants on human being, plants and materials. Green House effect (global warming).

Air Pollution Monitoring - Methods of collection of air samples, SPM and determination of air pollutants like SO2, NOx and solid particulate matter (SPM).

Case Studies - Air pollution due to thermal power plants and Paper Industry.

Source of noise pollution, units of noise level and control.

Unit IV **Industrial Solid Waste & Treatment Processes.**

(A) Introduction, types of Industrial solid wastes, methods of Industrial solid waste treatment & disposal.

(i) Composting.
(ii) Sanitary Land-fills.
(iii) Thermal Process (Inclineration & Pyrolysis)
(iv) Recycling & reure.

(B) **Hazards Waste.**

Types, radioactive waste, biomedical waste and non- radioactive wastes. Containing toxic & heavy metals. Methods of their disposal.

Unit V **Process Equipments.**

(A) **Thermometer** - Glass, bimetallic, pressure spring, resistance & radiation pyrometer.

(B) **Pressure** - Manometer, barometer, pressure gauge,

diphargm, Macleon & Pirani gauges.

(C) **Liquid Level** - Direct & indirect liquid level measurements, float type liquid level gauge, ultrasonic level gauge. (Contruction & working)

Practicals

Section - I

Unit Process - Synthesis of organic compounds involving the following processes.

Nitration, sulphonation, esterification, hydrolysis, reduction, halogenation, reduction, polymerisation reactions of diazonium salt.

Section-II

1 To determine temporary & permanent hardness of water sample.
2. To determine TDS (Total dissolved solid) & acidity/alkalinity of water sample.
3. To find DO of given sample of water.
4. To find BOD of given sample of water.
5. To find COD of given sample of water.
6. To determine Ca in cement by complexometric titration.
7. To determine SiO2 in cement by Gravimetric method.
8. Determination of Zn in brass by EDTA titration.
9. Determination of Al in Al alloy by Al-oxinate gravimetric method.
10. Determination of Fe / Cr in stainless steel.
11. Determination of SPM in air sample using high volume sampler.
12. Determination of SO2 in air sample by colorimetry .

LIST OF BOOKS

1. Environmental Chemistry by S.S. Dara, S.Chand & Camp.
2. Environmental Chemistry by A.K.De.
3. Environmental Chemistry by Tagi & Mehra.
4. Environmental Chemistry by Moor & Moor.
5. Industrial Chemistry by B.K.Sharma.
6. Pollution Monitoring and control by Editor - in - Chief :Dr.Priya Ranjan Trivedi.
7. Material Science & Metallurgy by O.P.Khanna.
8. Engineering Metals by Rungwala.
9. Unit process in organic synthesis by Groggins.

10. Environmental Protechion and Law (Manual)
11. Effluent Treatment and Waste disporal Inst. of Chem. Engg.
12. Effluent treatment and disposal of chem.Engg.
13. Systems approch to Air pollution control by R.J. Bibbero and J.G.Young.
14. Air Pollution Vol. I-IV, by A.C. Stern.
15. Gas Purification Process for Air Pollution control G Nonhebet Newnes-Butterwoths, London.
16. Air Pollution Technology, Painter D.E. Reston, Publishing Co.
17. Industrial Instruments D.P.Eckman, Jon-Wiley & Sons.
18. Instrumentation and control for the process Industries S.Sorer, Elsevier Applied Science.
19. Chemical Engineer, Hand Book J.H.Perry & D.Green B. Mc.Gram Hill Publishing Co. New York.
20. NEERI Manual.

11. PETROCHEMICAL SCIENCE

The syllabus is based on six theory periods and six practical periods per week.

The examination in Petrochemical Science will comprise of two theory papers and a practical. Each theory paper shall be of three hours duration and carry 60 Marks. The practical shall be of six hours duration and shall carry 30 marks. The distribution of practical marks shall be as follows :

1.	Record	5 Marks
2.	Viva-Voce	10 Marks
3.	Exercise	15 Marks
	Total :	30 Marks

PAPER - III

Petrochemical Science - I

Unit I Thermal & catalytic processes : Introduction; Thermodynamics of thermal stability of hydrocarbons with reference to the elements; Thermal cracking, visbreaking, pyrolysis, and coking : Relative study

with referene to feed stocks, products, operating conditions.

Unit II Thermal and catalytic cracking : mechanism, feedstocks, catalyst details, operating parameters and their effects; product pattern, catalyst deactivation and regeneration.

Unit III Recovery of ethylene from cracked gases, properties of ethylene, its storage, safety aspects; various petrochemicals obtained form ethylene through different unit processes and polymer products (no details of manufacturing processes)

Unit IV Vinyl chloride monomer by direct chlorination of ethane, oxychlorination of ethylene and balanced route ; Acetaldehyde by oxidation of ethyl alcohol, (Wacker process), Union Carbide process from ethylene, Lummus Process from ethane; Vinyl Acetate monomer from acetylene and ethylene, role of pdcl an CuCl2 and Celanese Process.

Unit V Manufacture, properties and uses of oxide derivatives like ethylene oxide, ethylene glycols, ethanol and ethanol amines.Ethylene oxide by direct oxidation and chlorhydrin process; Ethylene oxide hydrolysis; catalytic and non-catalytic, role of excess water and dilute sulpuric acid. Ethanol amine manufactures, properties and uses.

PAPER-IV

Petrochemical Science-II

Unit I Recovery of propane and propylene from refinery and cracked gases, their properties, storage and safety; Manufacture of propylene from ethylene; Relative yields of ethylene and propylene from different sources, Important derivatives of propylene based on unit processes.

Unit II Isopropyl alcohol by direct and catalytic hydration, details of Texaco process; Acetone from isopropyl alcohol, side reactions; propylene oxide through chlorohydrin process, disadvantages and side reactions in direct of oxidation.

Unit III Oligomerization of propylene to trimer and tetramaer, importance for detergents, polymer gasoline, alkylation;catalysts used and details of Dimersol-processes.

Unit IV Butanol manufacture through oxoprocesses by conventional and new process, their relative comparison based on feed, operating parameters catalysts etc; Relative studies of ethylene and propylen as petrochemical feed stocks, manufacture of linear alkene and linear

primary alcohols.

Unit V Acrylic acid : By carbonylation of acetone, air oxidation of propylene, chlorohydrin route and extension of Wacker process for its manufacture, details of catalyst and operating conditions; Details of production of Esters of acrylic acides, acrylamide Acrolonitrile manufacture with respect to chemistry, catalyst, optimum conditions, product pattern, chemistry, catalyst, process details

(Note : The subject should be taught giving elobrated consideration to thermodynamics, kinetics, mechanism, catalyst involved, process conditions, type of reactors and separation and purification of the product.)

BOOKS RECOMMENDED - B.Sc.Part-II :

1. Goldstein and Waddam : The Petroleum Chemical Industry.
2. Bhaskar Rao : A Text on Petrochemicals, Khanna Publishers.
3. Sukumar Maiti : Introduction to Petrochemicals, Oxford and IBH, Bombay.
4. Robert Richard Kinghorn : An introduction to the Physics and Chemistry of Petroleum; John Wiley & Sons.
5. Ludwig Kniel, Olafwinter, Karl Stork ; Ethylele Keysolene to the Petrochemical Industry.
6. Ethylene & its industrial derivative, S.A.Miler.

PRACTICAL

1. ASTM Distillation of petroleum product.
2. Viscosity determination & Viscosity Index determination.
3. Oil in wax determination in given wax sample.
4. Water determination in given oil sample.
5. Reid vapour pressure of volatile petroleum sample.
6. Ductility of bitumenous product.
7. Penetration Index of petroleum products.
8. Copper corrosion test for petroleum product.
9. Melting point determination of wax sample by various methods.
10. Conggeling point determination of wax sample.
11. Determination of crankcase oil dilution.
12. Viscosity by Redwood method.

BOOKS RECOMMENDED -

1. Institute of Petroleum Handbook Volume I.
2. Institute of Petroleum Handbook Volume II.

LIST OF APPARATUS AND EQUIPMENTS REQUIRED FOR A BATCH OF TWENTY STUDENTS FOR B.SC.I,II & FINAL FOR PETROCHEMICAL SCIENCE.

Sr. No.	Name	Minimum Quantity Required
1.	Burette	20 Nos.
2.	Pipette 10 ml, 25 ml	20 Nos. each
3.	Mohr Pipette 2 ml, 5 ml,	10 Nos. each
4.	Conical Flasks with stoppers	50 Nos.
5.	Standard volumetric flasks	20 Nos.
6.	Density bottle	20 Nos.
7.	Balance (Electronics / Digital)	02 Nos.
8.	Aniline point apparatus	01 No.
9.	U-tube viscometers of different capillary size	02 sets
10.	Thermometer (0 to 110 0c IP Grade)	10 No.
11.	Thermometer (0 to 360 0c IP Grade)	06 Nos.
12.	Test tube (20 ml and 50 ml with rubber cork	50 Nos.
13.	Smoke point apparatus (IP Grade)	01 No.
14.	Abel Flash point Apparatus (IP Grade)	01 No.
15.	Pensky Martens Flash point Apparatus	01 No.
16.	Clevaland Open cup Flash point Apparatus	01 No.
17.	Poroceline Disc	10 Nos.
18.	Constant Temparature Bath	02 Nos.
19.	Hot plate	01 No.
20.	Air condensor	20 No.
21.	Glass tubing 6mm, 10mm	20 Ft. Each
22.	Glass rod 4mm, 8mm	20 Ft. Each
23.	Stop Watches	04 No.
24.	LPG Cylinder with regulator	01 No.
25.	Refractometer	01 No.
26.	Refrigerator	01 No.
27.	Water Distillation Plant	01 No.
28.	Beaker 250 ml	20 No.
29.	Beaker 50 ml, 100 ml, 500 ml, 1000 ml	7 No.each
30.	Hot air oven	1 No.

31.	Heating Furnace	1 No.
32.	Karl Fisher Autotitrator	1 No.
33.	Dean and Stark apparatus	1 No.
34.	Flame Photometer	1 No.
35.	Colorimeter	1 No.
36.	Bomb Calorimeter	1 No.
37.	Spectrophotometer	1 No.
38.	Oxygen Cylinder with pressure regulating valve	1 No
40.	Vacuum pump	1 No.
41.	Air source	1 No.
42.	Air flowmeter	1 No.
43.	Desiccators	6 Nos.
44.	Water Suction	4 Nos.
45.	Filtration Flask with buckner funnels	
	100 ml	6 Nos.
	250 ml	6 Nos.
	500 ml	3 Nos.
46.	Heating Mental	6 Nos.
47.	ASTM Distillation Apparatus	1 No.
48.	Viscometer and Constant temparature bath viscometer	1 set of
49.	Apparatus for oil determination in given sample As per IP norm	1 No.
50.	Dean and stark method	1 No.
51.	Reid vapour pressure apparatus with const. temp. bath	1 No.
52.	Ductility measuring meter	1 No.
53.	Penetrometer	
54.	Copper corrosion test apparatus	1 No.
55.	Cooling curve apparatus	1 No.
56.	Crankcase oil ditution apparatus	1 No.
57.	Thermometer as per IP norm for above apparatus and methods	2 Each
58.	Redwood viscometer No.I & No.II	1 No.each

(Note : All equipment and apparatus should be of IP standard.)

* * *

12. PHYSICS
(Implemented from the Session 2004-2005)

The Examination in Physics will comprise of THREE theory papers and a practical examination. Each theory paper will be of THREE hours duration and carries 40 marks. The practical Examination will be of six hours duration and carries 30 marks. The distribution of marks for practical examination is as follows:

Experiments (Two Experiments)	18 Marks
(Nine marks for each Experiment)	
Sessional Record Book	06 Marks
Viva-Voce	06 Marks
Total :	30 Marks

Paper-IV
(Oscillations, Motion of charged particles, Electric currents)

UNIT-I : **Oscillations-I :-** Potential well and Periodic Oscillations : Case of harmonic oscillations, differential equation and its solution, kinetic and potential energy. Examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, torsional pendulum, bifilar oscillation, Helmoltz's resonator, LC-circuit, vibrations of a magnet, oscillation of two masses connected by a spring.

UNIT-II : **Oscillations-II:-** Superposition of two simple harmonic motion of the same frequencies along the same line, interference, super position of two mutually perpendicular simple harmonic vibrations of the same frequencies, Lissajous figures.
Two coupled oscillators, normal modes, N coupled oscillators, damped harmonic oscillations, forced harmonic oscillations, transient and steady states, power absorption, resonance in a system.

UNIT-III : **Motion of Charged Particles in Electric and Magnetic fields :** (Note : The emphasis should be on Mechanical aspects, and not on the details of the apparatus mentioned which indicated as applications of principles involved.)
Ó as an accelerating field : electron gun, case of discharge tube, linear accelerator (linac). Ó as a deflecting field : CRO, sensitivity. Transverse magnetic field : Mass spectrograph,

velocity selector, curvatures of tracks for energy determination of nuclear particles, Principle of cyclotron. Mutually perpendicular Ó and B fields : velocity selector, its resolution.

UNIT-IV : **Varying Currents :** Steady currents, current density J, non steady current and continuity equation, Kirchoff's laws and analysis of multiloop circuits, Rise and decay of currents in LR, CR circuits, transient in LCR circuit.

UNIT-V : **Alternating Currents :** A.C. currents, complex numbers, and their applications in solving A.C. circuits, pure R, L, C and their combinations, reactance and impedance, series and parallel resonance, Q.factor, power consumbed by A.C. circuit, power factor. Self and mutual inductance, theory of transformer and energy losses in transformer.

Reference Books :

1) Oscillations waves, D.P.Khandelwal (Himalaya Publishing House, Bombay)
2) Mathematics of wave and vibrations, R.K.Ghosh, Mcmilan, 1975.
3) Berkeley physics course, Vol.1, Mechanics E.M. Purcell, (McGraw Hill)
4) Mechanics, D.S.Mathur.
5) Electricity and Magnetism, D.N.Vasudeva.
6) Electricity and Magnetism, Brijlal and Subramaniam.
7) A text book of first year physics, M.K.Bagde and S.P.Singhs. S.Chand and Company Ltd.
8) Electrodynamic, S.L. Gupta and R.Singh, Pragati Prakashan, Merrut.

Paper -V
(Quantum Mechanics and Solid State Physics)

UNIT-I : **Origin of Quantum Theory :-** Failure of Classical Physics to explain phenomenon such as black body spectrum; photoelectric effect. Planck's hypothesis; Einstein's explanation of photo electric effect. Bohr's quantization of angular momentum and its application to hydrogen atom, limitations of Bohr's theory, wave particle duality; de-Broglie hypothesis of matter waves, wave velocity & Group velocity; evidence for diffraction of electrons & neutrons. Davisson & Germer's experiment.

UNIT-II : **Consequence of De-Broglie Wave Concept :-** Bohr's quantum conditions, wave packets; Heisenberg's uncertainty relation for momentum & position; extension to energy & time.

Consequence of Uncertainty relations :- Gamma Ray microscope; diffraction at a slit; Non-existance of electron in the nucleus.

Postulatory Basis of Quantum Mechanics; Schrodinger equations for a free particle; Physical significance of wave function; Normalization of wave function.

UNIT-III : **Applications of Schrodinger Equation :** Operators for momentum, & Energy, Hamiltonian operator; expectation values.

Applications of Schrodinger equation to a particle in one & three dimensional boxes; Harmonic Oscillator; Hydrogen atom (only radial part).

UNIT-IV : **Crystal Structure :** Periodicity; Space lattices & bases; fundamental translation vectors; unit cell; Bravais lattices; Wigner-Seitz cell; allowed rotations; lattice planes; Miller Indices; Co-ordination numbers; determination of lattice parameter using Avagadro's number & density. Diffraction of X-rays; Bragg's Law.

Magnetism : Atomic magnetic moment, magnetic susceptibility, Diamagnetism, Paramagnetism and Ferromagnetism (Concept only).

UNIT-V : **Thermal Properties :-** Lattice Vibrations; Simple harmonic oscillator; vibrations of one dimensional mono-atomic chain under harmonic & nearest neighbour interaction approximation; concept of phonons, density of modes (1-D); Debye model, lattice specific heat; low temperature limit.

Band Structure :- Electron in periodic potential; nearly free electron model (qualitative); energy bands, energy gap; metals, insulators & semiconductors.

Motion of electron : Free electrons; conduction electrons, electron collision; mean free path, conductivity & Ohm's law; density of states; Fermi energy; Fermi velocity.

Reference Books :

1. Quantum physics of atoms, molecules, solids, nuclei and particles - Eisenberg & Resnik (John Wiley)
2. Modern Quantum Mechanics - J.J.Sakurai.
3. Quantum Mechanics - S.L.Gupta, V.Kumar, H.V.Sharma, R.C.Sharma.
4. A text book of Quantum Mechancs- P.M.Mathews, K.Venkatesan
5. Quantum Mechanics - Ghatak, Loknathan.

6. Quantum Mechanics - P.T.Mathews
7. Quantum Mechanics - S.P.Singh, M.K.Bagde.
8. Quantum Mechanics - G.R.Chatwal, S.K.Anand.
9. Quantum Mechanics - Satya Prakash, C.K.Singh.
10. Quantum Mechanics - John L. Powell, Bernd Cresemann.
11. Introduction to Solid State Physics - C.Kittel (John Wiley)
12. Solid State Physics - J.S.Blackmoore.
13. Solid State Physics - A.K.Dekkar
14. Solid State Physics - N.W.Ascroft, N.D.Mermin
15. Solid State Physics - Kachhava
16. Solid State Physics - R.L.Singhal
17. Elements of wave mechanics & Solid State Physics - Kale, Dharmadhikari, Soman.

Paper -VI
(Mathematical Background, Electrostatics, Magnetostatics and Time Varying fields)

UNIT-I : **Mathematical Background :-** Scalars and Vectors, dot and cross product, vector differentiation, Gradient, divergence and curl of a vector field and their physical interpretation, Line, Surface and Volume integrals, flux of a vector field, Gauss's divergence theorem, Green's theorem, Stoke's theorem.

UNIT-II : **Electrostatistics-I :** Coulomb's law in vector form, calculation of electric field (E) for distribution of charge, dipole and quadrapole fields, work done on charge in electrostatic field expressed as line integral, conservative nature of electrostatic field, electric potential ϕ, $E = \nabla\phi$, Torque on dipole in uniform electric field and its energy, flux of electric field, Gauss's ;aw. Its application to i) Electric field intensity due to symmetric charge disribution on sphere ii) Electric field intensity on a surface of a conductor.

UNIT-III : **Electrostatistics-II :** Isolated conductor, force per unit area of a conductor in an electric field, conducting sphere in uniform field, capacitor, electrostatic field energy in capacitor, parallel plate capacitor, dielectric, dielectric constant, polarisation in dielectric, polarisation vector, displacement vector D, molecular field and Clausius Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogeneous dielectrics.

UNIT-IV : Magnetostatics : Force on moving charge, Lorentz force equation and defination of B, force on a straight conductor carrying current in uniform magnetic field, magnetic dipole moment, Angular momentum and Gyromagnetic ratio.

Biot - Savart's law, Ampere's law and its applications, field due to magnetic dipole, magnetisation current, magnetisation vector, magnetic permeability (linear cases).

UNIT-V : Time Varying field and Electromagnetic waves : Electromagnetic induction, Faraday's law, integral and differential form of Faraday's law, displacement current and Maxwell's equations.

Wave equations satisfied by E and B, Plane electromagnetic wave in vacuum, Energy density, Poynting vector, Poynting Theorem.

Reference Books :

1) Electricity and Magnetism Vol-II, Berkley Physics Course - Ed. E.M.Purcell (McGraw Hill)
2) Physics Vol-2, Resnik & Halliday.
3) Introduction to Electrodynamics - D.J.Griffits (PHI)
4) Electricity and Magnetism - Reitz & Millford (Addison Wesley)
5) Electricity and Magnetism - A.S.Mahajan & A.A.Rangwala (TMH)
6) Electromagnetic Fields- A.M.Portis
7) Principles of Electricity and Magnetism - Pugh & Pugh Addison Wesley)
8) Classical Electricity and Magnetism - Panofsky & Phillips (India Book House)
9) Electricity and Magnetism - S.S.Atwood (Dover)
10) Electromagnetics - B.B.Laud
11) Electrodynamics - S.L.Gupta, V.Kumar, S.P.Singh (Pragati Prakashan)
12) Electromagnetic waves and Radiating systems - EC Jordan, Prentice Hall of India Ltd. New Delhi.

List of Experiments : (Every student will have to perform at least 20 experiments from the following list. At the time of examination, each student will have to perform 2 expts.)

1) Temperature of flame by reversal of spectral lines.
2) Determination of temperature coefficient of resistance of platinum using platinum resistance thermometer.
3) Veriation of thermo e.m.f. with temperature.
4) Activation energy of thermister.

5) Study of statistical distribution on nuclear disintegration data (GM counter used as black box)
6) Characteristics of microphone and loud speaker system.
7) Speed of waves on streched strings.
8) Measurement of velocity of ultrasonic waves.
9) To show that frequency of Helmholtz resonator varies inversely with square root of air coloumn.
10) Determination of charge sensitivity of ballastic galvanometer.
11) Measurement of low resistance by Carry-foster bridge.
12) Measurement of low resistance by potentiometer.
13) Measurement of inductance by phaser diagram method.
14) Measurement of capacitance by phaser diagram method.
15) Study of frequency resonance of series LCR circuit and determination of Q-factor.
16) Determination of dielectric constant of solid.
17) Determination of dielectric constant of liquid and its variation with temperature.
18) To study behaviour of R.C.circuit as a filter.
19) To determine high resistance by universal shunt.
20) To determine high resistance by leakage method.
21) C_1 / C_2 by De-Sauty's method.
22) Varification of laws of capacitances.
23) Capacitance by Scherring bridge.
24) Self inductance by bridge rectifier method.
25) Study of transformer.
26) Surface tension of liquid by vibration method.
27) Frequency of a.c. mains by sonometer.
28) Frequency of UHF / VHF oscillator.
29) Dispersive power of prism.
30) Characteristics of a phototransister.
31) Study of LVDT.
32) Varification of Kirchoff's law, using electrical network.
33) Varification of Maximum power transfer theorem.
34) Varification of Thevenin's theorem.
35) Varification of Norton's theorem.
36) Varification of Milliman's theorem.
37) Varification of Star-Delta transformation.
38) Elementary Fortran Programes, flow charts and their interpretations.
39) To print out all natural even/odd numbers.
40) To evaluate sum of finite series using Fortran Programes.

41) To find "N" elements of Fibonacei series.
42) To find out roots of quadratic equation by Fortrans prog

List of equipment/Apparatus required for physics practical.

Sr. No.	Name of apparatus/Unit	Mainimum requirement
1.	Optical bench	1
2.	Research optical bench	1
3.	Convex lenses	4
4.	Bipirsm	1
5.	Prism	6
6.	Double image prism	2
7.	Sodium Lamps Complete	2
8.	Newton's ring apparatus	1
9.	diffraction grating	2
10.	Spectrometer	4
11.	Adjustable slits	4
12.	Microscope (Travelling) vertical Horizontal	4
13.	Telescope	4
14.	Potentiometer	2
15.	Resistance box -- 1 - 500	3
	1 - 5000	3
	1 - 10,000	2
	Fractional	2
16.	Two way plug keys	5
17.	Rheostats	6
18.	Galvanometers	3
19.	Battery eliminator (Variable)	7
20.	Ammeter	4
21.	Voltmeter	4
22.	Multimeter	8
23.	Leclanche's cell	3
24.	Plug key	10
25.	Tap key	6
26.	Carry Foster's bridge	3
27.	Thermocouple	1
28.	Hot water bath	2
29.	Ballistic galvanometer	2
30.	Transformer	4

31.	Mercury Lamps	1
32.	Standard resistance - 1	2
33.	Charge - discharge dy for absolute capacity	1
34.	Inductances . 01 H	2
	5 H	2
35.	Oscillator (A. F.)	5
36.	Oscillator (R. F.)	2
37.	Connecting wire	1 kg.
38.	V.T.V.M.	5
39.	C.R.O.	1
40.	Dimerstate	1
41.	Fixed condenser	4
42.	Babinet compensator	
43.	Polarimeter	
44.	Bar pendulum	1
45.	Stop watches	6
46.	Meter Scale	6
47.	G. clamps	4
48.	Knife edges	4
49.	Metal bars	3
50.	Vernier callipers	3
51.	Maxwell's needle for 'n' apparatus	1
52.	Ring disc (Dynamics) apparatus	1
53.	Poisullie's flow apparatus complete	1
54.	Thermometers 0 - 1100	5
55.	Steam traps (glass)	4
56.	Stands	5
57.	Weight boxes	6
58.	Helmholtz resonator	1
59.	Tunning forks set	1
60.	Frequency of A.C. mains apparatus	1
61.	Measuring cylinders 200 ml.	2
62.	Thomon's tube for e/m	1
63.	Milikan's apparatus	1
64.	X- ray diffraction pattern b c c powder	1
65.	Study board of power supply	1
66.	Study board of wein's bridge oscillator	1
67.	G.M. counter experiment set	1
68.	Study board of half adder/ full adder	1
69.	Study board of logic gates	1

70.	Study board of "Characteristics of Phototransistor"	1
71.	Study board of NOR gates and switching characteristics	1
72.	Study board of NAND gate and switching characteristics	1
73.	Study board of Sequential logic FF	1
74.	Study board of Sequential logic RS FF	1
75.	Study board of Sequential logic C RSFF	1
76.	Study board of Sequential logic J K FF	1
77.	Sutdy board of Op-Amp as differentiater	1
78.	Study board of Op-Amp as an integrator	1
79.	Study board of Op-Amp as an inverting amplifiers	1
80.	Study board Op-Amp as an Non-inverting amplifiers.	1
81.	Study of monostable mulitvibrator	1
82.	Study of bistal multivibrator	1
83.	Study of Astable multivibrator	1
84.	Study of MOPA	1
85.	Study of VHF oscillator	1
86.	Study of diode detector	1
87.	Study of amplitude modulator	1
88.	Study of TRF receiver	1
89.	Study of super herrodyne receiver	1
90.	Digital power supply (Dual type) +15 to-15	1
91.	P-N-diode	2
92.	Apparatus of I-H curve	1
93.	Study board for diode as rectifier	1
94.	Study board for Thevinin's theorem	1
95.	Study board for Millman's theorem	1
96.	Study of Activation energy of thermister	1
97.	Study board owen's bridge	1
98.	Study board for maximum power transfer theorem	1
99.	'Y' by bending apparatus	1
100.	Thermal conductivity of rubber tube cyparatus	1
101.	'n' by stastical method apparatus	1
102.	Keler's Pendulum	1

103.	Zener Diode expt.set	1
104.	Set for study of Star Delta Transformation	1
105.	Study of Multirange Voltmeter	1
106.	Study of Multirange ammeter	1
107.	Study of Series and Shunt Ohmmeter	1
108.	Screw Guage	3
109.	Study of Phase Shift Oscillator	1
110.	Study of Crystal Controlled Oscillator.	1
111.	Plank's Constant Apparatus	1
112.	'e/n' by Thomson's Apparatus	1
113.	Four Probe Apparatus.	1
114.	Crystal Models to Study Point Symmetry	1

* * *

13. Chemistry

(Effective from the Session 2004-2005)

There shall be following papers and practicals for B.Sc.Part-II examination.

There shall be three compulsory papers in theory as stated below and practical examination extending for 8 hours. Every examinee shall offer the following three papers of 40 marks each and practical examination of 30 marks.

1)	Paper-IV :	Inorganic Chemistry	40 Marks
2)	Paper-V :	Organic Chemistry	40 Marks
3)	Paper-VI :	Physical Chemistry	40 Marks
	Practical :		30 Marks
		Total :	150 Marks

The practical examination will be in the above three Branches of Chemistry. The Distribution of marks shall be as follows.

a)	Inorganic Chemistry (Exercise)	08 Marks
b)	Organic Chemistry (Exercise)	08 Marks
c)	Physical Chemistry (Exercise)	08 Marks
d)	Record	03 Marks
e)	Viva	03 Marks
	Total :	30 Marks

Paper-IV

(Inorganic Chemistry)

Total Lectures : **60** ***Marks :*** **40**

Note : Figures to the right hand side indicates number of Lectures.

UNIT I

A] Covalent Bonding : [8]

Directional nature of covalent bond. Different types of hybridizaion schemes to explain geometrical shapes of molecules and ions namely BeF_2, BF_3, NH_4^+, CH_4, PCl_5, SF_6 and IF_7. Limitations of valence bond theory, Molecular orbital theory. Postulates of MO theory. LCAO approximation . Formation of bonding and antibonding MOs. Rules for LCAO. Homonuclear diatomic molecules- Structure of H_2, N_2 and O_2. Paramagnetic nature of O_2. Stability sequence in O_2 species namely O_2^+, O_2^{2+}, O_2, O_2^-, O_2^{2-}. Relation of stability with bond order. Heteronuclear diatomic molecules - Structure of NO and Coulson's structure of CO. Explanation of properties of CO (namely triple bond, low dipole moment, electron donor and acceptor behaviour) on the basis of MO structure. Band theory to explain nature of conductor, insulator and semiconductor. Comparison of VB theory and MO theory.

B] VSEPR Theory : [4]

Various rules under VSEPR theory to explain molecular geometry. Following examples to be used for explaining different rules :

$BeCl_2$, BF_3, CH_4, PCl_5, SF_6, IF_7, NH_4^+, $SnCl_2$, NH_3, H_2O, SF_4, ClF_3, ICl_2^-, ICl_4^-, BrF_5, XeF_6, SOF_4, CoF_2, PCl_3, PBr_3, PI_3, F_2O, H_2S.

UNIT II

A] Chemistry of Elements of Transition Series : [12]

Characteristic properties of d-block elements. Comparative study of first transition series (3d) elements with respect to electronic configuration, size, ionization energy, metallic nature, oxidation states, magnetic properties, colour of salts, catalytic properties, complex formation behaviour. Introduction to 4d and 5d series and their comparison with '3d' elements with respect to ionic radii, oxidation states, magnetic properties and colour.

UNIT III

A] Lanthanides : [8]

Comparative study of lanthanide elements with respect to

electronicconfiguration, atomic and ionic radii, lanthanide contraction - its cause and effect on lanthanides as well as post lanthanide elements, oxidation states, magnetic properties, colour of salts, complex formation behaviour. Occurrence and isolation of lanthanides by chromatography, solvent extraction and ion exchange methods (only underlying principles expected in all the methods).

B] Actinides : [4]

Comparative study with reference to electronic configuration, Oxidation states. Chemistry of separation of Np, Pu and Am from Uranium. Comparison of Lanthanides and actinides.

UNIT IV

A] Oxidation and Reduction : [6]

Redox potential, analysis of redox cycle. Latimer diagrams for system : ClO_4^- to Cl^-, FeO_4^{2-} to Fe, Cu^{2+} to Cu and O_2 to H_2O .

B] Extraction of Elements : [5]

Principles involved in extraction of elements-Factors influencing the choice of extraction process. Thermodynamics of reduction processes - Ellingham diagram for oxides and its importance. General principles of metallurgy-Ore dressing (concentration), calcination, roasting, smelting, refining of metals.

UNIT V

A] Theory of quantitative inorganic analysis - volumetric Analysis : [7]

1) ***Important Terms :***

Primary standard, requirement of primary standards, standard solution, molarity, molality, normality, mole fraction. (problems not expected)

2) ***Acid-base titration :***

Concept of variation of pH during titration. Acid-base indicators. Choice of suitable indicators on the basis of indicator range and pH near equivalence point for different acid base titrations.

3) ***Redox Titrations :***

General principles (namely redox reaction between oxidant and reductant), indicators used in redox titrations. Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$ as oxidizing agents (in acidic medium) in redox titrations. Use of iodine in iodometric and iodimetric titrations involving use of starch as indicator.

B] Theory of Quantitative Inorganic Analysis - Gravimetric Analysis : [5]

Various steps (namely precipitation, digestion, filtration, washing, incineration, weighing) involved in gravimetric analysis with reference to estimation of barium sulphate. Theory of precipitation, co-precipitation and post-precipitation.

Paper-V (Organic Chemistry)

Total Lectures : **60** ***Marks :*** **40**

UNIT I ALDEHYDES AND KETONES

A] Aliphatic and aromatic (Acetaldehyde, Benzaldehyde, Acetone, Acetophenone) : [12]

Their methods of synthesis and physical properties. Chemical reactivity of carbonyl group. Nucleophilic addition reactions. Reformasky, witting, Mannich reaction. Relative reactivity of aldehyde and ketones(acetaldehyde and acetone). Acidity of α-hydrogen in carbonyl compounds. Formation and reactions of enolates- Perkin, Knoevengel reaction, benzoin, Reduction reactions, MPV, Clemenson, Wolff-Kishner, $LiAlH_4$, $NaBH_4$, reductions. Halogenation of enolizabde ketones.

UNIT II

A] Carboxylic Acids : [7]

Introduction structure and reactivity of carboxylic groups. Methods of synthesis and chemical reactivity of benzoic, phthalic, oxalic, lactic, maleic and fumaric acids.

B] Carboxylic Acid Derivatives : [5]

Acid chlorides, esters and amides. Preparation and reactions of acetyl chloride, benzoyl chloride, acetamide benzamide ethyl acetate and methyl salicylate.

UNIT III

A] Organic Synthesis Via Enolates : [6]

Definition of reactive methylene group, Synthesis and applications of malonic ester and acetoacetic ester. Keto-enol tautomerism. Mechanism of claisen condensation.

B] Polynuclear Hydrocarbons : [6]

Introduction, orbital picture of naphthalene. Mechanism and orientation of electrophilic substitution in naphthalene. Preparation and reactions of naphthols and naphthylamines.

UNIT IV

A] Aromatic Nitro Compounds : [3]

Introduction, methods of synthesis (Nitration and different nitrating agents). Reduction of aromatic nitro compounds under different conditions, applications.

B] Amino Compounds : [6]

Introduction basicity and effect of substituents. Methods of preparation of Arylamines by reduction of Nitro compound and nitriles, reductive amination of aldehyde and ketonic compounds, Hoffmann bromamide reaction. Properties of aniline. Hoffmann's exhaustic methylation and elimination.

C] Diazonium Salts : [3]

Diazotization its mechanicm synthetic applications of benzene diazonium halide. Mechanism of benzidine rearrangement.

UNIT V

CARBOHYDRATES, AMINO ACID PEPTIDES, PROTEINS AND NUCLEIC ACID.

A] CARBOHYDRATES [7]

Introduction, constitution of glucose, cyclic structure, pyranose and furanose structure. Determination of ring size. Haworth projection formula. Conformation of glucose. Epimerization. Chain lengthening and chain shortening in aldose. Interconversion of aldose and ketose. Introduction to fructose, ribose, 2-deoxyribose, maltose, sucrose, starch and cellulose (their structure only, determination not expected).

B] Amino aicd and Proteins : [3]

Classification of amino acids, Methods of synthesis and reaction on 2 amino acids, zwitterion structure. Isoelectric point, peptide synthesis, structure determination of polypeptides by end group analysis.

C] Nucleic acid : [2]

Nucleic acid, intorduction, constituents of nucleic acid. Ribonuclotides, Ribonuclosides. Double helicle structure of DNA.

Paper-VI

(Physical Chemistry)

Total Lectures : **60** ***Marks :*** **40**

UNIT I

THERMODYNAMICS - I [12]

Definition of thermodynamic terms : System, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic processes. Concept of heat and work. Second Law of Thermodynamics : Need of second law, different

statements of the law. Carnot's cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy, entropy as a state function, physical significance of entropy, entropy as function of V and T, entropy as a function of P and T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Numerical problems.

UNIT II

THERMODYNAMIC AND CHEMICAL EQUILIBRIUM [12]

Gibbs and Helmholtz functions : Gibbs function (G) and Helmholtz function (A), as thermodynamic quantities. A and G as criteria for thermodynamic equilibrium and spontaneity, their advantages over entropy change, Variation of G and A with P, V and T. Derivation of Gibbs-Helmholtz equation and its applications. Third law of thermodynamics, Nernst heat theorem, evaluation of absolute entropy from heat capacity data. Chemical potential, Gibbs-Duhem equation. Thermodynamic derivation of law of mass action. Vant Hoff's reaction isotherm, Equilibrium constant and free energy. Kp, Kc and Kx and their relationship. Vant Hoff's equation and its applications. Le Chatelier's principle. Numerical problems.

UNIT III

PHASE EQUILIBRIUM [12]

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system water and sulphur systems. Phase equilibria of two component system, simple eutectic Pb-Ag system, desilverisation of lead. Liquid-liquid mixtures, ideal liquid mixtures, Raoult's and Henry's law. Partially miscible liquids-phenol-water, triethylamine-water, nicotine water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature, Immiscible liquids. Nearnst distribution law and its applications. Numerical problems.

UNIT IV

ELECTROCHEMISTRY [12]

Electrical transport-conduction in metals and in electrolyte solutions, specific, equivalent and molar conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law. Weak and strong electrolytes, Debye Huckel theory of strong electrolytes. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number,

definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements : determination of degree of dissociation, determination of Ka of acids, determination of solubility product of sparingly soluble salts, conductometric titrations. Numerical problems.

UNIT V

SOLUTIONS, DILUTE SOLUTIONS AND COLLIGATIVE PROPERTIES [12]

Methods of expressing concentrations of solutions. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, by Berkeley-Hartley method, determination of molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties namely Backman's method and Lands-Burgers method. Abnormal molar mass, degree of dissociation and association of solutes.

Practical

A] Inorganic Chemistry Practicals :

Calibration of fractional weights, pipettes and burettes.

i) Gravimetric Estimations :

Gravimetric estimations of Ba^{2+}, Fe^{3+}, Zn^{2+}, Cu^{2+} as CuSCN and Ni^{2+} as Ni^{2+}-DMG. At least three estimations to be performed by the student. Electronic balance or calibrated fractional weight boxes may be used (At least one estimation to be done by using calibrated fractional weight box).

B] Organic Chemistry Practicals :

Complete analysis of a simple organic compound containing one or two functional groups and involving following steps;

1) Preliminary examination.
2) Detection of the elements.
3) Detection of the functional groups.
4) Determination of m.p. / b.p.
5) Preparation of derivative and its m.p./b.p.
6) Performance of spot test if any.

Minimum 12 to 15 compounds containing different groups should be identified by student.

C] Physical Chemistry Practicals :

1) To study distribution of benzoic acid between water and benzene. Determination of molecular state of benzoic acid.
2) To determine partition coefficient of iodine between water and organic solvent.
3) To determine the transition temperature of the given substance by thermometric method (e.g. $MnCl_2.4H_2O$ or $SrBr_2.2H_2O$)
4) To draw the solubility curve of phenol-water system.
5) To determine molar mass of a non-volatile substance by Rast method.
6) To determine the solubility of benzoic acid at different temperature and to determine H of the dissolution process.
7) To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

BOOKS RECOMMENDED for paper-III Inorganic Chemistry.

1. Principle of Inorganic Chemistry-by-Puri,Sharma and Kalia- S. Naginchand & Co.Delhi.
2. Text book of Inorganic Chemistry by A.K. De,Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik,Tuli and Madan S. Chand & Co.
4. Modern Inorganic Chemistry by R.C. Agrawal Kitab Mahal.
5. Instrumental Methods of Analysis by Chatwal & Anand,Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee - Elbs.
7. Inorganic Chemistry by J.E. Huheey-Harper & Row.
8. Fundamental Concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill Book Co.
9. Modern Inorganic Chemistry by W.L. Jolly-McGraw Hill Int.
10. Chemistry Facts, Patterns & Principle by Kneen, Rogers & Simpson Elbs.
11. Theoretical Principle of Inorganic Chemistry by G.S. Manku Tata McGraw Hill.
12. Inorganic Complex Compound by Murmann-Chapman & Hall
13. Text Book of Inorganic Chemistry by K.N. Upadhyaya.Vikas Publishing House,Delhi

14. Advance Practical Inorganic Chemistry by Hurdeep Raj Goel publishing House Meerut.
15. Co-ordination Chemistry by D.Banerjee,TMH publications
16. Text Book of Inorganic Chemistry by Nema, Agrawal, Solanki, Morkhade, Mesharam,Berad.
17. Text Book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.

BOOKS RECOMMENDED for paper IV (Organic Chemistry)

1. Organic Chemistry by R.T. Morrison & R.N. Boyd;6th Edn,Phi
2. Organic Chemistry by Pine 5th Edn.
3. Organic Chemistry Vol,I,II and III by Mukherjee and S.P. Singh.
4. Organic Chemistry by S.K.Ghosh.
5. Reaction Mechnism in Organic Compounds by S.M. Mukherjee and S.P.Singh.
6. Spectroscopy & Mechanism Chemistry by P.S. Kalsi
7. Stereochemistry & Mechanism through solved problems by P.S. Kalsi
8. Organic Chemistry by Twg Solomons 4th Edn.John Wiley.
9. Hand Book of Organic Chemistry Analysis by H.T. Clarke, Arnold Heinmen
10. Text Book of Practical Organic Chemistry by A.L.Vogal
11. Text Book of Organic Chemistry by Wadodkar, Raut, Dighade, Thakre, Kale, Kadu, Chincholkar.
12. Text Book of Organic Chemistry by P.S.Kalsi, published by Macmillan India 1999, Delhi.
13. Practical Organic Chemistry by F.G.Mann.B.C.Saunders, Orient Longman
14. Comprehensive practical Organic Chemistry (Qualitative Analysis) by V.K.Ahluwalia, Sunita Dhingra, Orient Longman.
15. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K.Ahluwalia, Renu Agrawal, Orient Longman.
16. Text Book of Organic Chemistry : Deshmukh, Awinashe, Tayade, Wadekar, Meshram, Parhate, Bokey Prakashan, Amravati.

BOOKS RECOMMENDED for paper V (Physical Chemistry)

1. Physical Chemistry : Walter J.Moore,5th Edn,New Delhi
2. Physical Chemistry : GM Barrow,Magraw Hill,Indian Edn.
3. Principle of Physical Chemistry : Maron and Prutton.

4. Principle of Physical Chemistry : Puri & Sharma.
5. Physical Chemistry : P.W. Atkins 4th Edn.
5. Text Book of Physical Chemistry : PL Sony, OP Dharma.
7. Physical Chemistry : Levine.
8. Practical Physical Chemistry : Palit and De.
9. Practical Physical Chemistry : Yadao
10. Practical Physical Chemistry : Khosla
11. Laboratory Manual of Physical Chemistry : W.J. Popiel
12. Practical Chemistry : Dr.S.B. Lohiya,Bajaj Publ Amt.
13. Text Book of Physical Chemistry by : Doshi, Rane, Mandakmare, Kulkarni,Wagh and Mahajan
14. Text Book of Practical Chemistry by Joshi,Deshmukh.
15. Text Book of Physical Chemistry : Doshi, Patil, Mourya, Jumale, Burghate, Bhangale, Bokey Prakashan, Amravati.
16. Text Book of Practical Chemistry for B.Sc.II : Murarka, Wadekar, Bokey Prakashan, Amravati.

Additional Books suggested for (Theory Courses).

1) Basic Inorganic Chemistry, F.A.Cotton, G. Wilkinson and P.L.Gaus, wiley.
2) Concise Inorganic Chemistry, J.D.Lee, ELBS.
3) Concepts of models of Inorganic Chemistry, B.Duglus, D.McDonial and J.Alexander, John Wiley.
4) Inorganic Chemistry, D.E.Shriver, P.W.Atkins and C.H.Langford, Oxford.
5) Inorganic Chemistry, W.W.Porterfield Addison Wisley.
6) Inorganic Chemistry, A.G.Sharpe, ELBS.
7) Inorganic Chemistry, G.L.Miessler and D.A.Tarr, Prentice Hall.
8) Organic Chemistry, Morrison and Boyd, Prentice Hall.
9) Organic Chemistry, L.G.Wade Jr.Prentice Hall.
10) Fundamentals of Organic Chemistry, Solomon's John Wiley.
11) Organic Chemistry, Volume I, II and III, S.M.Mukherji, S.P.Singh and R.P.Kapoor, Wiley Eastern Limited, (New Age International).
12) Organic Chemistry, F.A.Carey, McGraw Hill, INC.
13) Introduction to Organic Chemistry Streitwieser, Heathcock and Kosover, McMillan.
14) Physical Chemistry, J.M.Baro, International Student Edition, McGraw Hill.
15) Basic Programming with application, V.K.Jain, Tata McGraw Hill.
16) Computer Science Common Sense, R.Hant and Shelly, Prentice Hall.
17) University General Chemistry, C.N.R.Rao, Macmillan.
18) Physical Chemistry, R.A.Alberty, Wiley Eastern Limited.

19) The Element of Physical Chemistry, P.W.Atkins, Oxford.
20) Physical Chemistry through problem, S.K.Dogra and S.Dogra, Wiley Eastern Limited.

*****

List of equipments/Apparatus required for the chemistry practicals for B.Sc.

1.	Abbe;s rerfractometer	2 nos/batch
2.	Viscometer	10 nos/batch
3.	stalagmometer	10 nos/batch
4.	Melting point apparatus	10 nos/batch
5.	Thermometer 0 to 360 c	20 nos/batch
6.	thermometer 0 to 110 c	20 nos/batch
7.	Analytical balance	15 nos/batch
8.	weight box	15 nos/batch
9.	Density bottle	20 nos/batch
10.	Kipp's appratus	02 nos/batch
11.	Quick fit distillation assembly/ Multipurpose assembly	10nos/batch
12.	Sintered glass crucible	20 nos/batch
13.	Silica crucible	20 nos/batch
14.	Vacum suction pump	02 nos/Lab.
15.	Potentiometer	02 nos/batch
16.	Metzer electronic one pan balance	01 nos/lab.
17.	Filtration falsks with buckner funnels.	
	100 ML	10 nos/batch
	250 ML	05 nos/batch
	500 ML	02 nos/batch
18.	Descicators	10 nos./batch
19.	Magnetic stirrer	10 nos/batch
20.	water suction	10 nos/batch
21.	Conductometer with conductivity cell	04 nos/batch
22.	Colorimeter	02 nos/batch
23.	Ph-meter	02 nos/batch
24.	Chromatographics jar	05 nos/batch
25.	Separating funnels 250ml,500ml	05 nos/batch.
26.	Hot Air Ovan	02 no/lab
27.	Hot Cold Air Blower	01 no/lab
28.	Centrifuge Machine (Electrically operated)	02 no/lab

29.	Deioniser/Water still (Electrically operated)	01 no/lab
30.	Hot plate/Heting mantle	05 no/batch
31.	Models of Element (Seven Cryst.types And their symmetry)	01 no/batch
32.	Flame Photometer	02 nos/batch
33.	Spectrophotometer	02 nos/batch
34.	Shaking Machine	01 no/batch
35.	Polarimeter	02 nos/batch

* * *

14. BOTANY

(Implemented from the session 2004-05)

The syllabus is based on the six lectures and two practicals each of three periods duration per week. The examination shall comprise of three theory papers and a practical. Each theory paper shall be of three hours duration and carry forty (40) marks. The annual practical shall be of four hours duration and carry thirty (30) marks.

PAPER-IV
DIVERSITY AND REPRODUCTION IN SEED PLANTS

UNIT-I : **Seed Plants :**

(1) Charactristics of seed plants.

(2) Evolution of seed habit (Gymnosperms and Angiosperms)

(3) Geological time scale.

(4) General features of Gymnosperms and their classification.

(5) Palaeobotany -a) Process of fossilization and types of fossils.

b) Fossil Gymnosperms : Calymatotheca hoeninghausii.

UNIT-II : **Gymnosperms :**

Morphology of vegetative and reproductive parts, anatomy of root, stem and leaf; Reproduction and life cycle of a) Pinus, b) Gnetum.

UNIT-III : **Angiosperms :**

Flower : A modified shoot, structure, types and functions of different parts of flower, Types of placentation and inflorescences.

Types of pollination; attractions and rewards for pollinators; pollen-pistil interaction.

UNIT-IV : **Angiosperms :**

Microsporangium, microsporogenesis, development of male gametophyte, Megasporangium, types of ovules, Megasporogenesis; development of female gametophyte (monosporic); double fertilization and triple fusion.

UNIT-V : **Angiosperms :**

Formation of seed :- Endosperm, , its types, development of embryo in Capsella bursa-pastoris.

Significance of seed :- Suspended animation, ecological adaptations, unit of genetic recombination and replenishment, dispersal strategies.

Fruits : Morphological types.

PAPER-V
STRUCTURE AND DEVELOPMENT IN FLOWRING PLANTS

UNIT-I : **Morphology :**

a) The basic body plan of a flowering plant - root, stem and leaves.

b) Diversity in plant habits - Annuals, biennials and perennials.

c) Root :- Tap and adventitious root.
Modifications of roots for storage, respiration, reproduction and for interaction with microbes.

UNIT-II : **Morphology :**

a) Stem : Modifications of underground and aerial stem.
Role of stem in vegetative propagation :
Cuttings and grafting.

b) Leaf : Parts, simple and compound leaves, phyllotaxy, stipules and venation.

UNIT-III : **Anatomy :**

Types of tissues : i) Meristematic : Apical meristems in root and stem, cambium and its functions. ii) Permanent :- Simple tissues and complex tissues.

General account of wood structure in relation to the conduction of water, minerals with comments on sapwood, heart wood and Role of woody skeleton in plant body, characteristics of growth rings, Secondary Phloem - Structure, Function, relationship; Periderm.

UNIT-IV : Anatomy :

a) Root : Primary structure in Dicot root (Sunflower) and monocot root (Maize); Normal secondary growth in Dicot root.

b) Stem : Histological and vascular organisation in primary structure of monocotyledons and dicotyledons stems.

UNIT-V : Anatomy :

a) Normal secondary growth in Dicot stem.

b) Anomalies in primary structure of Boerhaavia stem,

c) Anomalies in secondary structure of Bignonia stem and Dracaena stem.

d) Leaf : Internal structure in relation to photosynthesis, waterloss, adaptation to water stress in Nerium leaf and Maize leaf.

PAPER-VI
ANGIOSPERMS SYSTEMATICS

UNIT-I : Angiosperms :- Origin and evolution.
(Pteridospermean and Bennititalean theory.)
Botanical Nomenclature : Principles and rules, Taxonomic ranks. Type concept; Principle of priority.

UNIT-II : Angiosperm Taxonomy :- Brief history; aims and fundamental components (alpha - taxanomy; omega taxanomy; holotaxonomy); identification keys.
Taxonomic Literature : Floras; Monographs, Indian herbaria. ` Indian Botanical Gardens at Kolkatta; and Luckhnow.
Major contributions of cytology and Phytochemistry to taxonomic studies.

UNIT-III : Classification of Angiosperms : Bentham and Hooker's system, Engler and Prantl's system.
Families of Monocotyledons-Liliaceae, Poaceae.

UNIT-IV : Families of Dicotyledones : Annonaceae; Brassicaceae; Malvaceae; Rutaceae, Leguminosae ; Apiaceae.

UNIT-V : Families of Dicotyledons : Asteraceae; Apocynaceae; Asclepiadaceae; Solanaceae; Verbenaceae; Lamiaceae; Euphorbiaceae.

Laboratory Exercises :

1] Study of Fossils : Compression, impression.
   a) Lyginopteris oldhamia
   b) Lagenostoma lomaxii

2] Study of Pinus and Gnetum.
   a) Pinus : i) Study through hand sections - Preparation of temporary mounts Of T.S./T.L.S./R.L.S. of stem, T.S.of needle, pollen grain mountings.
   ii) Study through permanent slides :- T.S. of Root, T.S., T.L.S. and R.L.S. of stem, L.S. of female cone and male cone, L.S. of ovule, L.S. of embryo.
   b) Gnetum : i) Habit and structure of whole male and female cones.
   ii) Hand sections of T.S. of stem and T.S. of leaf.
   iii) Study through permanent slides :- T.S. stem (primary & secondary) Male cone L.S., L.S. of ovule, L.S. of embryo.

3] Embryology of Angiosperms :
   i) Observation of wide range of flowers available in locality and methods of their pollination.
   ii) Study through permanent slides of T.S. of anther, microsporogenesis, L.S. of ovule, Types of endosperms and embryo of Capsella.
   iii) Mounting of T.S. of anther, Pollengrains and Pollinia.

4] Morphology of Angiosperms : Morphological studies of root, stem, leaves, inflorescences and fruits as specified in syllabus.

5] Anatomy of Angiosperms : Preparation of double stained slide of root, stem and leaves of angiosperms mentioned in the syllabus.

6] Taxonomy : Description of ten plants belonging to the different families in technical language and identification upto family level.

7] Long excursion and short excursions are essential.

NOTE : The students should not collect the plants from excursion sites and prepare field report for submission during practical examination..

Taxonomy : The following species are suitable for study. This list is only indicative. Teacher may select plants available in their locality.

1] Annonaceae : *Annona squamosa, Polyalthia longifolia*
2] Brassicaceae : *Brassica, Raphanus*
3] Malvaceae : *Hibiscus, Sida, Malvastrum, Abutilon.*
4] Rutaceae : *Murraya, Citrus.*
5] Fabaceae : (Leguminosae)
a) Faboideae (Papilionoideae) :- *Cajanus, Tephrosia, Indigofera, Crotalaria, Clitoria.*
b) Caesalpinoideae : *Caesalpinnia, Cassia, Delonix.*
c) Mimosoideae : *Prosopis, Acacia, Pithecelobium.*

6] Apiaceae : *Coriandrum, Foeniculum.*
7] Apocynaceae : *Vinca, Thevetia, Tabernemontana*
8] Asclepiadaceae: *Calotropis, Cryptostegia.*
9] Solanaceae : *Datura, Solanum, Withania.*
10] Euphorabiaceae: *Croton, Jatropha, Euphorbia.*
11] Lamiaceae : *Ocimum, Hyptis, Leucas.*
12] Verbenaceae : *Lantana, Verbena, Vitex.*

Practical Examination

Time : 4 Hrs. Marks : 30

Q.1 Preparation of temporary mount of TS/TLS/RLS of given Gymnospermic material. Identify with reasons. ----(4)

Q.2 Preparation of double stained permanent micropreparation of given Angiospermic material.
Identification with reasons. ---- (5)

Q.3 Description of the given Angiospermic plant in technical language, identification upto family, floral
formula and floral diagram. ---- (5)

Q.4 Comments on given Morphological specimens - A) Vegetative, B) Reproductive. ---- (4)

Q.5 Spotting - a) Gymnosperm, b) Palaeobotany, c) Anatomy of Angiosperm, d) Embryology . ---- (6)

Q.6 Class record, field report, submission of micropreparations, viva-voce.
. ---- (6)

Books Recommended :

1] Vyas Purohit Garg : A Text Book of Gymnosperms.
2] Saxena and Sarabhai : A Text Book of Botany, Vol.II
3] Coulter M.J. & Chamberlain C.J. : Morphology of Gymnosperms.
4] Sporne K.R. : Morphology of Gymnosperms.
5] Sharma O.P. : Gymnosperms.
6] Vasistha P.C. : Gymnosperms.
7] S.Sundar Rajan : College Botany, Vol.II & Vol.III.
8] A.C.Dutta : Text Book of Botany.
9] Gangulee & Kar : College Botany Vol.II
10] Tyagi & Kshetrapal : Taxonomy of Angiosperms.
11] Vasistha P.C. : Taxonomy of Angiosperms.
12] Pande B.P. : A Text Book of Angiosperms.
13] Trivedi B.S. & Sharma B.B. : Introductory Taxonomy.

14] Rendle A.B. : Classification of flowering plants, Vol.I & Vol.II.
15] Singh and Jain : Taxonomy of Angiosperms.
16] Esau K. : 1977, Anatomy of seed plant, 2nd Edition, John Wiley and Sons, New York.
17] Vasistha P.C. : Plant Anatomy.
18] Singh and Jain : Plant Anatomy.
19] Chandurkar : Plant Anatomy
20] Gangulee Das and Dutta : College Botany, Vol.I
21] Maheshwari P. : Introduction of Embryology of Angiosperms.
22] Bhojwani & Bhatnagar : Embryology of Angiosperms.
23] Walton : An Introduction & Study of fossil.
24] Eames E.J. : Morphology of vascular Plants.
25] Andrews A.N. : Studies in Paleobotany.
26] Arnold C.A. : Introduction of Paleobotany.
27] Shukla & Mishra : Paleobotany.
28] Bhatnagar S.P. and Moitra A., 1996 : Gymnosperms, New Age International Limited, New Delhi.
29] Davis P.H., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy : Oliver and Boyd, London.
30] Giford E.M. and Foster A.S., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
31] Heyhood V.H. and Moore D.M. (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
32] Jeffrey C., 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
33] Radford A.E., 1986 : Fundamentals of Plant Systematics, Harper and Row, New York.
34] Singh, 4. 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
35] Sporne K.R., 1965 : The Morphology of Gymnosperms, Hutchinson & Company, (Publisher) Ltd. London.
36] Stace C.A., 1989. : Plant Taxonomy and Biosystematics (2nd Edition) Edward Arnold, London.
37] Stewart W.N., 1983 : Paleobotany and Evolution of Plants, Cambridge University Press, Cambridge.
38] Cutter, E.G. 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
39] Cutter E.G., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
40] Hartmann H.T. and Kestler D.E., 1976 : Plant Propagation Principles and practices, 3rd edition, prentice Hall of India Pvt.Ltd. New Delhi.

41] Proctor M. and Yeop, 1973 : The Pollination of Flowers, William Collins Sons, London.
42] Thomas P., 2000 : Trees - Their natural history, Cambridge University Press, Cambridge.

*****

15. ZOOLOGY

(Implemented from the Session 2010-2011)

The examination shall comprise three theory papers and a practical. Each theory paper shall be of 3 hours duration and shall carry 40 marks. The practical shall be of 5 hours duration and shall carry 30 marks. The syllabus is based on 6 theory periods and 6 practical periods per week. Candidates are required to pass separately in theory and practical examinations.

Paper IV

LIFE AND DIVERSITY OF CHORDATA

Unit I — Phylum Chordata;
General characters and classification up to orders –
Origin of Chordata
Protochordates: General characters - Type study: Amphioxus External Characters - Digestive system, Excretory organs, gonads- Affinities of Amphioxus.
Agnatha: General characters and affinities –

Unit II — **Pices: General characters,**
Type study: Scoliodon (Dogfish) – External Characters
Digestive system: alimentary canal and digestive glands, Respiratory system: respiratory organ and mechanism of respiration, Circulatory system: Arterial, venous system, structure and working of Heart, Lateral line receptors, Migration in fishes- Types, causes and significance.

Unit III — Amphibia : General characters; Type Study – Frog, external characters.
Circulatory system, Respiratory system - Structure of Heart, Arterial system, Venous System,
Male and Female urinogenital system. Structure of Eye. Parental care in amphibia.

Unit IV. — Reptilia: General characters
Type study- Calotes- External characters, circulatory system- Structure of Heart, Arterial system, Venous system. Urinogenital system. Poison apparatus in snake, venom and biting mechanism. Types of Skulls in Reptilia

Unit V — **Aves** : General-characters
Type study : Pigeon- External characters, Respiratory system, Excretory system, Flight adaptations, Migration in birds.
Mammalia : General characters, Adaptive radiations in mammals. General characters of Prototheria, Metatheria, Dentition in mammals. Comparative account of heart, aortic arches, and urinogenital systems of vertebrates.

REFERENCE BOOKS:

1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Times Merror/Mosby College Publication. St. Louis. 1065 pp.
2. A life of Vertebrate – K.Z.Young, ELBS Oxford University Press.
3. A Text Book of Chordates – H.S.Bharah and Kavita Juneja.
4. Modern Text Book of Zoology Vertebrate – R.L.Kotpal, Rastogi Publication Meerut.
5. A Text Book of Chordates – A .Thangamani, S, Prasannakumas, L.M.Narayanan and
6. Arunmugam Saras Publication, Nagercoil.
7. A Text Book of Chordate Zoology – R.C.Dalela –Jaiprakashnath Publication Meerut.
8. Chordate Zoology – E.L.Jordan and P.S.Verma, S.Chand and Company New Delhi.
9. A Text book of Practical Zoology Vertebrate – S.S.Lal, Rastogi Publication, Meeru
10. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
11. Chordate Zoology and Elements of Animal Physiology, Jordan, E.K. and P.S. Verma, 1995. 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
12. Zoology of Chordates, Nigam, H.C., 1983. Vishal Publications, Jalandhar - 144 008, 942.
13. The Phylum Chordata, Newman, H.H., 1981. Satish Book Enterprise, Agra - 282 003, 477 pp.
14. Text Book of Zoology, Vol. II (Chordata), Parker and Haswell, 1964. A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp
15. Chordate Structure and Function, Waterman, Allyn J. et al., 1971. Mac Millan & Co., New York, 587 pp.

Paper V

ADVANCED GENETICS

UNIT I Introduction, scope and importance of genetics, Concept of gene and gene action.

Mendel and his laws of hereditary – Monohybrid – Laws of dominance, law of segreegation. Dihybrid cross – Law of independent assortment.

Interactions of genes: Types of genetic interaction, Supplementary factor, complementary factor, duplicates factor, inhibitory factors, and lethal factors – dominant and recessive.

UNIT II **Linkage -** Types of linkage, linkage group, arrangement of linked genes, and significance of linkage. Crossing over – Mitotic and meiotic crossing over, Mechanism of crossing over, theories of crossing over – Darlington's theory, breakage and exchange theory, and copy choice theory. Types of crossing over – Single, double and multiple crossing over. Factors affecting crossing over, Significance of crossing over.

UNIT III **Types of chromosomes**: Sex Chromosomes and autosomes, Bar body, Sex determination in animals, Chromosomal Theory. Genic Balance Theory. Environmentally and hormonally controlled sex determination, Gynandromorph. Multiple alleles. Multiple alleles in relation to eye color in Drosophila.

UNIT IV Genetic disorders; Sickle cell anemia, Cystic fibrosis, Phenylketonuria, Albinism, Alkaptonuria, Huntington's chorea. Diabetes mellitus. Non-disjunction: Turner's syndrome, Klinefelter's syndrome, Down's syndrome. Sex linked genetic disorders and their inheritance in man; Hemophilia and color blindness. mtDNA disorders,

UNIT V **Genetic Screening and parental diagnosis** :- Parental, Carrier, Predictive, CVS (Chorionic Villus Sampling), Amniocentesis, Gene probe and DNA analysis.

Genes in Human Heredity :- Inheritance of eye color. Skin color. Recessive genes and consanguineous marriages.

Genetic counseling :- Risk of marriages in affected family. Birth control measures (male and female).

Kinds of twins :- Identical, Fraternal, Siamese twins. .Significance of twins study.

REFERENCE BOOKS:

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – P.S.Verma & V.K.Agrawal.

2. Principles of Genetics – S.K.Jain
3. Genetics – P.K.Gupta
4. Applied Genetics – C.Pmmanuol.
5. Genetics: M.W.Strickberger, New York.
6. Principles of Genetics: Sinnot, Dunn and Dobzansky.
7. Principles of Genetics: Edidon Gardner.
8. Genetics. S. Verma, P.S. and V.K. Agarwal. Chand & co. New Delhi
9. Gene VI .Lewin, B. 1998. Wiley Eastern Ltd., New Delhi.
10. Human Genetics. Rothwell, N.V.1979. Prentice Hall of India, New Delhi

Paper VI

Ecology and Evolution

UNIT I **Ecology:** concept and scope:

Abiotic factors

Water: Properties, water problem in terrestrial and aquatic habitat.

Temperature:. Temperature range, Temperature tolerance, Effects of temperature on animals. A Homeotherms, poikilotherms. Dormancy, hibernation, aestivation & diapauses.

Light: Spectral distribution, Biological effects of light on aquatic and terrestrial animals: Reproduction, Metamorphosis, pigmentation, vision, photokinesis, phototropism, photoperiodism, migration. Ecological effects on photosynthesis,

Biotic factors:

Intra specific and interspecific associations, Predation, parasitism, Antagonism. , commensalisms, mutualism, competition, Competitive principle or Gauze's principle.

UNIT II **Ecosystem**

Structure and function of ecosystem. -relationship between habitat and ecological niche - Autotrophic and heterotrophic producer, consumer - trophic level - energy flow in an ecosystem - food chain - food web - pyramids - Ecotypes. Homeostasis of ecosystem.

Terrestrial ecosystem: Classification and Biomes,

Aquatic ecosystem: Fresh water ecosystem-Lentic and lotic ecosystem ,

Marine ecosystem: Characteristics, salinity, temperature - pressure, zonation and stratification Estuarine ecology: Characteristics, types, fauna and their adaptations.

UNIT III **Evolution:** concept and scope,

Indirect Evidences of evolution: Comparative- anatomical,

physiological and Biochemical, embryological, Geographical distribution.

Direct evidences of evolution: Paleontological evidences: Fossils and fossilization –Types of fossils, Radioactive carbon dating of fossils - Living fossils. Introduction to Geological eras -

UNIT IV **Evolutionary Processes**

Natural selection: Mechanism of Natural selection – resistance of insects to pesticides, antibiotic resistance in bacteria, - Industrial melanism –Types of selection-

Isolation:Types and mechanisms –

Speciation - definition of species –mode of speciation - Allopatric and Sympatric speciation. Gene pool, Gene frequency, Genetic drift - Convergent, Divergent and Parallel evolution - Co-evolution.

UNIT V Evolution of horse.

Evolution of Man,

Mimicry & Coloration,

Aquatic, and desert Animal Adaptations:

Bioluminescence; Chemistry and significance

Indian Wild life and its management.

REFERENCES BOOKS:

1. Kotpal, R.L. and N.P. Bali, 1986. Concepts of Ecology, Vishal Publications, Delhi - 7, 264 pp.
2. Rastogi V.B. and M.S. Jayaraj, 1988-89. Animal Ecology and Distribution of Animals, Kedar Nath Ram Nath, Meerut - 250 001, 429 pp.
3. Clarke, G.L., 1954. Elements of Ecology, John Wiley & Sons Inc., New York, London, 534 pp
4. Ananthakrishnan, T.N. and S.Viswanathan, Principles of Animal Ecology.
5. Eugene P. Odum, 1971. Fundamentals of Ecology. Saunders Internatioanal Student Edition, W.B.Saunders Company, Philadelphia, London, Toronto, 574 pp.
6. Verma, P.S. and V.K.Agarwal, 1986. Environmental Biology, S.Chand & Co. Ltd., 591 pp.
7. Richard Manual of Wild life Conservation
8. Our Environment Pollution control & future strategies - M.P.Mishra - S.Chand & Company - 2000
9. Fundamentals of Environmental Pollution - Krishnan Kannan - S.Chand & Company - 1997.
10. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition - New Haven, Tale University Press.

11. Colbert, E.H. 1969 - Evolution of Vertebrates, Wiley, New York.
12. Mayr, Ernst, 1973 - Animal Species and Evolution. The Belknap Press of Harvard University, Cambridge.
13. Dobzansky, T. 1976 - Genetics and the Origin of Species. Oxford and TBH Publishing Co. New Delhi.
14. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
15. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
16. Leninger, A.L., Nelson, D.L. and Cox, M.M. (1993) - Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
17. Life, Origin, Evolution and Adaption (2002) - Sanjib Chattopadhyay. Books and Allied (p) Ltd.
18. P.S.Verma & V.K.Agrawal.(2008) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology –S. Chand Publications.

Practical. :-

Two practical per week of 3 periods duration. Examination shall be Of 5 hrs duration and of 30 marks.

A) Classification of the following animals (specimens or models) up to orders:

Protochordata : Herdmania, Doliolum Salpa, Amphioxus.

Agnatha : Petromyzon, Myxine.

Pisces : Scoliodon, Torpedo, Acipenser, Exocoetus. Hippocampus

Amphibia : Ichthyophis, Salamander, Bufo, Hyla.

Reptilia : Varanus, Phrynosoma, Chameleon, Cobra, krait, Russell's viper, Typhlops, Hydrophis

Aves : Duck, Woodpecker, Kingfisher, Parrot.

Mammals : Mongoose, Squirrel. Manis. Bat.

B) Dissections :

1. Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
2. Dissection - Digestive system, Arterial system, Venous system, reproductive system of wild rat.
3. Permanent micro-preparations .a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
4. Observations of air bladder in air breathing fishes.

C) **Osteology.** Rabbit, varanus (excluding loose bones of skull).

D) **Genetical experiments:**

1. Recording of Mendelian traits in man.

2. Detection of monohybrid and dihybrid cross with the help of plastic beads.
3. Study of following human genetic traits and application of Hardy-Weinberg Principle to them – Baldness, length of index and ring finger, attached and Free earlobes, rolling of tongue, PTC taste. Other notable traits.
4. Demonstration of bar bodies.
5. Preparation of human Karyotypes from Xerox pictures (E).
6. Photo slides for, Turner's syndrome, Klinefelter's syndrome, Down's syndrome
7. Detection of syndrome from chromosome spread picture.

E. Ecology and Evolution:

1. Estimation of Dissolved oxygen, salinity, pH, free CO2, carbonates and bicarbonates, calcium in water samples.
2. Adaptations of aquatic and terrestrial animals based on a study of museum specimens. Such as rocky, sandy, muddy shore animals, flying and burrowing animals.
3. Study of natural ecosystem and field report of the visit.
4. Study of fossils, including living fossils.

F. General :-

1. Visit to a National park or sanctuary, Natural history museum, and submission of report.
2. Study of diversity of vertebrates from local area.

DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION.

1.	Dissection:	-	05
2.	Permanent stained micropreparation.	-	03
3.	Spotting. (specimens, Slides, bones, syndrome photo, fossil)	-	08
3.	Genetic experiment	-	04
4	Ecology experiment	-	04
4.	Class record	-	02
5.	Viva - Voce	-	02
6.	Submission of study tour report.	-	02
	Total Marks:		30

*****

16. ELECTRONICS (INSTRUMENTATION)
(Effective from the session 2006-07)

The examination in Electronics (Instrumentation) at the end of IInd Year shall comprise three theory papers of 40 marks each of 3 hours duration and practical examination of 30 marks.

At the time of Practical examination every student will have to perform two experiments. One of two hour's duration from Section A and other of four hour's duration from Section-B.

The distribution of marks is as under :

Expt. (Section A)	-	06 Marks
Expt. (Section B)	-	12 Marks
Practical Record	-	06 Marks
Viva – Voce	-	06 Marks
Total :	-	30 Marks

PAPER – IV
ELECTRONIC DEVICES AND CIRCUITS

Unit I : Transistor amplifier :
H-parameters, transistor equivalent circuit of CB, CE & CC connections using h-parameters, Analysis of small signal CE amplifiers. Cascading amplifiers : Direct coupled, RC coupled amplifier (Construction working and frequency response, merits and demerits).

Unit II : Power Amplifier :
Classification : Class A, Class B, Class C and Class AB amplifiers, Class A - transformer coupled amplifier, Class-B push-pull amplifer (Construction, working and efficiency of each). Crossover distortion, complementry symmetry Class-B push-pull amplifier.Principle consruction & working of class C tuned amplifier(single & double tuned)

Unit III : Feedback Amplifer & Oscillator:
Concept of feedback, feedback theory, positive & negative feedback,
Advantages of negative feedback, physical idea of types of feedback (block diagrams only).
Concept of oscillators, barkhausen criteria of oscillations, RC oscillators,- phase shoft and Wein bridge, LC oscillators – Collpitts

and hartely. Crystal oscillators. .

Unit IV : Operational amplifiers :
Difference amplifier (Concept, construction and working), Block diagram of Op-Amp, Characteristics of ideal op-amp, parameters of op-amp, Input impedance, (Zi), output impedance (Zo), open loop gain, close loop gain, CMRR, Slew rate Input offset voltage & current, Input bias current.

Unit V : Application of Op-Amp:
Inverting & Non-inverting Amplifier, Adder, substractor, Buffer, Differentiator & Integrator.Solution to simultaneous equations, Differential equation for Harmonic oscillator, Regenerative comparator, Logarithmic amplifier,Astable ,Monostable & Bistable Multivibrators.

PAPER – V
DIGITAL TECHNIQUES

Unit I : Multivibrators & Flip flops:
Construction & working of Astable, monostable and Bistable transistorised multivibrators, RS, CLK RS, D, JK, JKMS Flip Flops (Logic diagram, Truth table, construction & working), Concept of edge trigger Flip-Flop, Concept of preset & clear terminal.

Unit II : Counters:
Asynchronous & synchronous Counter , Up-down counters(up to 4-bits), modified asynchronous counter, Applications of counters, IC vertion of counters – 7493IC & 7490IC.

Unit III : Shift registers :
Types of shift registers, SISO, SIPO, PISO & PIPO shift registers (Construction & working),left shift-right shift registers, IC version of shift register – 7495, Application of shift register. Ring counter, johnson's counter.

Unit IV : Memory :
Concept of primary & secondary memory, memory hierarchy, classification of memories,Floppy disk,Winchesterdisk,CD,DVD. Semiconductor memories :RAM, ROM, PROM, EPROM, EAROM,EEPROM.

Unit V : A/D & D/A converters :
Need of A/D and D/A converters.
D/A converters : weighted resistors, R-2R ladder

type,Specifications,IC version DAC0808
A/D converters : Counter type, successive approximation type, Specifications,IC version ADC0808.

PAPER -VI
MICROPROCESSOR

Unit I : Evolution of microprocessor,Microcomputer (block diagram with functions of each block),Architecture of INTEL 8085 microprocessor, Functions of each blocks of 8085, pin diagram and functions of all pins of 8085.

Unit II : Instructions and Timings of 8085 :
Instruction format, Addressing modes, classification of instruction set of 8085 with examples, T-state, fetch & execute cycle, timings of fetch, execute cycle & machine cycle.

Stack & subrooutine :
Concept of stack, stack pointer, stack related instructions (PUSH & POP), simple programs illustrations.
Concept of Subroutine : CALL & RET instruction, simple programs illustrations.

Unit III : Programming :
Algorithem, flowchart, assembly and machine language, its advantages & disadvantages, Assembly language programmes for addition, substraction, multiplication, division, finding maximum and minimum numbers.

Unit IV : Interfacing :
Basic interfacing concept, memory mapped and I/O mapped I/O schems, data transfer scheduling, 8255 PPI : Block diagram, functions of each blocks, Pin diagram, functions of each Pins, operation modes of 8255, control word format in I/O & BSR mode. illustrative examples.

Unit V : Microprocessor Applications :
Delay subroutine (using one reg. & reg. pair),Seven segment LED display,Display of Alphanumericcharacters,Measurement of electrical quantity (frequency & phase), measurement of Physical Quantity (temp. &strain).

*****

BOOKS RECOMMENDED -

1. Analog and Digital techniques by Navneeth, Kale, Gokhale(Kitab Mahal Prakashan)
2. Digital Principles and Applications by Malvino and Leech.
3. Pulse, Digital and Switching Waveforms by Millman and Taub.(MC Graw Hill Publication).
4. Modern Digital Electronics by R.P.Jain (TMH).
5. Digital Computers by Malvino (Mc Grow Hill Publication)
6. Electronic Devices and circuits by Millman and Halkias (Mc Graw Hill publication)
7. Elements of Electronics by M.K.Bagde and S.P.Singh (S.Chand and Company)
8. Basic Electronics by B.L.Theraja (S.Chand and Company)
9. Monograph on Electronic Design and Principle by Goyal and KHETAN (Khanna Publisher)

PRACTICALS

Every student is expected to perform at least eight experiments from each group.

SECTION A

1. Study of frequency response of single stage CE amplifier.
2. Study of phase shift oscillator and calculation of frequency.
3. Study of Wein Bridge oscillator and calculation of frequency.
4. Study of zener regulated power sypply.
5. Study of series transistor regulator.
6. Study of RS,CKRS and DFF.
7. Study of JKFF.
8. Study of JKMSFF.
9. Study of 4 bit asynchronous ripple counter.
10. Study of up/down counter.
11. Study of 4 bit universal shift register.
12. Study of ring counter.
13. Study of IC 7490 as decade counter.
14. Study of IC 7483 as 4 Bit binary adder.

15. Study of decoder.
16. Study of 4-bit parallel counter.
17. Study of decoder to seven segment display.
18. Study of diode as stair case generator.

SECTION B

1. To construct and verify the working of op Amp as inverting amplifier.
2. To construct and verify the working of op Amp as non inverting amplifier.
3. To construct and verify the working of op Amp as summing amplifier.
4. To construct and study the OP AMP as integrator and differentiator.
5. To construct and study the frequency response of RC coupled amplifier.
6. To construct and study the transistorised monostable multivibrator.
7. To construct and study the transistorised astable multivibrator.
8. To construct and study the transistorised bistable multivibrator.
9. To construct and study the modified asynchronous counter.
10. To construct and study UJT as relaxation oscillator.
11. To construct and study pushpull amplifier.
12. To construct and study high pass RC circuit.
13. To construct and study of diode circuit as clipper.
14. Study of microprocessor kit 8085.
15. Program for addition of two 8-bit numbers.
16. Program for substraction of two 8-digit numbers.
17. Program for multiplication of two 8-digit numbers.
18. Program for Division of two 8-digit numbers.
19. Program for display of sequential Hexadecimal numbers.
20. Program for display of sequential serial numbers.
21. Any other inovative program or Assembly language program for 8085 microprocessor.

List of optimum apparatus required to perform the practicals for a batch

Sr.No.	Name of Apparatus	Minimum Nos.
1.	VTVM/FET VOM	05
2.	CRO Single Trace	05

3.	CRO DUAL TRACE		02
4.	Function Generators		10
5.	Frequency Counter		01
6.	RF Generator		01
7.	Digital Multimeter		05
8.	Multimeters		15
9.	AC Millivoltmeter		01
10.	Voltmeters	a) 0 - 1 V	02
		b) 0 - 5 V	06
		c) 0 - 10 V	10
		d) 0 - 15 V	06
		e) 0 - 30 V	02
11.	Ammeters	a) 0 - 100 mA	02
		b) 0 - 250 mA	04
		c) 0 - 500 mA	04
		d) 0 - 1 mA	04
		e) 0 - 5 mA	04
		f) 0 - 10 mA	06
		g) 0 - 20 mA	06
		h) 0 - 50 mA	06
		i) 0 - 100 mA	06
		j) 0 - 250 mA	02
		k) 0 - 500 mA	02
		l) 0 - 1A	02
12.	Stabilised D.C. Power Supply - 1A		
		a) 0 - 9 V	05
		b) 0 - 12 V	10
		c) 0 - 30 V	03
		d) 0 - 5 stabilised for 78xx series.	07
		e) +15 V and -15 V	04
13.	Dimmerstat		02

14.	Table Lamp	02
15.	Resistance Boxes	10
16.	Rheostates	05
17.	Soldering Gun & Desoldering Pump	08
18.	Wire metal and paste	500 gm & 1 pack each.
19.	Stop watch, Continuity Tester	03
20.	Microprocessor kits	10
21.	PC (Pentium- 4 with Printer)	01
22.	Microprocessor unit 8086	01
23.	Experimental boards of each expt. as per sullabus	01 each.
24.	All electrical & electronic tools each	01 of each type.
25.	bread boards	12
26.	Patch chords & sockets	as per req.
27.	Wires, buttons, fuses & other materials	-"-
28.	Linear & digital IC tester boards each	01

* * *

List of Loose Components

Sr.No.	Component		Quantity
1.	Registers - 1W (Mixed)		SD (pieces of each)
2.	Capacitors - 30V (Mixed)		10 (pieces of each)
3.	Inductors (Mixed)		2 (pieces of each)
4.	Transistors		
		a) AC 127/128	
		b) BC 147/148	
		c) SL/HL 100	
		d) BC 107/108	15 pieces of each
		e) others if necessory	

5.	Diodes		15 pieces of each.
6.	UJT/SCR/Diac/Triac		05 pieces of each.
7.	Potentiometers		
		a) 0 - 500	05
		b) 0 - 1K	10
		c) 0 - 2K	10
		d) 0 - 5K	08
		e) 0 - 10K	05
8.	Step down transformers		03 pieces each.
9.	ICs 741/3085/555		each 05
	723/78XX/79XX		
	74XX series		
10.	Other Missilaneous components for designing & construction		as per requirements.

17. BIOLOGICAL TECHNIQUES AND SPECIMAN PREPARATION.

The examination in "Biological Techniques and specimen Preparation", will comprise of two theory papers and a practical examination. Each paper will be of three hours duration and carry 60 marks.

The practical examination will be of 6(Six) hours duration and carry 30 marks.

Each unit of theory paper will carry two questions with internal option to solve any one question. Candidates are required to pass separately in theory and practical.

Project work at the end of IIIrd year will carry 10 marks. Study tour will be compulsory for collection of animal/plant specimens during fist year which will be trated as a part of "on the job training".

The following syllabus is based on 6(six) theory periods and 6(six) practical periods (of two terms of 3 periods each) per week.

PAPER-III
GENERAL LABORATORY TECHNIQUES

UNIT-I : Distilled Water - Types of distilled water and their uses, distillation stills, construction and functioning of metal stills, solor stills and glass stills (including triple distilled water stilles) proper collection and storage. Amount and types of impurities. What are ion-exchanges and how they work; regeneration of ion-exchangers, uses of ion free water.

Unit-II : Cleaning agents (composition) for various types of dirty glassware : pipette cleaners (construction and proper use); removal of hardwater marks from glassware; storing of glassware. What is standard joint equipment; proper usage and cleaning; Utility of standard joint equipment. Methods of sterillization of glassware and storage of sterilized glassware. Steriware disposable plastic petridishes and injection syringes and their uses. Glass blowing-equipment for glass blowing-safety in handling; cutting and glass blowing.

Unit-III : Solutions- Definition of solute, solvent, molar, molal, normal, weight percent, ppm/ppb; calculation of molecular weight, interconversion between percent molar and normal; methods of dilution and sources of error. pH-What is pH? Methods of determining pH;pH paper; pH indicators and their range and uses in the Biology laboratary. Buffer Solutions-theory of buffering; some standard buffers Acetate, Phosphate, TRIS, TRIS-glycine calculation of pH of buffer-solutions.

Unit-IV : Balances:- Chemical, Physical, analytical, beam, single pan, double pan, top pan, torsion, electrical, spring, parts and working, degree of accuracy and sources of errors. Tempreature sensing control devices: thermometer, thermocouples, thermostat-construction, calibration and use of incubators, oven, water bath and shakers.

Unit-V : Common organic solvents - characteristics, uses, purification and relcamation, safety in handling of organic solvents, Colorimeter, spectrophotometer, flame photometer, theory, construction use and maintenance.

PAPER-IV
BIOLOGICAL, ELECTRONIC AND TISSUE CULTURE TECHNIQUES

UNIT-I : Organisation of teaching laboratary-chemicals & reagents /

glassware / specimes / living organisms / equipment / purchase and maintenance of living organisms including-aquarium, terrarium, animal house, garden.

Unit-II : Abiotic pollutants of water and their indicators and assay techniques. Distribution of plants and animals-Methods of survey, determination of frequency dominace etc. Air pollution-determination of abiotic and biotic components.

Unit-III : Simple circuits - how to read a circuit diagram; parallel and series connections; fuses, plugs, wires for common electrical equipments; voltage stabilizers; safety in handling electrical equipments.

Unit-IV : Chromatographic techniques : theory, methods and application of paper chromatography; TLC, ion-exchange, gel-filteration and other types, fraction collector; gradient elution techniques. Electrophoresis-theory, methods and applications-paper and gel electrophoresis.

Unit-V : Tissue culture techniques and their application-Cellular components-identification, separation for in vivo & in vitro studies-applications. Immunological techniques-antigen-antibody, reactions; monoconal antibodies; blood grouping. Isolation and characterisation of molecules of the cell : sugars, proteins, amino acids, lipids, RNA, DNA.

PRACTICAL COURSE

1. Preparation of various grades of distilled water.
2. Cleaning of glass wares, microscope slides etc.
3. Use and maintenance of standard joint equipment
4. Sterilization of galssware
5. Glass blowing, cutting glas plates, tubes and rods, bending tubes, drawing capillary, sealing vials.
6. Use and care of balances.
7. Preparations of solutions, bufferes as per theory.
8. Use and care of pH meter.
9. Acid base titration.
10. Preparation and maintenance of aquarium, terrarium.

11. Maintenance of living organisms, plants & animals.
12. Maintanance of museum and herbarium.
13. Water analysis DO, CO2, BOD, COD, pH, Salinity, Chorides, nitrates, phospnates, fluorine, silicates, Alkalinity, hardness.
14. Analysis of heavy metals in soil and water -Hg, Cd, Pb.
15. Estimation of plant and animal population in aquatic and terrestrial ecosystem.
16. Study of effect of pollutants on aquatic fauna.
17. Study of air pollution.
18. Use and maintenance of colorimeter, spectrophotometer and flame photometer.
19. Simple circuits, soldering, changing plugs, wires, fuses, voltage stabilizers, rheostats.
20. Repair and maintenance of oven, incubator, electical waterbath, shakers.
21. Purification of organic solvents.
22. Paper chromatogrphy (one & two dimensional)
23. Thin layer chromatography.
24. Electrophoresis, gel and paper techniques and maintenance of equipments.
25. Column chromatography including ion-exchange and gel filtration.
26. Plant and animal tissue culture techniques.
27. Separation of cellular components, use of senicator and high speed centrifuge.
28. Enzyme action and factors affecting enzyme action
29. Still reaction of isolated chloroplast.
30. Immunological techniques.
31. Isolation of proteins and DNA (as per theory)
32. Quantitative determination of glucose, proteins, amino acids, DNA, chlorophyll.
33. Tissue culture techniques.

PRACTICAL EXAMINATION

(30 Marks)

Q1. Estimation of glucose/proteins/DNA/chlorophylls.
or

	Chromatography - Thin layer or paper	10 Marks
Q2.	Water analysis, any one DO, CO2, alkalinity, hardness, pH, salinity, Chlorides, Phosphates, nitrates.	
	or	
	Identification of Phytoplanktons/Zooplanktons	5 Marks
Q3.	Soldering of wires	
	or	
	Acid-base titration	
	or	
	Glass blowing, cutting glass plates	
	or	
	Enzyme action	
	or	
	Identification of blood groups	5 Marks
Q4.	Minor experiment on Electrophoresis	
	or	
	Tissue Culture	5 Marks
Q5.	Practical record & Viva-Voce	5 Marks
	Total :	30 Marks

BOOKS RECOMMENDED for Paper-III and Paper-IV.

1. Limnology : Welch, McGraw Hill Book Co. N.Y.
2. Priciples of Biochemistry : Lehninger A.L., Warth Publisher N.Y.
3. Methods for Physical and Chemical analysis of Fresh waters : Golterman, Clymo and Ohnstand, IBP hand book No. 8 Balckwell Scientific Publications.
4. Fresh water animals of India (An ecological approach) : G.T.Tonapi, Oxford & IBH Publishing Co. New Delhi.
5. Text Book of Physiology and General Biology : Dr. R.R.Dhande and G.N.Vankhede, Bajaj Publications, Amravati.
6. Work book on Limnology : A.D.Adoni, Publication MAB Committee, Department of Environment, Govt. of India.
7. Fundamentals of Aquatic Ecosystem : Barnes, A.K. & K.H.Mann., Balckwell scientific Publications, Oxford.
8. Quantitative inorganic analysis : A.I.Vogel, ELBS publisher.

9. Essentials of plant techniques : Dwivedi J.N., Scientific Publishers, Jodhpur.
10. Introduction to plant tissue culture : Dey Dalyankumar, Central Book Agency, Calcutta.
11. Plant Cell and tissue culture : Narayan Swami S. Tata McGraw Hill.
12. An introduction to plant tissue culture : Razdan M.K., Oxford & IBH, New Delhi.
13. Plant Biotechnology : Trevan M.D., TMH, Delhi.
14. Biotechnology : Trehan Keshao, Wiley Est. Ltd.
15. Fundamentals of Biotechnology : Purohit S.S., Agro Biotechnical Publisher, Bikaner.
16. Elements of Biotechnology : P.K.Gupta, Rastogi Publications.

* * *

18. Instrumentation (Vocational)

Paper-IV

Electronic Devices and Circuits

Unit I Semiconductor Physics of Diodes, Characteristics of diodes, Rectifying circuits and dc power supplies, Filter circuits for power supplies, The diode clamper and voltage doublers, Zener diode Tunnel diode and Thermistors.

Scope: Electronic Devices and Circuits, Allen Mottershed, PHI, 18th Printing 1996

Chapters: 5,1,2,3,4,6

Unit II Bipolar Transistor Amplifiers: Basic characteristics of the transistor, Transistor Amplifier, Common base amplifier, common emitter amplifier, Thermal stability, Hybrid equivalent circuit for a transistor, Low frequency response of transistor amplifier, High frequency response of transistor amplifier.

Scope: Electronic Devices and Circuits, Allen Mottershed, PHI, 18th Printing 1996

Chapters: 9,10,11,12,13,14,15,16.

Unit III Negative feedback in transistor amplifiers. Transistor oscillators and multi-vibrators.

Scope: Electronic Devices and Circuits, Allen Mottershed, PHI, 18th Printing 1996

Chapters: 17,18.

Unit IV Transistor Power Amplifiers: Class A, Class B and Class C.

Scope: Electronic Devices and Circuits, Allen Mottershed, PHI, 18th Printing 1996

Chapters: 19,20.

Unit V Field Effect Transistors: FET amplifier, MOS- FET, Other applications Opto-electronic devices. Thyristors and UJT's.

Scope: Electronic Devices and Circuits, Allen Mottershed, PHI, 18th Printing 1996

Chapters: 21,22,27,28.

Reference Books :-

1) Electronic Devices & Circuits : Millman and Halkias
2) Basic Electronics : B.L. Theraja
3) Electronic Principle. : Ryder
4) Electronic Devices & Circuits by Pimple & Pimple.

Paper V

Electronic Instrumentation

Unit: I **Measurement and Errors**: Definition, Accuracy and precision, Significant figures, Types of errors, Statistical analysis, Probability of errors, Limiting errors.

System of units Measurement: Fundamental and derived units, System of units, Electric and magnetic units, International system of units, Other systems of units, Conversion of units.

Standards of measurement: Classification of standards, Standards of mass, length and volume, Time and frequency standards, Electrical standards, Standards of temperature and luminous intensity, IEEE standards

Scope: Modern electronic instrumentation and measurement techniques: A.D.Helfrick and W.D.Cooper: Prentice- Hall of India 1997: Fifth reprint

Chapters: 1,2,3.

Unit: II **Electromechanical indicating instruments:** Suspension galvanometer, Torque and deflection of the galvanometer, Permanent-Magnet Moving-Coil mechanism.

DC ammeters, DC voltmeters, Voltmeter sensitivity, Series type ohmmeter, Shunt type ohmmeter, Multimeter, Calibration of DC instruments, Alternating - current indicating instruments, Thermo instruments, Watt-hour meter, Power-factor meter.

Scope: Modern electronic instrumentation and measurement techniques: A.D.Helfrick and W.D.Cooper: Prentice- Hall of India 1997: Fifth reprint

Chapters: 4

Unit: III **Bridge measurements**: Wheat-stone bridge, Kelvin bridge, Guarded Wheat-stone bridge, AC bridges and their application, Maxwell bridge, Hay bridge, Schering bridge, Unbalance conditions, Wien bridge, Wagner ground connection.

Scope: Modern electronic instrumentation and measurement techniques: A.D.Helfrick and W.D.Cooper: Prentice- Hall of India 1997: Fifth reprint

Chapters: 5

Unit: IV **Electronic Instruments for measuring basic parameters:** Amplified DC meter, AC voltmeter using rectifiers, True RMS responding voltmeter, Electronic multimeter, Considerations in choosing an analogue voltmeter, Digital voltmeter, Components measuring Instruments, Q-meter, Vector impedance meter, Vector voltmeter, RF power and voltage measurement.

Scope: Modern electronic instrumentation and measurement techniques: A.D.Helfrick and W.D.Cooper : Prentice- Hall of India 1997 : Fifth reprint

Chapters: 6

Unit:V **Oscilloscopes**: Oscilloscope block diagram, Cathode ray tube, CRT circuits, vertical deflection system, delay line, multiple trace, Horizontal deflection system, Oscilloscope probes and transducers, Oscilloscope techniques, special oscilloscopes.

Scope: Modern electronic instrumentation and measurement techniques: A.D.Helfrick and W.D.Cooper: Prentice- Hall of India 1997: Fifth reprint

Chapters: 7

Reference Books :

1) Basic Electronics by Malvino
2) Electrical Measurements by Goldy.

Paper VI

Mechanical Measurements and Transducers

Unit I **Basic concepts of measurement**: System calibration, Problem analysis, Basic characteristics of measuring devices, Calibration.

Transducer classification: Electrical transducer, Classification, Basic requirements.

Performance characteristics: Generalized measurements, Zero-order system, First-order system, Second-order system, Dead-time element, Specification and testing of dynamic response.

Scope: Instrumentation Devices and Systems: Rangan, Sharma & Mani: 2nd Ed. Tata McGraw-Hill

Chapters 1, 2 & 3

Unit II **Measurement of displacement**: Principal of transduction, Transducers. Potentiometers and LVDT.

Measurement of velocity: Revolution counters and Tachometers

Measurement of acceleration:

Measurement of strain: Types of strain gauges, resistance strain gauges, electrical strain gauges, strain gauge circuits (Bridge configurations), temperature compensation.

Scope: Instrumentation Devices and Systems: Rangan, Sharma & Mani: 2nd Ed. Tata McGraw-Hill

Chapters 4 & 5

Unit III **Measurement of pressure**: Diaphragms, Elastic elements, Transduction methods, Solid-state devices, Piezoelectric transducers. Calibration

Measurement of flow: Classification of flow meters, Head-type, Rotameter, Electromagnetic and Mechanical flow meters, Anemometers, Ultrasonic flow meters, Vortex and mass flow meters

Scope: Instrumentation Devices and Systems: Rangan, Sharma & Mani: 2nd Ed. Tata McGraw-Hill

Chapters 7 & 8

Unit IV **Measurement of Temperature**: Temperature scales, Mechanical temperature sensors, resistance type temperature sensors, Platinum resistance thermometer, Thermistors, Thermocouples, Solid state sensors, Temperature measurement by radiation method, Optical

pyrometers, Calibration

Scope: Instrumentation Devices and Systems: Rangan, Sharma & Mani: 2nd Ed. Tata McGraw-Hill

Chapters 9

Unit V **Measurement of force and torque**: Force measuring sensor - Load Cell, Effect of temperature, Dynamic response of elastic transducers, Force balance devices, Torque measurement.

Measurement of vibration, Time, Frequency, Phase angle, Sound, Noise, Liquid level, Humidity and Chemical composition.

Scope: Instrumentation Devices and Systems: Rangan, Sharma & Mani: 2nd Ed. Tata McGraw-Hill

Chapters 10 & 6.1,6.2,6.3,6.4

Measurement systems Application and design: E.O.Doeblelin: 4th Ed. McGraw-Hill Int.

Chapter 9

1) Practicals: 15 practicals based on three theory papers.

2) Enterprenership - 2

Reference Books :

1) Doeblin E.V. Measurement System - Applications and Design, McGraw Hill 1975.

2) O'Hignim - P.J. Basic Instrumentation - McGraw Hill.

Entrepreneurship-II

1. Subject overview: after completion of first year inputs, second year inputs will focus on business opportunity identification and managerial aspects of SSI.
2. Perceiving a business opportunity: Identification & selection of business, potential opportunities at the selected area/state, environment scanning, source of information.
3. Assessing project feasibility: concept of project feasibility, criteria for assessing project feasibility, importance of project feasibility in business opportunity selection.
4. Visit to small-scale industries: with a focus on how an entrepreneur selects his/her business opportunity (preferably units started by passed out students from the same college).
5. Interaction with entrepreneurs: On how entrepreneurs select a business opportunity and criteria they follow during the process.

6. Understanding business environment and related terminology: concept of business environment, critical elements of the economic environment, impact of micro and macro environment.
7. Sources of information: Support institutional networking, national and stage level, whom to contact for what and other source of information.
8. General Management: Introduction to management, principles of management, principles in operation, key aspects of managing a small enterprise.
9. Production management in practice: installing and utilising project capacity, selecting appropriate technology and cost, purchase techniques.
10. Production Management: Importance of production, planning and control, tools and techniques.
11. Marketing Management: Concept and steps of marketing management, tools and techniques.
12. Market survey: Concept & practice, assessment of demand & supply, Preparation of survey questionnaire.
13. Financial Management-I: Understanding working capital cycle, assessment of working capital.
14. Financial Management-II: Financial ratios and its importance, tools and techniques for calculating financial ratios.
15. Business communication (Oral & written): Importance of business communication, how to improve oral and written communication, exercises.
16. Developing entrepreneurial competency: Knowing entrepreneurial competency profile and how to develop these competencies.

* * *

19. SEED TECHNOLOGY (VOCATIONAL)

There shall be three theory papers of 40 marks each. Duration of each paper shall be 3 hours. Practical examination shall be of 4 hours duration and of 30 marks.

The syllabus is based on 6 lectures and 6 practical periods per week.

"Two on job training" on one month duration shall be compulsory during three years degree course.

PAPER IV
HYBRID SEED PRODUCTION AND VEGETABLE SEED PRODUCTION

Unit-I : Introduction

- Definition of heterosis and inbreeding depression and brief history of the development of these concepts.
- Genetic, Physiologic and Biochemical basis of heterosis.
- Calculation of heterosis and its importance in crop improvement.
- Exploitation of heterosis at commercial scale in crops:
- Maize, Perlmillet, Sorghum, Sunflower, Castor, Pigeonpea and Cotton.

Fixation of heterosis - an approach

- Apomixis and its exploitation - Hybrid Sorghum Rice
- Vegetative mulitiplication of ratoon - Hybrid Rice. and splitting of early tillers in rice seedlings in nursery.
- **Haploid breeding and its role in development of inbreds-** Maize.
- **Definition of incompatibility, its kinds and importance**
- Exploitation of incompatibility for hydrid seed production its advantages and disadvantages.
- Maintenance of self incompatible parental lines.
- Differences between sterility and incompatibility.
- **Devices for Hybrid Seed Production**
- Genetic male sterility and hybrid seed production
- Advantages and disadvantages of genetic male sterility.
- Role of marker genes linked with genetic male sterility.
- Procedure of hybrid seed production and maintenance of seed parent - Pigeonpea, Cotton and Sunflower.
- **Cytoplasmic - genetic male sterility.**
- Introduction to the system.
- Synchronisation methods of achievement.
- Seed production of CMS line 'A'
- Seed production of maintainer line 'B'
- Seed production of restorer line 'R'
- Border rows, planting ration, live rear-kers.
- Hybrid seed prodcution based on functional male **sterility system:**Its limitations and scope e.g.Tomato.

- **Gametocides and their use in hybrid seed production**
- Chemicals causing male castration.
- Effect on female organs.
- Effect on seed setting and seed quality.
- **Environmental sterility and its exploitation in hybrid seed production in rice. A chinese experience**
- Role of environment in sex expression - poten- shedders
- Maintenance of parental lines - female stenility factors
- Pollination technique.

Unit-II - **Hybrid Seed production in different crops.** floral biology, seed production planning, land and isolation requirement, wild poll-netors, special agronomic practices, maintenance of varietal purity, field inspection, havesting and threshing in the following crops.

1. Maize
2. Pearl millet
3. Sorghum
4. Sunflower
5. Pigeonpea
6. Cotton
7. Castor
8. Hybrid Rice
9. Hybrid Mustard
10. Safflower

- Economics of hybrid seed prduction
- Seed Planning

Unit-III : History and Objectives of Vegetable breeding

- History of vegetable crop improvement
- Objectives of vegetable breeding

Reproduction, Pollination Control Mechanisms

A. - Asexual Reproduction
- Vegetative propagation
- Apomixis
- Artificial feeds

B. - Sexual Reproduction
- Male gamete formation
- Female gamete formation
- Fertilization

C. Pollination Control Mechanisms

a. Flowering habits
- cucurbits
- Asparagus
- Spinach

b. Self incompatibility
- Gametophytic : in Lycoperscium spp. and solanum spp.
- Sporphytic : Heteromorphic, Homomorphic
- Incompatibility system in cauliflower and cabbage
- Methods for breaking incompatibility :- Irradiation of pollen, application of NAA, IAA.

c. Male Sterility
- Genic male sterility in tomato, Brinjal and musk melon
- Gene - cytoplasmic male sterility in onion, carrot, radish cabbage and cauliflower.

: Natural Cross pollination
- Extent of natural cross pollination in vegetable crops
- Factors determining natural cross pollination
- of natural cross pollination in seed production of vegetable crops.
- Natural cross pollination and pollination vectors in vegetable crops

Hybridization techniques in Vegetables
- Raising of crop
- Equipments required
- Emasculation and use of gametocide
- Pollination methods - hand pollination, rubbing and hooking - use of electric bee.

Unit-IV : Breeding methods in vegetabls

i. Role of introduction and thier utilization
- Collection
- Maintenance
- Evaluation
- Storage

ii. Selection

a) Pure line selection

- Definition
- Method
- Achievements

b) Single plant Selection

- Procedure
- Achievements

c) Clonal Selection

- Collection of clones
- Testing of Clones
- Achievements

iii) Hybridization with reference to vegetable crops.

- Crosses betwee parents single cross, double cross, three way cross. back cross, triple cross, hybrids.

Selection procedure in segregating progenies

- Pedigre Selection
- Bulk Method
- Pure line family method (PLF)
- Single seed discent method

iv) Population improvement

- Mass Selection
- Line breeding
- Family breeding
- Selfing and massing

Unit-V : Vegetable Seed Production

i) Introduction

- Importance
- Present Status & Future prospectus

ii) Classification of vegetable crops

- Root crops
- Bulbous crops
- Leafy crops
- Flowering & Fruit crops

iii) Requirements of Seed Production

iv) Effect of environment on Seed Setting and production

v) Methods of Seed production of the under, mentioned crops dealing with the aspects of

- Land requirement
- Seedling/root production
- Nursery Management
- Planting
- Cultural Practices
- Breeding method used
- Plant protection
- Seed harvesting, vegetable cum seed production
- Dying, grading, Seed extraction method wet-dry methods

(a) Tropical Crops

- Solanaceous : Brinjal, Potato, Chillies, Tomato
- Cruciferous : Early Cauliflower, Turnip
- Root Crops (Radish, Carrot, Colocacea
- Leaf vegetables (Palak, Maithi etc)
- Bulb crops (Onion etc)
- Okra

(b) Temperate Vegetables

- Cauliflower
- Cabbage
- Capsicum

(c) Hybrid Seed Production in Vegetables

- use of male sterile lines
- Method of production of maintainers, pollen parents
- Planting ratio of 'A' : C lines
- Insect pollination (Honey bees, Blow flies)

PAPER-V
SEED TESTING

Unit-I :

- Introduction, history and development
- National and International organisations and seed testing linkages
- Seed Testing Laboratory Layout and furnishing
- Seed Testing equipments and their maintenance

Unit-II :

- Seed Testing Laboratory Management & functioning
- Seed Sampling, dividing
- Hetrogenity Test
- Handling and testing of the sample

- Physical Purity Analysis

Unit-III :
- Determination of Other Distinguishable Varieties
- Other Determinations
- Moisture Testing
- Germination Testing - requirements, seeding evaluation

Unit-IV :
- Rapid tests for seed quality determination
- Seed Vigour Testing
- Cultivar Purity Testing

Unit-V :
- Testing of Pelleted Seeds
- Uniformity in seed testing results & use of tolerances
- Record Keeping and reporting of results
- Storage of guard samples
- Seed testing in relation to Seeds Act & Marketing

PAPER-VI

SEED QUALITY CONTROL

Unit-I : **General Introduction**
- Seed quality its concept; physical purity, germination, health, and genetic purity.
- Concept of variety variation - heritable and non-heritable characters.

Seed quality control systems
- Seed legislation, seed certification

Seed legislation
- Objectives - Indian Seeds Act, Seed Rules and Seed Order. Seed Inspector qualifications, duties and responsiblities.

Seed Certification
- Concept and history
- Classes of seed and phases of seed certification

Unit-II :
- Seed Certification Agency - its organisation
- Seed Certification Standards
- Land requirements and isolation distance
- Principles of field inspection

Unit-III :
- Techniques of field inspection of seed production plots of varieties and hybrids of cereals, pulses, oilseeds, forage & fibre crops, potato and vegetables

Unit-IV :
- Inspection at harvesting, threshing, processing
- Sampling for seed quality evaluation
- Issue of certificates and tags, sealing
- Testing of genetic purity of seed in grow out test particularly

of cotton
- Revalidation of seed lots
- Interstate seed certification
- New Seed Policy (1988) provisional seed certification

Unit-V :
- Seed quality control organisation in India
- Composition and function of Central Seed Committee, Central Sub-Committee on Crop Standards, Notification and Release, Central Seed Certification Board, State Seed Committee.
- Management of Seed Certification Programme

Seed Certification Internationally
- Organisation of Economic Cooperation and Development Seed Certification Schemes.
- Future trends in Seed Certification
- Plant variety protection- Plant breeders rights

PRACTICALS

HYBRID SEED PRODUCTION

1. Studies on inflorescence, floral arrangment, floral morphology of some important crop plants. Cotton, Castor, Pigeonpea, Pearlmillet and Maize.
2. Artificial masculation and pollination studies in Maize and Cotton.
3. Studies on protogynous and protandrous nature of flowers in Pearlmillet and Sunflower.
4. Detailed study on sunflower - Receptacle, Ray flowers.
   Disc flowers. Main capitulum and lateral capitula in restorers.
   - Anthesis - Anther arrangement and time of anthesis.
   - Stigma extrusion - Process of stigma extrusion and hour of extrusion.
   - Pollination - Mechanism of cross pollination and self pollination in sunflower.
5. Floral structure of 'A' line, 'B' line and 'R' line. in reference to essential parts of the flower.
6. Studies on Synchronisation problem in Pearlmillet, Maize and Sunflower.
7. Identification and roguling of pollen shedders in C.MS.lines of Pearlmillet, sunflower and sorghum.
8. Genetic male sterility and maintenance of female line in Pigeonpea hybrid.
   (i) Identification of genetic male sterile plants at bud initiation stage.
   (ii) Methods of identifying male sterile anthers by structure and colour.

(iii) Laboratory methods of confirmation by acetocarmine test under microscope. I in Pot iodide test.

Land requirement 5 Acres well irrigated land.

VEGETABLE SEED PRODUCTION.

1. Raising of Nursery and Plantin

- Nursery requirement and management for different vegetables
- Seedling age for transplanting
- Precautions, irrigation etc.

2. Floral Biology of Vegetables

- Time for opening of flower
- Time for anther maturity
- Dehiscence of anther, hermophordite flowers

3. Study of Pollent grains of Vegetables

- Collection of Pollen
- Germination of pollen grains in water, Sugar solution Pollen gelly and other media.

4. Selfing and Crossing Techniques in Vegetables

- Cucurbits
- Solanaceous Crops
- Onion and Carrot
- Legumes - Pea and Beans
- Cole crops
- Garden beet and Palak
- Okra
- Lettuce

5. Identification of Vegetable Seeds

- Temperate Vegetables
- Tropical Vegetables
- Temperate - tropical Vegetables

6. Visit of the Vegetable breeding farm

- Experiments on Vegetable seed production, collection of seed, separation from pulp, drying etc.
- Seed planning.

7. Exercise on Planning of seed multiplication in different Vegetables.

Practical examples regarding seed multiplication ratio based on some assumptions.

SEED TESTING

1. Sample registration and determination of the relative efficacy of various mixing and dividing techniques
2. Obtaining working sample, making separation, weighing, identification of purity components and reporting results.
3. Testing of the germination substrata and determination of moisture holding capacity of sand.
4. Platting the seeds for germination, seedling evaluation and reporting of results
5. Pre-treatments, pre-drying, pre-chilling, chemicals (KNo3, GA3), scarification; hot water treatment and delinting of cotton seed.
6. Tetrazolium testing of agricultural, vegetable and forestry seeds.
7. Moisture testing by oven drying method
8. Handling of moisture meters and determination of relative efficacy of moisture meters.

SEED QUALITY CONTROL

1. Filling of application form for seed certification
2. Exercise in field area measurement and field map preparation
3. Checking of seed source, isolation requirements
4. Observation in field inspection-
   - Identification of objectionable weed plants and inseparable other crop plants.
   - Study of stable morphological characters useful in identifying off-types in seed production plots.
5. Taking of field counts and filling of inspection reports of important field crops both hybrids and vars
6. Study of sampling techinques and equipment
7. Study of varietal purity through examination of seeds, seedling and plants, recording of data and filling result forms

Practical examination

Distribution of marks.

(Note: Draw neat and well labelled diagrams wherever necessary)

		Marks
1.	Describe in detail the floral biology of the Specimen "A" classify upto family level.	4
2.	Artificial emasulation and pollination/ pilling of seed certification form in detail.	4
3.	Raise a nursery bed for the given vegetable samples and describe.	4
4.	Identify and describe vegetable seed specimens and equipments (M), (N), (O), (P)	4
5.	Moisture testing by over drying method or seed germination test	4
6.	Submission of on job training reports, specimens and viva voce	5
7.	Record books	5
	Total marks :	30

REFERENCES

1. Principles of plant Breeding : R.W. Allard
2. Breeding Asian Field Crops : J.M. Poehlman and D.N. Borthakur.
3. Plant Breeding : B.D. Singh.
4. Practicals in Plant Breeding : M.M. Bhandari
5. Cytogenetics and plant and Breeding : Chandrashekharan Parthasarthy.
6. Male sterility in higher plants : M.L.H. Kaul.
7. Heterosis reapraisal theory and practice : R. Frankel
8. Sunflower Science and Technology : Jack. F. Carter
9. Castor : V.A. Moshkin
10. Castor : L.G. Kulkarni and G.V. Ramamurthy.
11. Principles of culture development crop species : Walter R. Fehr.
12. Insect Pollination of crops : J.B. Free
13. Pollination Mechanisms, reproduction and breeding : R. Frankel and E.Galun
14. Seed Technology : R.L. Agrawal
15. Seed Production manual : NSC and Rockefeller Foundation-Publication.
16. Ahandbook of seedinspectors Min. of Agriculture. : Centralseed committee
17. Principles of seed certification and testing : N.P. Nema
18. An introduction to seed : T.R. Johnson.
19. Techniques in seed science and Technology : P.K. Agrawal and M. Dadlani
20. Swarup, V, 1977 Breeding proceedures for cross pollinated vegetable crops. Indian council of Agriculturel Research New Delhi. Innes, N.L. 1983. Breeding field vegetables, Asian Vegetable Research and Development Centre. Tainan... Taiwan.
21. Kalloo 1985. Vegetable Breeding RPC
22. Bassett, M.J.(1986) Breeding Vegetable Crops AVI Publishing Company.
23. Agarwal, P.K. and Dadlani, M. (1990). Techniques in Seed Science and Technology. South Asian Publishers, New Delhi.
24. Agrawal, R.L. (1987). Seed Technology. Oxford & IBH Publishing Co. New Delhi.
25. Kozlowski T.T. (1972) Ed. Seed Biology Vol. III. Academic Press, New York and London.
26. Tunwar N.S. and Singh S.V. (1988). Indian Minimum Seed Certification Standards. The Central Seed Certification Board, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

* * *

20. Computer Application (Vocational)
(Effective from the session June/July 2007-08)

The examinations in vocational Computer Application will comprise of two theory papers and practical examination. Each theory paper will be of 3 hours duration and carry 50 marks.

The practical examination will be of 6 hours duration and carry 50 marks.

The distribution of marks in the practical will be as follows

1) Practicals based on computer lab III	15 Marks
2) Practicals based on computer lab IV	15 Marks
3) Viva Voce (based on lab III & IV)	10 Marks
4) Record/Practical Journal	10 Marks

Each unit of theory paper will carry two questions with internal options to solve any one questions.

Candidates are required to pass separately in theory and practical.

The following syllabus is based in 8 theory periods and 4 practical periods (of 2 terms of 2 periods) per week.

PAPER III : VISUAL PROGAMMING

UNIT-I : Introduction to VB, integrated development environment, tool bar, menu bar, Project explorer, tool box, Property window, form designer, form layout, immediate windows , renaming and saving, Project objects, events properties and methods.

UNIT-II : Selecting and using controls, command button, text box, labels, option button, list box, check box, combo box, image object, picture box, line object data control

UNIT-III : Working with variables, procedure and functions, code module using private and public sub procedure, creating and using functions, design time and run time change of properties, program flow, branching with IF..THEN, ENDIF, FOR...NEXT, looping operation, select case, GO TO, DO loop, while using data control.

UNIT-IV : Interacting with Data: database and visual basic, data control, advance data control usage, advanced database control using VB application wizard.

UNIT-V : Printing output in VB: Printing information using print collection, Controlling output, Scaling output, formatting with fonts, Simple VB Programmes. Connection with Database.

Book recommended

1) Visual Basic in 21 Day's: Grey Pery (Techmedia)
2) Visual Basic 6.0 Programming guide : Microsoft Press.
3) Guide to VB : Petrnorten- (Techmedia)
4) V.B.6 for window : Davis (Addison – Wesley)
5) Mastering Visual Basic - Evangelous Petroutsos - BPB

*****

PAPER-IV : RELATIONAL DATA BASE MANAGEMENT SYSTEM

UNIT-I : Fundamentals of DBMS, RDBMS, Data Base Models, Architecture of Data Base Systems. Entity, Relationship, domain & Atrributes, keys, Functional Dependencies, Normalisation :

Normalisation Process, INF, 2NF, 3NF, BCNF.

UNIT-II : **Introduction to SQL:** Variables & constants, data types, operators & conditions, DDL commands: Create, Alter, Drop. DML commands: select, insert, update, delete. DCL Command : Commit, Rollback.
Functions: Numeric Functions, Character Functions, Conversion Functions, Group Functions.

UNIT-III : Joins : Equi Join, Non-equi, Self Join, Outer Join. Unions, Clauses. PL/SQL: Block, Architecture, data types, Type declarations, Control Structure.
Cursor : Concept of cursor, types of cursor, declaring cursor, opening & fetching cursors, cursors attributes, closing cursor, save point, data locking.

UNIT-IV : Security concept, types of Security, user ID, security object, types of privileges : Grant, revoke privileges. Column, passing privilege. Database Triggers, Procedures

UNIT-V : Dynamic SQL: Limitation of static SQL , basic concept of dynamic SQL, Dynamic statement execution, Dynamic queries.
SQL * Forms, creating forms, entering data, running forms, editing forms, Creating & running Reports.

Books Recommended: -

1) Understanding Oracle: James J. Perry, J.Q.Lqteer
2) Essential of Oracle7: Tom Luers
3) Oracle complete reference: Koch & Loney
4) Introduction to DBMS: Majumdar & Bhattacharya
5) Oracle 8 PL/SQL Black Book : Mark Gokman & Jonathan Ingram Comdex Publications.

Books for additional reading: -

1) The complete reference SQL (with CD): James R. Groff & Pawl N. Weinbarg(Tata Mac)
2) Oracle developers guide: Carol M. C. Dieter
3) Database management system: Corey
4) Database system concept: Korth & Silberschatz

PRACTICALS

COMPUTER LAB III : Minimum 16 practicals based on Syllabus of Paper-III

COMPUTER LAB IV : Minimum 16 practicals based on Syllabus of Paper-IV

Study tour : Study tour may be arranged to computer industry / software development organisation/ institutes, software park, IT park.

*****

List of equipments- (Minimum requirement) For Computer-Science/Vocational Computer Application for B.Sc. Part I, II, III

I. Hardware

a) Computer terminals-10 Nos.

Desirable configurations: Pentium-III/IV 64MB RAM, 20/40GB HDD, 1.2MB & 1.44MB FDD, 14"color monitor, 101KBD with modem, LAN card.

b) Printer (DMP)-2nos.

Desirable configuration: 132/80 col with 240cps

c) Inkjet Printer-1no.

d) Multimedia kit-1no.

II. Accessories:-

1) Floppy boxes, 1.44 MB or 1.2MB-2Boxes
2) Printer ribbon(Cartridge)
3) Printer stationary-5000sheet
4) Stabilizer/UPS
5) Internet facility

III. Softwares legal Versions based on syllabus.

IV. Other accessories be available based on syllabus.

---

21. FOOD SCIENCE

The syllabus is based on six theory periods and six practical periods per week.

The examination in Food Science will comprise of two theory papers and a practical. Each theory paper shall be of three hours duration and carry 60 marks. The practical shall be of 06 Hours duration and shall carry 30 marks. The distribution of practical marks shall be as follows:

1.	Record	05 marks
2.	Viva-voce	10 marks
3.	Exercise	15 marks
	Total :	30 marks

PAPER - III

FUNDAMENTALS OF NUTRITION

Unit I : Definition of overnutrition and under nutrition. Nutrients in foods. Water as nutrient. Role of fiber in nutrition.

Nutritional role of fats. Essential fatty acids. Physiological effects of saturated and unsaturated fatty acids. Effects of deficiency of fats. Phynoderma, obesity and atherosclerosis.

Unit II: Functions of proteins in nutrition, Essential and nonessential Amino acids. Evaluation of protein quality. Amino acid imbalance. Amino acid supplementation for quality improvement. Deficiency symptoms of proteins and aminoacids.

Unit III: Definition, classification, sources and functions of vitamins. Requirements and deficiency symptoms of vitamins, Loss of vitamins in processing.

Unit IV: Nutritional significance of macro and micro minerals. Requirement, sources and deficiency symptoms of minerals. Loss of minerals in processing.

Unit V : Concept of Balanced diet. Energy value of foods. BMR and its measurement. RDA for different age groups. Antinutritional factors, toxic constituents in foods, and their detoxification. Fortification and enrichment of foods.

BOOKS RECOMMENDED :

1) "Essentials of Food and Nutrition" by Swaminathan M.S., The Bangalore Printing and Publishing Co. Mysore Road, Bangalore.
2) Nutritive Value of Indian Foods, Ed Gopalan Pub., National Institute of Nutrition, Hyderabad.
3) Human Nutrition and Dietetics, Dandson, Passmore B.T., Oxford & IBH Pub. Co.
4) Normal and Therapeutic Nutrition, Robinson M.C. and Lower M.R., Mcmillan Pub. Co., Newyork (1985).

PAPER-IV

FOOD MICROBIOLOGY

Unit I : Classification & terminoloy of microorganisms. Study of morphology & physiology of bacteria, yeasta, molds & actinomycetes. Introduction of viruses. Nutritional requirements of microorganisms. Autotrophic and heterotrophic mode of Nutrition. Composition of nutrient media.

Unit II : Isolation, characterization of reproduction of microorganisms. Growth cycle of microorganisms synchronised of balanced

growth. Enumeration of microorganisms. Bacteriological analysis of food & water. Significance of coliform bacteria in foods.

Unit III: Effect of temperature on growth of microorganism control of micro-organisms by high and low temperature. Determination of TDT curve sterilisation by heat.

Unit IV : Effect of dehydration, irradiation of chemicals on growth of microorganisms. Evaluation of antimicrobial agents control of microorganism by physical & chemical methods.

Unit V : Role of microbes in fermented foods. Benefits of fermentation. Microbiology of alcoholic beverages, fermented dairy products. Oriental fermented foods, Bread, vegetable products, Vinegar.

BOOKS RECOMMENDED :

1) Microbiology Vol. I & II by C.B.Powar and H.F.Daginawala.
2) Microbiology by M.A.Pelczar, R.D.Reid & C.S.Chan, Tata McGraw Hill Publication Co. Ltd., New Delhi.
3) Food Microbiology by W.C.Frazier, Tata McGraw Hill Publication.

PRACTICALS

1) Estimation of Vitamin 'C' by dye titration.
2) Estimation of Iron by Wongs method.
3) Estimation of Calcium by EDTA titration.
4) Identification of microorganisms by gram staining, spore staining.
5) Identification of yeasts & molds.
6) Enumeration of microorganisms by SPC and MPN.
7) Microbiological analysis of water.

List of Recommended Equipment for a Batch of 16 Students

1.	Hot air oven.	2/Batch
2.	Incubator microbiological	1/Batch
3.	Quickfit Nitroen digestion/distillation assembly (Set of six)	3/Batch
4.	Controlled Temp. Water bath.	4/batch
5.	Analytical balance. (Digital preferred)	4/Batch
6.	Weight box	16/Batch
7.	Dessicators.	3/Batch
8.	Magenetic Stirrer	8/Batch
9.	Water Suction	1/Batch

10.	Photoelectric colourimeter	2/Batch
11.	pH meter	One
12.	Centrifuge machine electrically operated	one
13.	Water Deioniser/Distilled water still	2/Lab
14.	Heating Mantle	4/Batch
15.	Inoculation needles	5/Batch
16.	Microscopes with 10x, 45x & 90-100x objective monocular	6/Batch
17.	Colony counter	1/Batch
18.	Laminar air flow chamber	1/Batcher
19.	Bunsen burners	16/Batch
20.	Test tube stands. 12 tubes.	16/batch
21.	Tripod stands.	20/Batch
22.	Burrette stands	20/Batch
23.	Autoclave Portable Nonelectric	2/Batch
24.	Refrigerator	1
25.	Triple Beam Balance 100 gm capacity	1/Batch
26.	Mixer/Food Processor	1/Batch
27.	Gerber centrifuge with test tube	One set

List of Reconnended Appratus for a Batch of 16 Students

1.	Therometers 0-110 oC		10/Batch
2.	Thermometers 0-360 oC		10/Batch
3.	Silica crucibles		16/Batch
4.	Sintered glass crucibles		8/Batch
5.	Filteration flask with buchner funnel. 250 ml.		8/Batch
6.	Seperating funnel		4/Batch
7.	Microscopic slides/Coverslips		6 doz/Batch
8.	Test tubes		16 dox/Batch
9.	Pippettes Vol-10ml		16/Batch
		5 ml	16/Batch
		1ml	1/Batch
10.	Pippettes. Graduated-	10ml	16/Batch

		5ml	16/Batch
		1ml	1/Batch
11.	Burrettes	50ml	16/Batch
12.	Petridishes		3doz/Batch
13.	Vot flask	100 ml	18/Batch
14.	Vot flask	250 ml	18/Batch
15.	Vot flask	500 ml	4/Batch
16.	Conical Flask	250ml	36/Batch
17.	Conical Flask	100ml	36/Batch
18.	Measuring Cylinder	100ml	18/Batch
19.	Measuring Cylinder	250ml	4/Batch
20.	Measuring Cylinder	500ml	4/Batch
21.	Wash bottle	200ml	16/Batch
22.	Vernier Caliper (Digital)		1
23.	Lactometer		2
24.	Butrometers		1 set

*****

22.INDUSTRIAL FISH AND FISHERIES
(VOCATIONAL)

The examination in Industrial Fish and Fisheries will comprise of two theory papers and a practical examination. Each theory paper will be of three hours duration and carry 60 marks.

The practical examination will be of six hours duration and carry 30 marks.

Each unit of theory paper will carry two questions with internal option to salve any one question. Candidates are required to pass separately in theory and practical.

Project work at the end of IIIrd year will carry 10 marks.

Study tour will be complulsory for observation and collection of fishes, prawns, crabs, molluses during first year which will be treated as a part of "on the job training"

The following syllabus is based on 6 (six) theory periods and 6 (six) practical periods (of two terms of 3 periods each) per week.

PAPER-III
SEED PRODUCTION AND FISH PATHOLOGY.

Unit-I : Principles of fish breeding, Different stages of seed-Eggs, Spawn, fry and fingerlings Riverine collection. Transportation of fish seed and brood fish. Life cycle of penaeid and non-penacid prawn.

Unit-II : Pituitary gland and its role in fish breeding. Methods of fish and prawn breeding; induced breeding, bundh breeding, ovulating agents used (fish pitutary glands, HCG, pheromones and new generation drugs). Factors influencing fish breeding.

Unit-III : Hatching techniques. Different types of hatcheries; hatching hapa, vertical jar hatchery, chinese hatchery, D-variety hatcheries, prawn hatcheries and their management.

Unit-IV : Different types of farms and ponds. Topography, design, layout and construction of a fish seed farm. Nursery,rearing ponds, their preparation an management; harvesting of fry and fingerlings.

Unit-V : Principles of disease dignosis and fish health management. Pathogens, symptoms and treatment of infectious diseases; bacterial, fungal, viral, protozoan, helminthic, crustacean. Abolishing, pathogens and controlling its spreading.

Non-infectious and nutritional diseases and their treatment. Fish immunization and vaccines. Important disease problems of prawns, cultured shellfishes and their control. Environment in relation to diseases.

PAPER-IV
AQUACULTURE

Unit I : Definition, history, scope and importance of aquaculture, Status of aquaculture in different countries, Extensive, semi-intensive and intensive culture.

Different systems of aquaculture-monoculture, polyculture, integrated farming, pond culture, cage culture, pen culture, raft culture, raceway culture, culture in recirculatory water system, warm water and cold water aquaculture, sewage-fed fish culture.

Unit-II : Concept and principle of aquafarm management, Preparation of stocking pond; Prestocking management, predators and their control. Aquatic weeds, algal blooms and their control. Liming and fertilization.

Unit-III : Selection of species for culture, seed procurement and stocking. Post-stocking management, supplementary feeds and feeding. Nutritional requirement and formulation of artificial diets. Storage of feeds. Feeding techniques. Natural food an its importance in aquaculture.

Unit-IV : Characteristics of brackishwater. Brackishwater resources of India. Existing culture practices in bheris, pokkali paddy fields and kharlands. Breeding and culture of brackishwater finsfishes-milkfish,gray mullets, poearl-spot,cock-up, etc.

Unit-V : Mariculture-culture of edible oysters, mussels, clams, cockles, sea urchins, sea cucumber,etc. Pearl oyster culture. Culture of sea weeds.

Important species of cultivable penaeid and non-penaeid prawns. Tiger prawn culture, fresh water prawn culture. Polyculture of prawns with finfish. Air-breathing fish culture.

PRACTICALS

I. Collection and analysis of soil and water, samples for physio-chemical characteristics; study of food cycle in a pond, collection and identification of fish food organisms. Visits to farms to study different systems of aquaculture.

II. Maintenance of brood fish. Characteristics of gravid fishes and selection for induced breeding. Histological studies of fish endocrine glands. Collection and preservation of pituitary glands; preparation of extract; hypophysation. Study of different hatchery system. Water quality monitoring in hatcheries. Fish seed and brood fish transportation.

III. Preparation of Nursery, rearing and stocking ponds, Identification of aquatic insects, weeds and predotors and their control. Water quality analysis, Feed preparation and feeding. Indentification of seed of cultivable fish species. Seed stocking. Examination of plankton from culture ponds. Fish growth, survival an production analysis.

IV. Identification of important species of brackishwater finfishes and shellfishes an their seed. Collection and rearing of brackishwater shrimps

and fishes. Identification of cultivable species of prawns oysters, mussels, clams, sea weeds, etc. Visits to prawn hatcheries and mariculture centres.

V. Methods of isolation and culture of bacteria and fungi. Identification methods for common bacterial and fungal pathogens of fish. Examination and identification of common fish parasites. Fish disease diagnosis. Stuy of normal histology of gills, skin, kidney, spleen and liver and related histopathology. Assessment of water quality. Experimental treatments, case studies and field visits.

Practical Examination

Practical Examination will be of six hours duration and for total 30 marks.

Q.1	Identification of spots I to X (Fishes and prawns 4, Weeds-2,Predators and parasites-2, Plankton slides-2)	-	10 Marks
Q.2	Water analysis experiment.	-	5 Marks
Q.3	Dissection of pituitory gland OR Preparation and administration of pituitary extract.	-	5 Marks
Q.4	Submission of collection, food preparation, permanent slides	-	4 Marks
Q.5	Record and field diary	-	4 Marks
Q.6	Viva voce	-	2 Marks
	Total :		30 Marks

EQUIPMENTS AND FACILITIES

1.	Earthen ponds(0.05-0.1ha)	-	2
2.	Cement cisterns (25 m^2)	-	4
3.	Portable chinese hatchery	-	1
4.	Breeding hapas	-	4
5.	Hatching hapas	-	6
6.	Drag net	-	1
7.	Hand nets	-	3
8.	Compound microscopes	-	4
9.	Occular micrometers	-	4
10.	Centrifuge	-	2

11.	Homogeniser	-	6
12.	Syringes	-	12
13.	Needles	-	24
14.	Catheter	-	3
15.	Droppers	-	12
16.	Beakers(assorted)	-	12
17.	Emamel trays	-	6
18.	Plastic drays	-	6
19.	Refrigerator	-	1
20.	Hot air oven	-	1
21.	Hand mince	-	1
22.	Water analysis kit	-	1
23.	pH meter	-	1
24.	O_2 analyser	-	1
25.	Spectrophotometer	-	1
26.	Colorimeter	-	1
27.	Plankton nets	-	3
28.	Plastic pools	-	6
29.	Sieves for soil texture analyses	-	1 set
30.	Sedgwick Rafter Cells	-	2
31.	Glass troughs	-	12
32.	Pressure cooker	-	1
33.	Millipove filters	-	6
34.	Autoclave	-	1
35.	Phase contrast microscope	-	1
36.	Microtome	-	1

Facility for tissues block making, staining and mounting, glassware for analysis of carboon dioxide, alkality and ammonia, petri dishes, test tubes, etc.

REFERENCES

1. Principles and prectices of pond aquaculture. A state of the art review. Lennan, J.F.,R.O., Smitherman and G.Tehobanglous (Eds.), 1983, Oregon State University, U.S.A.
2. Giant Prawn farming, New, M.B.(Ed.) Elsevier Scientific Publishing Co.,Amsterdam.
3. Fresheater prawn farming : A mannual for the culture of M.Rosenbergii new, M.B.and S.Sngholka, 1982, FAO, Fish.Tech.Pap225, FAO,Rome.

4. The Biology and culture of Tilapias, Pullin, R.S.V. and R.H. Lowe-Mcconel (Eds.), 1982. ICLARM Conference Proceedings, 7, ICELARM, Manila, Philippines.
5. Standard methods for the examination of water andd waste water. APHA, 1981, American Public Health Association, Washington, D.C.
6. The theory and practice of induced breeding in fish. Harvey, B.J. and W.S. Hoar, 1979, IDRC-TS 21e. IDRC, Ottawa, Canada.
7. Bivalve Culture in Asia and the Pacific. Davy, F.B. and M.Graham (Eds.) 1982, IDRC-200e. IDRC-Asia Regional Office, Singapure.
8. Fish and Fisheries of India, Jhingram V.G.,1982. Hindustan Publishing Corporation, New Delhi.
9. Coastal aquaculture in the Indo-Pacific region, 1972. Pillay, T.V.R.(Ed.). Fishing News.
10. Handbook of Tropical aquaculture. Bard, J.1976. Centre Technique Forestier Tropical. Nogent-Sur-Marne,France.
11. Farming Marine fishes and shrimps; a multidisciplinary treatsise. Korringa, P. 1976. Elsevier Scientific Publishing company, Amsterdam.
12. Prawn farming today : Opportunities, techniques and development. Wickins, J.F.1986. Outlook on Agriculture, 15(2):52-60.
13. Fish Pathology. Robers, R.J.(Edd.) 1978. Bailliere Tindall, London.
14. Parasites and diseases of fish cultured in the tropics. Kabata,Z. 1985. Taylor and Frances, London.
15. Integrated agriculture farming systems. Pullin, R.S.V.and Z.H.Shehades (Eds.), 1980. ICLARM Coonference Proceedings, 4, ICLAR. Manila, Philippines.
16. A hatchery manual for the common Chinese and Indian major carps. Jhingran, V.G. an R.S.G.Pullin, 1985, ICLARM. Studies and Reviews 11.ICLARM, Manila, Philippines.
17. Principal diseasesof marine fish and shellfish. II Edition, 1990, Vol.1. Diseases of marine fish, Vol.2. Diseases of marine shellfish. Sindermann, C.J.Academic Press, London.
18. Wyonarovich, E. and L.Horvath, 1980. The artificial propagation of warm water fin fish - A manual for extension. FAO Fisheries Technical paper-201.
19. Advances in aquaculture, 1979. Food and Agriculture Organisation. Fishing News.
20. Planning of aquaculture developement - an introductory guide, 1977, FAO, Fishing News.
21. Handbook of Mariculture: Curstacean aquaculture, 1986. McVey James, P.(Ed.), CRC, Florida.

22. Selection, Hybridization and genetic engineering in aquaculture, 1987. Tiews, K.(Ed.), Heenemann, Berlin.
23. Aquaculture in Asia, 1990. AFSIB, Mangalore.
24. Fish culture, 1962. Hickling, C.F.Faber & Faber.
25. Practical approack to Fresh Water Culture,1985, Malu R.A.,Bharati Publication, Akola.
26. Aquaculture; Farming and husbandry of freshwater an maring organism, 1972. Bardach, J.E.Wiley.
27. Cage aquaculture, 1987. Beveridge, M.C.M. Fishing News.
28. Backyard fish farmming, 1990. Bryant, P. and others. Prism Press.
29. Aquaculture, 1979. Reay, P.J.Edward.
30. Perspective in aquaculture development Southeast Asian and Japan, 1988. South Asian Fisheries Development Centre, Aquaculture Deptt. Soafdec.
31. Commercial fish farming; with special reference to fish culture in Isreal, 1981. Hepher, B. and Y.Prunginin John Wiley and Sons.
32. Pond Fisheries in China, 1991. Lin.Z(Ed.) Pergamon.
33. Fish and Shellfish farming in coastal waters, 1972. Milne, P.H.Fishing News.
34. Coastal aquaculture in India, 1990. Santhanam, R. & Others, CBS Publications.
35. Project report on breeding of carps with ovaprim in India. Nandeesha, M.C.& Others. AFSIB, Mangalore.
36. Salmon and trout farming, 1988. Laired. L.M. and T. Needham (Eds.), John Wiley & Sons.
37. Trout farming handbook, 1990. Sedgwick, S.D.Fishing News.
38. Culture of Bivalve Molluscs 50 years experience at Conway, 1974. Walne, P.R. Fishing News.
39. Aquaculture of Fresh water Prawns/Macrobrachium species, Goodwin, H.J. and I.A.Hanson. United States Department of Commerce, NTIS.
40. Handbook of shrimp farming, 1991, MPEDA, Cochin.
41. Problems in prawn culture, 1978. Shigeno, K.Amerind Publications.
42. Pond culture of the Malaysian Prawn, Macrobranchiya Rosenbergii. Theodore, I.J.S. and Others, USDC, NTIS.

23.COMPUTER MAINTENANCE (VOCATIONAL)

The Examination in Computer Maintenance will comprise of two theory papers & one practical. Each theory paper will be of three Hrs. duration & carry 60 marks. The practical examination will be of 6 Hrs. duration & carry 30 marks.

Each unit of theory paper will carry two questions with internal option to solve any one question.

The syllabus is based on six theory periods & 6 practical periods per week. Candidates are required to pass separately in theory & practical.

Distribution of Practical marks are as follows.

1.	Practical based on computer lab.-I	9
2.	Practical based on computer lab.-II	9
3.	Viva-Voce on 1 & 2	6
4.	Practical journal / Record	6
	Total	30

Paper-III
(Microprocessor & Interfacing)

Unit-I : Introduction to microprocessor, Explanation to terms, Evolution of microprocessor, Microcomputer programming languages, Practical application, Microcomputer architecture, Single chip microprocessors, CU, ALU, Memory, I/O, Characteristics of Interrupts I/O, DMA, Coprocessor.

Unit-II : Microcomputer S/W concepts, Instruction formats, Addressing modes, Instruction types, ALP, 8085 mpu : Register structure, memory addressing.
Interrupt system in 8085, Important features of 8086, 80486 and pentium.

Unit-III : Intel 86 : Introduction, Architecture, Register, Addressing modes, Data X'fers, Arithmetics, Bit manipulation, String, Unconditional X'fer, Conditional branch, Iteration control, Interrupt, Processor control, Assembler Dependent & Assembler pseudo instructions, I/O, IOP (8089), 86 Interrupts, 86 DMA.

Unit-IV : **Peripheral Interfacing :** Parallel vs Serial interfacing, Synch. & Asynch. data S'mission, USART, UART, keyboard /Display interfacing, cCassatte recorder I/P Concept, CRT interfacing &

CRT Controller, Printing interfacing, Printer controller chip, DMA controller.

Unit-V : **Interfacing Standard :** Introduction, Parellel Interface, IEE488, GPI B, Typical interface std., CPIB system, GPIB operation, S-100 std. Bus, Serial interface, RS232C model, CRT interface, MODEM interface, RS422, RS 423.

Books Recommended :

1. Microprocessor Theory and Application (revised edition) - M.Raffiquellazammam
2. Microprocessor & interfacing : D.V.Hall.
3. Advanced Microprocessors and Peripherals :- Ray & Bhurchandi.
4. Intel Microprocessor's (fourth edition) : Barry Brey.
5. Microprocessing System 8086/8088 :- Liu & Gibson.
6. IBM PC Assembly Language & Programming : Peter Abel.

PAPER-IV
(C LANGUAGE WITH ALP)

Unit-I : **Introduction to C :** Introduction, Simple C program, character set, Keywords, Identifier, Variables, Data types operators, Expressions, Statements, Functions.

Unit-II : **Conditional statements, Loops & functions :** Relational operators, Logical operators, Conditional branching statements, conditional operators, Loops, Jumping functions, Anatomy of functions, Writing own functions, Function call.

Unit-III : **Arrays, Structures & Pointers :** Declaring & initialising arrays, Accessing array elements, Single dimensional array, 2-D arrays, Introduction to structures & Pointers.

Unit-IV: **Advance C :** Storage class specifiers : Auto, Register, Static, External, C preprocessor, Conditional compilation. Using assembly language in C : Clear Screen program for C, Compilation & Linking, Passing multiple parameters, summary on writing C procedures in assembly, Writing in-line assembly code in C, Summary on in-line assembly in C.

Unit-V : **C language with ALP using BIOS & DOS functions :** Procedures examples, Setting cursor, Clearing screen, Screen & K/B operation, Display on the screen, Display ASCII character set, Accepting input from K/B Display name.

Using debug for ALP.

Books Recommended :

1. Programming & problem solving through "C" - Kanetkar.
2. ALP for PC : John Jocha, Peter Norton.
3. IBM PC ALP : Peter Abel "

PRACTICALS :-

Computer Lab I :- Based on syllabus of Paper-I (Min.10 experiments)

Computer Lab II :- Based on syllabus of Paper-II (Min.10 experiments)

LIST OF EQUIPMENTS/SOFTWARES

1.	(a) Oscilloscopes (15/20 Hrs.)	-	3 Nos.
	(b) Oscilloscope (100 Hrs.)	-	1 No.
2.	Power Supplies	-	4 Nos.
3.	Digital and Analogue Multimeter	-	10 Nos.
4.	Bread Boards	-	10 Nos.
5.	Microprocessor Kit / Mother board	-	4 Nos.
6.	Digital IC Tester	-	2 Nos.
7.	PC (80286, 8086 XT) Trainer Kits	-	3 Nos.
8.	Printer	-	2 Nos.
9.	Diagnostic Cards (as per syllabus)	-	4 Nos.
10.	P.C. with current configuration	-	2 Nos.
11.	Add-on Cards (as per syllabus)	-	4 Sets
12.	Monitor	-	3 Nos.
13.	SMPS	-	2 Nos.
14.	UPS	-	2 Nos.
15.	CVT	-	4 Nos.
16.	Function Generator	-	2 Nos.
17.	Logic Probes	-	2 Nos.
18.	Virus Cards/Filter	-	2 Nos.
19.	HDD	-	2 Nos.
20.	Floppy Drives	-	4 Nos.
21.	MASM Assembler (S/W)	-	2 Nos.
22.	MS-DOS, UNIX & NOVEL (S/W)	-	1 No.
23.	Computer Unit	-	2 Nos.
24.	Antistatic Mat, Wrist Band	-	1 No.
25.	Vac. Cleaner	-	1 No.
26.	Computer Spares & Cards related to syllabus	-	2 No Each
27.	Licensed Softwares related to Syllabus & General functionality.	-	1 No. Each

24. BIOTECHNOLOGY (Regular/Vocational)
(Effective from the session 2002-2003)

The syllabus is based on six theory periods and six practical periods per week.

The Examination shall comprise of three theory papers and one practical. Each paper is divided into five units. There shall be one question on each unit with internal choice. Examinee shall attempt all five questions. Each theory paper shall be of three hours duration and carry 40 marks. The practical examination shall be of six hours duration and carry 30 marks.

PAPER-IV
BIOPHYSICS, MATHEMATICS, BIOSTATISTICS AND COMPUTER

Unit-I Energetics of a living body. Sources of heat limits to temperature. Heat dissipation and conservation. Strategies of light reception in microbes, plants and animals. Primary events in photosynthesis. Electrical properties of biological compartments, electricity as a potential signal. Generation and reception of sonic vibrations. Hearing aides. Intra- and intermolecular interactions in biological systems. Spatial and charge compatibility as determinant of such interactions.

Unit-II Physical methods applied to find out molecular structure: X-ray crystallography and NMR. Physical methods of imaging intact biological structures: Ultrasound, Optical filters, X-ray, CAT scan, ECG, EE, NMR imaging.

Unit-III The set theory, properties of subsets,Linear and geometric functions,Limits of functions, derivatives of functions,The binomial theorem,Logarithm, Differentiation and Integration.

Unit-IV Biostatistics : Probability calculations, Methods of sampling, Measurement of Central tendencies (Mean, median, mode), Measures of dispersions (range, mean deviation and standard deviation), ANOVA.

Unit-V Computers : General introduction to computers, organization of computers, digital and analogue computers, computer algorithm.

Computers in on line monitoring and automation. Application of computers in co-ordination of solute concentration, pH and temperature etc of a fermenter in operation.

PAPER-V
MOLECULAR BIOLOGY

Unit-I Molecular basis of life, Structure of DNA, DNA replication in prokaryotes and eukaryotes.DNA recombination: molecular mechanisms in prokaryotic and eukaryotic organisms. Insertion elements and transposons.

Unit-II Structure of prokaryotic genes,Prokaryotic transcription, Prokaryotic translation and Prokaryotic gene expression (lac, his, trp,catabolic repression).

Unit-III Structure of eukaryotic genes,Eukaryotic transcription, Eukaryotic tanslation and Eukaryotic gene expression, transcription factors.

Unit-IV Gene expression in yeast, Gene expression in protozoan parasites and Gene organization and expression in mitochondria, chloroplasts.

Unit-V Post translation regulation of gene expression, Development and environmental regulation of gene expression. Outline of developmental stages in Drosophila. Arapdopsis as a tool in molecular biology.

PAPER-VI
IMMUNOLOGY AND RECOMBINANT DNA TECHNOLOGY

Unit-I The Immune system and Immunity along with historical perspective. The organs and the cells of the immune system and their function. Antigen-antibody, their structure and interaction.

Unit-II Humoral and cell mediated immunity (role of MHC and genetic restriction). Origin of diversity in the immune system, Effector mechanisms and Immunity to infectious diseases, vaccines

Unit-III Gene cloning and its importance:

Tools and techniques: genomic DNA, handling of DNA, RNA, cDNA, RT enzymes and other reagents & techniques.Vehicles: Plasmids and bacteriophages, available plasmids, cosmids, viruses. Safety measures and regulations for recombinant DNA work, choice and selection of the tools and techniques.

Unit-IV Purification of DNA from bacterial,plant and animal cells.

Introduction of DNA into living cells, cloning vectors for E.coli, Cloning vectors for organisms other than E. coli,yeast, fungi, plants- agrobacterium, plant virus and animal viruses.

Unit-V Application of cloning in gene analysis:-

Identification of clone, study of gene location, structure and expression. Gene cloning and expression of foreign genes in research and biotechnology. Production of protein from cloned genes. Gene cloning in medicine: Pharmaceutical compounds, artificial insulin gene,recombinant vaccine, and diagnostic reagents.

PRACTICALS

1. Separation of cell types (from blood).
2. Separation of cell organelles:

   - Methods for cell lysis : rupture Osmotic/Chemical/Enzymatic lysis of cells followed by centrifugation. Monitoring cell lysis by release of cellular material and by change in light scattering etc.

   - homogenization, centrifugation of cell organelles.
3. Extraction of cellular materials:-

   - Extraction in saline buffers,

   - Extraction in solvents and

   - Precipitation from extracts.
4. Separation of the constituent molecules of the extract in aqueous buffer,

   - Adsorption chromatography,

   - Ion exchange chromatography and Thin layer chromatography of extracted material.

   Demonstration of chromosomal and plasmid DNA from bacteria.Restriction digestion of DNA. Separation of digested DNA by Gel electrophoresis.
5. Purification of antigens.
6. Enzyme -linked immunoassay.
7. Antigen - antibody reaction test (Widal test,Blood grouping,Pregnancy and VDRL test)
8. Radial immunodiffusion analysis.
9. Visit: Training programme for students - The students should be assigned visit/ training programme in clinic / hospital, dairy, water purification plant or biotechnological based industry, post graduate /research institution. Students should submit report of training/visit.

PRACTICAL EXAMINATION

TIME : 6 HRS MARKS : 30

1)	To perform one major experiment	10
2)	To perform one minor experiment	05
3)	Viva-Voce	05
4)	Practical record	05
5)	Training/Visit/study tour report	05
	Total :	30

Note : Major and minor experiment shall be decided by the internal examiner.

Books Recommended:

1. Methods in Biostatistics : B.K.Mahajan
2. Basic Biotechnology : Rev. Fr. Dr.S.Ignacimuthu.
3. Molecular Biology & Biotechnology : H.D.Kumar
4. Text Book of Biotechnology : G.R.Chhatwal
5. A Text Book of Biotechnology : R.C.Dubey
6. Modern Biotechnology : S.B.Primrose
7. Biotechnology : Trehan K.
8. Fundamental of Biotechnology : S.S.Purohit and S.K.Mathur.
9. Biochemistry : Lehninger
10. Text Book of Microbiology : R.Ananthanarayan and C.K.J.Paniker
11. Molecular Cloning - A Laboratory Mannual : M.J.Sambrook, E.F.Fritsch and T.Maniatis.
12. Essentials of Molecular Biology : D.Freifelder.
13. A Text Book of Biophysics : R.N.Roy
14. Elements of Biotechnolgoy : P.K.Gupta
15. Genes V : Lewin.

LIST OF INSTRUMENTS, EQUIPMENTS WITH SPECIFICATION REQUIRED FOR B.Sc.I,II AND FINAL BIOTECHNOLOGY.

SR.No.	NAME	MAKE
1.	pH Meter	Systronics/Elico J.Mitra/ any std. make

2.	Autoclave a.Portable	Yarco/Wiswo or any Std.make
3.	Incubator	Yarco/Tempo/Lab. Hosp.or any std.make
4.	Hot air oven	Yarco/Tempo/Lab.Hosp.or any Std.make
5.	Environmental Growth chamber	
6.	Laboratory Shaker/Platform Shaker	
7.	Colorimeter	Erma/Elicol Systronics or any std.make
8.	UV-Vis spectrophotometer	
9.	Tissue culture racks with illuminators.	
10.	Verticle & horizontal electropherosis apparatus with power pack	Genei/any std.make
11.	Single pan electrical balance	Systronics/K.Roy contac or any std. make
12.	Cyclo-Mixer	Remi/Tempo/or any std.make
13.	High Speed cooling centrifuge/with micro centrifuge rotor.	Remi C24 + 10X16 ml rotar + 4X100 ml rotar.
14.	UV Transilluminator/UV torch, Male Genei/Fotodyne with dual lamps.	
15.	Computer with Internet facility,	
16.	Microscope a Monocular	Olympus/Metzer/Labo.or any other std.make
17.	Oil Immersion lens	Olympus/Meopta Labo/or any std. make (preferabley Imported)
18.	Serological Water bath	Yarco/Tempo/Lab Hosp or any std.
19.	Laminer Air-flow (Hozt.) (to be installed in Asceptic room)	Micro filt/or any std.make
20.	Refrigerator	Godrej/Kelvinator/BPL/or any std. make
21.	Over head Projector	Metzer/photophone or any std.make
22.	Automatic Pipette Washer	Kumar/Modern or any std.make
23.	Membrance Filter Assembly	Yarco/Tempo/or any std.make

24.	Magnetic Stirver with hot plate	-"-
25.	Glass distillation assembly	NPL or any other std. make.
26.	Mixer	Sumit / Jyoti or any other std. make.
27.	Rotary shaker make.	Yarco/Tempo/Remi or any other std.
28.	B.O.D. Incubator	Toshiba / Yarco or any other std. make.
29.	Epidiascope	Metzer/Photophone or other std. make
30.	Slide Projector	Metzer/Photophone or other std. make

25. INDUSTRIAL MICROBIOLOGY

The examination in Industrial Microbiology comprised of two theory papers and one practical. Each theory paper is divided into five units. There shall be one question from each unit with internal choice. Theory paper is of three hours duration and shall carry 60 marks each. Each practical examination will last for atleast two consecutive date with minimum working hours each day. The syllabus is based on six theory periods and six practical periods per week.

Paper-III
(Industrial Fermentations and Metabolism)

Unit-I :- Fermentation Metabolism and enzymology:-

A) a) Metabolism, Definition and general strategy.
b) Metabolic Pathways (EMP, TCA, Oxidative Phosphorylation, and E.T.C.)
c) General concept of Respiration and fermentation.

B) a) Enzymology; Nature and definition of enzymes.
b) Classification and nomenclature of Enzymes.
c) Terminologies used in Enzymology.

Unit-II :- Biomass production:-

A) Bacterial biomass production *(Bacillus megaterium)*
B) Yest Biomass production(Torula yeast)
C) Fungel biomass *(Candida utilis)*
D) Biofertilizer production (Bacterial, Algal and Mycorrhizal)
E) Microbial insecticide production (Bacterial, viral and fungal insecticides)

Unit-III :- Fermentation of Alcoholic Beverages and amino-acids

A) Ethyl alcohol production from molasses, and waste sylphite liquor.

B) Beer production.
C) Wine production
D) Amino acid production (glutamic acid and L.lysine)

Unit-IV :- Fermentation of acids, enzymes and vitamins

A) Vinegar production (Orlean's process and Fring's generator)
B) Lactic acid production (from whey)
C) Citric acid production (Surface and submerged process)
D) Amylase (bacterial and fungal)
E) Vitamin (Riboflavin)

Unit V :- Antibiotics and Vaccine production

A) Antibiotics, Definition and applications.
B) Penicillin production.
C) Streptomycin production
D) Vaccine, Definition and types
E) Production of BCG Vaccine (live attenuated vaccine)
F) Salk vaccine (Killed vaccine)
G) Toxoid (Diphtheria, Tetanus)
H) Control, testing and Standardization of vaccines.

Paper IV
Food and Dairy Microbiology

Unit I :- Food Microbiology

A) Sources of Contamination of Fresh foods
B) Microbial Spoilage of Foods.
C) Preservation of Foods
   i) Low & High temperature
   ii) Dehydration
   iii) High osmotic pressure
   iv) Chemical preservation
   v) Radiation
   vi) Canning.

D) Food Poisoning :
   i) Food Infection
   ii) Food Intoxication.

Unit II :-Milk Microbiology

A) Definition, Composition & types of milk.
B) Sources of microorganisms in milk

C) Types of microorganisms in milk.
D) Pasteurization of milk - LHT, HTST, UHT.
E) Phosphatase test & its application
F) Quality & Grades of milk.

Unit-III:-Fermented food products

A) Introduction
B) Some important fermented food products.
   i) Pickles
   ii) Sauerkraut
   iii) Idli
   iv) Bread
   v) Oriented food product.

Unit IV :- Fermented Milk Products.

A) Introduction
B) Selection of raw milk for manufacture of fermented milk.
C) Production of Yogurt, Dahi & Cheese
D) Cultured Butter milk - Lassi, Chhach
E) Acidophilus milk products
F) Production of Kefir, Kaumiss & Leben
G) Nutritional & therapeutic value of fermented milk products
H) Defects & spoilage of fermented milk products.
I) Tests & Standards for fermented milk products.
J) Pathogens in fermented milk products.

Unit V:- Meat & Fishery Products

A) Spoilage of fresh and processed meat, fish and poultry.
B) Fermented sausages and country cured hams.
C) Fish sauges
D) Microbiological quality of various sea food products
E) Preservation of meat fish and poultry.

Practicals

1) Microbilogical Examinations of milk.
   A) Plate Count
   B) Methelene Blue Reduction test
   C) Test for Coliforms
   D) Phosphatase test
   E) Estimation of fats in milk.
   F) Demonstration of microbes in curd

2) Microbial Examination of vegetables, fruits, egg, canned food & ice cream
   A) Plate count
   B) Test for coliforms
   C) Yeast & molds
3) Demonstration of Mushroom Cultivation.
4) Isolation & study of food spoilage micro organisms from Sweets & Bakary Products.
5) Test of Sterility of food products
6) Production & estimation of alcohol
7) Production & estimation of citric acid.
8) Demonstration of enzyme production by micro organisms (eg. Amylase)
9) Immobilization of yeast
10) Isolation of antibiotic producing micro organisms from soil.
11) Estimation of Riboflavin.
12) Study Tour

Distribution of marks for Annual Practical Examination.

1)	Two minor experiments ----------	06
2)	One major experiments----------	08
3)	Spotting----------	05
4)	Viva-Voce----------	05
5)	Study tour report----------	04
6)	Class record ----------	02

	Total :	30

List of recommended books--

1) Fermentation technology by Whittakar
2) Industrial Microbiology by Casida.L.E. (Wiley Eastern Ltd. Publication)
3) Industrial Microbiology by A.H. Patel (Mac.millan Publication)
4) Fundamentals of Dairy Microbiology by J.B. Prajapati (Akta Prakashan)
5) Modern Food Microbiology by James M.Joy (B.S.Publication)
6) Industrial Microbiology by B.M. Miller and W. Litsky
7) Outlines of Dairy Bacteriology by SuKumar De.
8) Industrial Microbiology by Prescott and Dunn
9) Food Microbiology by Frazier
10) Industrial Microbiology by Rose

*****

26. BIOINFORMATICS

(Introduce from the session 2009-2010)

The examination shall comprised of 3 theory papers and one practical. Each theory paper shall be of 3 hours duration and carry 40 marks. The course is based on 6 theory periods and 6 practical periods per week.

The practical examination shall be of six hours duration and carry 30 marks.

PAPER-IV

Fundamentals of Biochemistry

Unit I : Water as the universal biological solvent, concept of osmolarity, ionization of water, weak acids and bases.

Unit II : Carbohydrates - Definition and classification of carbohydrates. Structure, occurrence and biological importance of Monosaccharides, Disaccharides, Oligosaccharides, polysaccharides and Mucopolysaccharides. Proteoglycans and glycoproteins.

Unit III : Lipids – Fatty acids : Classification, Nomenclature, structure and properties of saturated and unsaturated fatty acids. Simple and compound lipids, Triacylglycerols, Glycerophospholipids, glycolipids , Isoprenoids and steroids. Biological functions of lipids.

Unit IV : Proteins – Principles of protein structure, basic building blocks of proteins, Hierarchical organization of protein structure – Primary, Secondary, Tertiary and quaternary structure, Denaturation and Renaturation of proteins . Biological functions of Proteins.

Unit V : Enzymes - General characters and properties of enzymes . Nomenclature of enzymes . Holoenzymes, apoenzymes, active site of an enzyme, isoenzymes. Mechanism of enzyme action. Factors affecting rate of enzyme catalyzed reactions . Enzyme kinetics . allosteric inhibition .

Recommended books:

1. Lehninger's principles of Biochemistry by Nelson , Cox (M.M. Macmillan , New York.)
2. Fundamentals of Biochemistry by Donald Voet, Judith Voet, Charlotte Oratt. (John Wiley and Sons, N.Y.)
3. Text Book of Biochemistry by Dr.O.P.Agrawal.
4. Text Book of Biochemistry by J.L. Jain.
5. Text Book of Biochemistry by West and Todd.
6. Text book of Biochemistry by U. Satnarayan

7. Biochemistry 3rd edition by Lubert Stryer (WH Freeman and Co. San Francisco)
8. Molecular biology of gene by J.D. Watson, Hopkins, Ribertis, Stertz, Weiner.
9. Cell and Molecular biology by Darnell , Lodish , Baltimore.

PAPER-V
Fundamentals of Molecular Biology and Immune System

Unit I : Structure DNA, A,B,C,D and Z form of DNA. Secondary structure of RNA, Replication in Prokaryotic and Eukaryotes. Anatomy of Prokaryotic and Eukaryotic Genomes. Organelle genomes, Transposons.

Unit II : Fundamentals of Structural, Comparative and Functional Genomics and its applications. Genome Sequencing, Introduction to Genome Analysis. Structure of Prokaryotic and Eukaryotic Genes. Transcription of Prokaryotic and Eukaryotic Genes. Regulation of Gene Expression.

Unit III : Translation in Prokaryotics, Eukaryotics, Translation factors, Initiation, Elongation and Termination of Translation. Regulation of translation. Structure of Prokaryotic and Eukaryotic Ribosomes.

Unit IV : Organs and Cells of Immune System and their Function. Various types of Antibodies, their Structure and Function. Antigen Antibody Reaction. Antigen. Hapten.

Unit V : Humoral and Cell Mediated Immunity, MHC and immunity to infectious diseases. Vaccines, Lymphocytes Trafficking, T-Lymphocytes-cells, B-Lymphocytes-Cells, Macrophages, Dendritic Cells, Natural Killer Cell and Lymphokine Activated Killer Cells, Eosinophiles, Neutrophiles and Mast Cells. (Antigen Presenting Cells, Cell Mediated Subset of T-cells, helper and supressor cells, cell mediated and humoral immunity, antibody dependent cell mediated cytotoxicity, NKcells.)

Books :

(1) Essentials of Molecular Biology – D. Freifelder
(2) Elements of Biotechnology – P.K.Gupta
(3) Genes VI – Benzamin Lewin
(4) Molecular Biology of Cell, By Bruce Alberts 4th Edition.
(5) Molecular Cell Biology, Lodish (5th Edition)
(6) Immunology : An Introduction – Iam R. Tizard
(7) Fundamentals of Immunology, William Paul
(8) A Handbook of Practical Immunology – G.P.Talwar.

PAPER-VI
Basic Bioinformatics

Unit I : Introduction to Windows : Starting Windows XP, Handling the Mouse, Window Controls, Using Menus. Dialog Boxes, Microsoft Office 2007. Launching and Application, Menus and Dialog Boxes, Dialog Box Options, Toolbars.

Unit II : Basic Internet Use and Search Engines : Fundamentals of Internet, WWW, HTML, URLs, Browsers : Netscape/Opera/Explorer Search Engines : Google, PUBMED, NCBI EMBL, GENBANK, Entrez, Unigene, PDB, SwissProt, And TrEMBL.

Unit III : Sequence Aligment : Introduction to sequnce Analysis, Sequence, Analysis of Biological Data, Models for Sequence Analysis and their Biological Motivation, Methods of Alignment, Application of Dot Matrix, Methods of Optimal Alignment using gap penalty and sore Matrices, tools for Sequence Analysis : BLAST, FASTA, Multiple Alignment Tools and its Application.

Unit IV : Methods for Gene Expression Analysis : Introduction to Microarray Technology, Sources of Variability, Raw data, Design of Microarray Experiments, Low level Analysis, Data Management Procedures, Diagnostic plots, Dye-intensity bias corrections (c DWA Microarray), EST clustering, TIGR Gene Indices.

Unit V : Phytogenetic Analysis : Concepts of Phylogeny, Homology, Analogy, Orthology & paralogy, Phylogenetic Data Analysis, Tree building methods, Tree Evaluation & Interpretation Methods, Distance & Parsimony, Nature, Scape and Applications of Phylogenetic Software.

Recommended Books :

(1) Introduction to Bioinformatics – S.Sundar Rajan & R.Balaji (Himalaya Publishing Housing)
(2) Introduction to Bioinformatics – T.K.Attwood & DJ Parry Smith (Pearson Education Asia)
(3) Bioinformatics : A Practical Guide to the Analysis of Gene & Proteins – D.Baxevanis and F.Oulette (Wiley Publication)

Distribution of practical marks :

(1)	To perform two major experiment	:	20 marks
(2)	Viva-voce	:	05 marks
(3)	Practical record	:	05 marks
	Total	:	30 Marks

Practical :

1. Paper Chromatography of Amino Acid.
2. Paper Chromatography of Carbohydrates.
3. TLC
4. Estimation of Carbohydrate by Qualitative Methods.
5. Estimation of Carbohydrate by Quantitative Methods.
6. Estimation of Oil.
7. Learning the Internet System in the Laboratory and Getting its Characteristics.
8. Searching Scientific Information using NCBI, or any Search Engine.
9. Retrival of Data from NCBI/SWISS Prot Databank and Analysis of Motif
10. Identification of Gene using gene scan.
11. Multiple Sequence Alignment of Plant Protein using Clustal-W
12. Retrival of 3D Structure of Protein from PDB.
13. Citation of Literature using pub med.
14. General Purpose Utilities, Cal, Date, Eco, Printf, be, Script, passwd, who etc.
15. The File System : pwd, cd, mkd, rmdir, etc.
16. Handling Ordinary Files:Cat, cp, rm, m,v, more, wc, od, cmp, tar, zip, unzip, etc.
17. Basic File Attribute : ls, chmod etc.
18. The vi editor : Basic Commands.

List of Equipments :		**Quantity**
(1)	Photoelectric Calorimeter	02
(2)	pH meter‘	02
(3)	Table Centrifuge	04
(4)	Incubator	02
(5)	Hot Air Oven	01
(6)	Refridgerator	01
(7)	Serological Water Bath	02
(8)	Water Distillation Plant	01
(9)	Thin Layer Chromatography Assembly.	
(10)	Single Pan Balance (Triple Beam)	02
(11)	Top Pan Balanace	01
(12)	Cyclo Mixer	01
(13)	Laboratory Microscopy	05
(14)	PC Pentium IV (1 PC for 2 students)	
(15)	Legal Software Windows-XP.	01
(16)	Legal Software Visual Studio	01

(17)	PC based Unix O.S. Legal Software	01
(18)	Printers	
(i)	80 Column Dot Matrix	01
(ii)	Inkjet Printer	01
(19)	LCD Projector	01
(20)	Broad Band Connection.	01

27. ENVIRONMENTAL STUDIES

Total Marks : 100

PART-A

SHORT ANSWER PATTERN **25 Marks**

1. The Multidisciplinary nature of environmental studies

. Definition, scope and importance.
. Need for public awareness.

(2 lecture hours)

2. Social Issues and the Environment

. From Unsustainable to Sustainable development
. Urban problems related to energy
. Water conservation, rain water harvesting, watershed management
. Resettlement and rehabilitation of people; its problems and concerns. Case studies.
. Envionmental ethics : Issues and possible solutions.
. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
. Wasteland reclamation.
. Consumerism and waste products.
. Environment Protection Act.
. Air (Prevention and Control of Pollution) Act.
. Water (Prevention and Control of Pollution) Act.
. Wildlife Protection Act.
. Forest Conservation Act.
. Issues involved in enforcement of environmental lesislation.
. Public awareness. (7 lecture hours)

3. Human Population and the Environment

. Population growth, variation among nations.
. Population explosion - Family Welfare Programme.

. Environment and human health.
. Human Rights.
. Value Education.
. HIV / AIDS.
. Women and Child Welfare.
. Role of Information Technology in Environment and human health.
. Case Studies. (6 lecture hours)

******

PART-B

ESSAY TYPE WITH INBUILT CHOICE 50 Marks

4. Natural resources :

. **Renewable and non-renewable resources :**
  . Natural resources and associated problems.
    - Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
    - Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
    - Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
    - Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
    - Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
    - Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
  . Role of an individual in conservation of natural resources.
  . Equitable use of resources for sustainable lifestyles.

(8 lecture hours)

5. Ecosystems

. Concept of an ecosystem.
. Structure and function of an ecosystem.
. Producers, consumers and decomposers.
. Energy flow in the ecosystem.
. Ecological succession.

. Food chains, food webs and ecological pyramids.
. Introduction, types, characteristic features, structure and function of the following ecosystem :-
  - Forest ecosystem
  - Grassland ecosystem
  - Desert ecosystem
  - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lecture hours)

6. Biodiversity and its conservation

. Introduction - Definition : genetic, species and ecosystem diversity.
. Biogeographical classification of India.
. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
. Biodiversity at global, National and local levels.
. India as a mega-diversity nation.
. Hot-spots of biodiversity.
. Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
. Endangered and endemic species of India.
. Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

(8 lecture hours)

7. Environmental Pollution

. Definition
  . Causes, effects and control measures of :-
    - Air pollution
    - Water pollution
    - Soil pollution
    - Marine pollution
    - Noise pollution
    - Thermal pollution
    - Nuclear hazards
  . Solid Waste Management : Causes, effects and control measures of
  . Role of an individual in prevention of pollution.
  . Pollution case studies.
  . Diaster management : floods, earthquake, cyclone and landslides.

(8 lecture hours)

PART-C

ESSAY ON FIELD WORK **25 Marks**

8. Field work

. Visit to a local area to document environmental assets - river / forest / grass land / hill / mountain

. Visit to a local polluted site - Urban / Rural / Industrial / Agricultural

. Study of common plants, insects, birds.

. Study of simple ecosystems - pond, river, hill slopes, etc.

(5 lecture hours)

(**Notes :** i) Contents of the syllabys mentioned under paras 1 to 8 shall be for teaching for the examination based on Annual Pattern.

ii) Contents of the syllabys mentioned under paras 1 to 4 shall be for teaching to the Semester commencing first, and

iii) Contents of the syllabys mentioned under paras 5 to 8 shall be for teaching to the Semester commencing later.

LIST OF REFERENCES :-

1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.

2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email : mapin@icenet.net **(R)**

3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

4) Clark R.S., Marine Pollution, Clanderson Press Oxford **(TB)**

5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.

7) Down to Earth, Certre for Science and Environment **(R)**

8) Gleick, H.P. 1993, Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p.

9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural Histroy Society, Mumbai **(R)**

10) Heywood, V.H. & Watson, R.T. 1995, Global Biodiversity Assessment, Ca mbridge Univ. Press 1140p

11) Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi. 284 p.

12) Mckinney, M.L. & Schoch, R.M. 1996, Environmental Science Systems & Solutions, Web Enhanced Edition. 639 p.

13) Mhaskar A.K., Matter Hazardous, Techno-Science Publications **(TB)**

14) Miller T.G.. Jr., Environmental Science, Wadsworth Publishing Co. **(TB)**

15) Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co., U.S.A., 574p.

16) Rao M.N. & Datta A.K.,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.

17) Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.

18) Survey of the Environment, The Hindu **(M)**

19) Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science **(TB)**

20) Dr. Deshpande A.P., Dr. Chudiwale A.D., Dr.Joshi P.P. & Dr. Lad A.B. : Environmental Studies, Pimpalapure & Company Pub., Nagpur.

21) डॉ. विठ्ठल घारपुरे : पर्यावरणशास्त्र, पिंपळापुरे ॲन्ड कंपनी पब्लिशर्स, नागपूर.

22) Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media **(R)**

23) Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications **(TB)**

24) Wagner K.D., 1998, Environmental Management, W.B.Saunders Co., Philadelphia, USA 499p.

(M) Magazine

(R) Reference

(TB) Textbook

25) Environmental Studies : R.Rajgopalan, Oxford Uni. Press, New Delhi, 2005

******

%SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI ORDINANCE NO. 42 OF 2005

Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."
2. This Ordinance shall come into force from the Academic session 2005-06.
3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-
   - (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
   - (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competant officer of the University.
   - (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
   - (iv) "Candidate" means a person who has been admitted to an examination by the University.
   - (v) "Regular Candidate" means an applicant who has applied for admission to a Univeristy examination through an affiliated college, Department or Institute in which he/she has prosecuting a regular course of study.
   - (vi) "Examinee" means a person who present himself/herself for an examination to which he/she has been admitted.
   - (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
   - (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.
   - (ix) " Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.

% Amended by Ordinance No. 7 of 2006, and 10 of 2007.

   - (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
   - (xi) "Bachelor Degree Examination" means a examination leading to Bachelor Degree of the University.
   - (xii) "Previous Year" means a year following by final year of Bachelor Degree.
4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.
5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-

   1) Bachelor of Arts
   2) Bachelor of Performing Arts
   3) Bachelor of Fine Arts
   4) Bachelor of Mass Communication
   5) Bachelor of Social Work
   6) Bachelor of Commerce
   7) Bachelor of Business Administration
   8) Bachelor of Science
   9) Bachelor of Computer Science
   10) Bachelor of Computer Applications
   11) Bachelor of Pharmacy
   12) Bachelor of Science (Home Science)
   13) Bachelor of Technology (Cosmetics)
   14) Bachelor of Engineering
   15) Bachelor of Engineering (Part Time) (Civil)
   16) Bachelor of Textile
   17) Bachelor of Technology (Chemical Technology)
   18) Bachelor of Technology (Chemical Engg.)
   19) Bachelor of Architecture, and
   20) Bachelor of Laws (Five Year Course)

6 i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,

1) Bachelor of Arts
2) Bachelor of Performing Arts
3) Bachelor of Fine Arts
4) Bachelor of Mass Communication
5) Bachelor of Social Work
6) Bachelor of Commerce
7) Bachelor of Business Administration
8) Bachelor of Science
9) Bachelor of Computer Science
10) Bachelor of Computer Applications
11) Bachelor of Pharmacy
12) Bachelor of Science (Home Science)
13) Bachelor of Technology (Cosmetics)
14) Bachelor of Engineering (Part Time) (Civil)

ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,

1) Bachelor of Engineering
2) Bachelor of Textile
3) Bachelor of Technology (Chemical Technology)
4) Bachelor of Technology (Chemical Engineering)
5) Bachelor of Architecture, and

iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)

iv) Students admitted to Second Year/Third Year/IVth Semester Vth Semester of various degree examination courses in different faculties n the academic session 2005-06 or thereafter shall have to appear for examination in the subject Environmental studies.

7. The main Examination leading to Environmental Studies shall be held in Summer and Supplementary examination in Winter every year, at such places and on such date as may be appointed by the Board of Examinations.
Explanation :- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree examination courses irrespective of annual or semester pattern.

8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.

9. Common question paper for all courses covered under this Ordinance alongwith answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of the subject.

10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University.
Provided that prescribed evaluation fee for evaluation of each answer Book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.

11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-

Sr. No.	Grade/Category	Marks secured
1.	"A"	- 60 and above
2.	"B"	- 45 to 59
3.	"C"	- 35 to 44
4.	"D"	- 25 to 34
5.	"Fail"	- 24 and below
6.	"Absent"	

12. For the purposes of teaching, learing and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/ Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.

13. i) Duration of theory examination of this subject shall be three hour.
ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.
iii) Distribution of these 100 marks shall be as follows :-

a) Part-A, Short Answer Pattern	-	25 Marks
b) Part-B, Essay type with inbuilt choice	-	50 Marks
c) Part-C, Essay on Field Work	-	25 Marks

14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.

15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or Summer examination.

16. For teaching of the subject, there shall be atleast two hour per week.
For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered elligible.

17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.

18. Every College/University Teaching Department shall Charge addtional fee of Rs. 100/- to every student of the subject Environmental Studies. Out of this Rs.100/-, the College/University Teaching Department shall have to pay Rs.25/- to the University as an examination fee of each candidate for the subject Environmental Studies.

19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.

20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.

21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.

    Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.

22. Certificates shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.

*****

DIRECTION

No.:5/2005. Date : 3/6/2005

Subject : Fees to be charged to the students of the subject Environmental Studies as a compulsory subject at Bachelor Degree level

Whereas the Academic Council in its meeting held on 24/8/2003, vide Item No. 65, considered the letter received from Dr. Narendra Jain, Joint Secretary, University Grants Commission, New Delhi, dtd. 31st July, 2003, alongwith a copy of "Six month module Syllabus for Environmental Studies for Undergraduate courses" of all branches of Higher Education and resolved to refer the letter alongwith module Syllabus to all faculties for their considerations and recommendations threon. The Council further resolved that the said recommendations be placed before the joint meeting of the Deans for further recommendations to the Academic Council,

AND

Whereas the joint meeting of Deans of faculties under the Chairmanship of Hon'ble Vice-Chancellor held on 16th July, 2004 has considered the recommendations of the faculties in the University regarding "Six month module Syllabus for Environmental Studies for Undergraduate courses" and resolved to recommend the decisions taken by it in respect of the subject Environmental Studies to the Academic Council,

AND

Whereas Academic Council in its meeting held on 16-08-2004 on considering Item No. 46 on the Agenda, resolved to accept the minutes of the joint meeting of Deans of the faculties in the University,

AND

Whereas as per decision of the Academic Council, the subject Environmental Studies is to be appointed as a compulsory subject for the previous year of the Bachelor Degree from the Academic session 2005-2006 excluding the Bachelor Degrees in the faculty of Education and LL.B. Three Year Course,

AND

Whereas the Management Council in its meeting held on 21/05/2005, vide Item No.167 has accepted fees to be charged to the students of the subject Environmental Studies as a compulsory subject at Bachelor Degree level,

AND

Whereas the matter is required to be regulated by an Ordinance and making amendment in the existing Ordinance is time consuming process,

Now, therefore, I, Dr. S.N.Patil, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers conferred upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, do hereby issue the following direction :-

1) This direction shall be called "Examination in Environmental Studies leading to Bachelor Degree, Direction, 2005"
2) This direction shall come into force from the date of its issuance.
3) Every College / University Teaching Department shall charge additional fee of Rs.100/- to every student of the subject Environmental Studies.Out of this Rs.100/-, the College / University Teaching Department shall have to pay Rs. 25/- to the University as an examination fee of each candidate for the subject Environmental Studies.
4) Answer books of external examinee shall be evaluated at the examination centre where the examinee has been examined for the subject Environmental Studies. Each examination centre shall be paid prescribed evaluation fee for evaluation of each answer book of external examinee appeared from that examination centre.

Sd/-
(Dr. S.N.Patil)
Vice-Chancellor

Amravati
Date :03/06/2005.

*****

Index

B.Sc. Part-II (Prospectus No. 2011122)

Sr. No.	Sub. No.	Subject	Page No.
1.		Special Note	-
2.		Ordinance No. 143	1
3.		Ordinance No.42 of 2005 (Environmental Studies)	13
4.		Direction No. 5 of 2005	18
5.	1	Mathematics	1
6.	2	Geology	5
7.	3	Statistics	10
8.	4	Geography	15
9.	5	Microbiology	19
10.	6	Biochemistry	31
11.	7	Computer Science	39
12.	8	Environmental Science	43
13.	9/10	Industrial Chemistry/(Regular/Vocational)	48
14.	11	Petrochemical Science	54
15.	12	Physics	59
16.	13	Chemistry	68
17.	14	Botany	79
18.	15	Zoology	85
19.	16	Electronics (Instrumentation)	92
20.	17	Biological Techniques & Specimen Preparation (Vocational)	99
21.	18	Instrumentation (Vocational)	104
22.	19	Seed Technology (Vocational)	109
23.	20	Computer Application (Vocational)	120
24.	21	Food Science	123
25.	22	Industrial Fish & Fisheries (Vocational)	127
26.	23	Computer Maintenance (Vocational)	134
27.	24	Biotechnology (Regular/Vocational)	137
28.	25	Industrial Microbiology	142
29.	26	Bioinformatics	146
29.	27	Environmental Studies	150