

NORTH MAHARASHTRA UNIVERSITY, JALGAON
SYLLABUS FOR F.Y.B.Sc. (ELECTRONICS)

PAPER : 1

Passive Electronic Components and Network Theorms and Digital Electronics.

SECTION A : FIRST TERM

Passive Electronic Components and Network Theorems

CHAPTER 1 : RESISTORS :

Symbols, Colour Codes, types such as Carbon, Metal Film, Wirewound, variable resistors (Logarithmic and linear Potentiometers and Presets)

(Periods 6, Marks 8)

CHAPTER 2 : CAPACITORS :-

Symbols, Colour Codes, types such as Paper, Mica, Tantalum, Polystyrene, Electrolytic, Variable Capacitors (Gang & Trimmer).

(Periods 8, Marks 8)

CHAPTER 3 : INDUCTORS :-

Symbol, types such as air core, iron core, ferrite core, chokes.

(Periods 4, Marks 6)

CHAPTER 4 : TRANSFORMER :-

Principle of transformer, types of transformer such as stepup, stepdown, autotransformer, isolation transformer, Design of mains transformer (voltage ratio, current ratio, impedance ratio, turns ratio, secondary current, power in primary & secondary, transformer efficiency), types of cores, mention different losses.

(Periods 6, Marks 8)

CHAPTER 5 : SWITCHES, RELAYS AND CONDUCTORS :-

Idea of SPDT, DPDT switches, types such as toggle switch, rotary switch, Reed switch, Thumbwheel switch, Thermal & electromagnetic relay, concept of conductors, specifications such as wire size, resistance, current carrying capacity, capacitance, breakdown voltage.

(Periods 8, Marks 10)

The study of above passive components should be as regards to :

- | | |
|----------------------------|---------------------------|
| i) Composition | ii) Range values |
| iii) Practical limitations | iv) Electrical properties |
| v) Ratings | vi) Name different uses. |

CHAPTER 6 : NETWORK THEOREMS :-

Ohm's law, kirchhoff's Current & Voltage law, Thevenin's theorem, Norton's theorem, Superposition theorem.
(Periods 8, Marks 10)

REFERENCE BOOKS :

- 1) Understanding Electronic Components : Water
- 2) Electronic Principles : V.K. Mehta
- 3) Basic Electronics : B. Grob
- 4) A Monograph Integrated Electronic : Goyal & Khetan
- 5) Communication : Shrader
- 6) Radio by experiments : D. C. Sahani

PAPER I : SECTION B : SECOND TERM

DIGITAL ELECTRONICS

CHAPTER 1 : NUMBER SYSTEMS

Decimal, Binary, Octal, Hexadecimal number Systems & their interconversion, BCD codes (8421, Gray, Excess-3)
(Periods 8, Marks 10)

CHAPTER 2 : LOGIC GATES :-

Positive and Negative logic, OR, AND & NOT gates using discrete components, NOR, NAND, EX-OR gates, study of IC's-7400, 7404, 7408 (Internal logic diagram and pin connections), Logic Families (Diode logic, DTL, TTL), Definitions of performance parameters of logic families, Basic building blocks of TTL gates; Multimeter input transistor, Totem pole and open collector outputs.
(Periods 10) (Marks 12)

CHAPTER 3 : BINARY ARITHMETICS AND BOOLEAN ALGEBRA :-

Binary additions & subtraction, 1's complements, 2's complements and its arithmetics, Half and Full adders, Boolean axioms (Laws and theorems of Boolean algebra), D'Morgans theorems (Statement, Verification and Applications).
(Periods 10) (Marks 12)

CHAPTER 4 : FLIP FLOPS :-

R-S, Clocked R-S, D, edge triggered D-flip flop, J-K, Masterslave (M-S) J-K & T flip flops (Using logic gates), Concept of preset and clear.
(Periods 6) (Marks 8)

CHAPTER 5 : TIMER IC 555 :-

Functional description and it's application as square wave generator (Astm mode), Idea of duty cycle bitable and monostable mode.
(Periods 6, Marks 8)

REFERENCE BOOKS

1)	Digital Principles and Applications:	Malvino-Leach
2)	Digital Electronics :	R.P.Jain
3)	Digital Electronics :	Gothman
4)	Digital Electronics :	V.K.Jain
5)	Digital Computer Electronics :	A.P.Malvino
6)	Digital Electronics :	Avinash Kapoor

SYLLABUS FOR P.Y.B.Sc. (ELECTRONICS)

PAPER : II

SEMICONDUCTOR DEVICES AND BASIC ELECTRONICS CIRCUITS

SECTION A : FIRST TERM

SEMICONDUCTOR DEVICES

CHAPTER 1 : SEMICONDUCTOR :-

Review of atomic structure, formation of energy bands, Energy diagrams for conductor, Semiconductors, insulators, charge carriers in semiconductors (electron-hole pair) intrinsic and extrinsic semiconductors, (formation of P and N type semiconductors)

(Periods 8) (Marks 10)

CHAPTER 2 : P-N JUNCTION :-

Junction diode, Depletion layer and barrier potential, Effect of forward and reverse bias on depletion layer and barrier potential, I-V Characteristics (Knee voltage, Break down voltage, PIV), Junction diode as a switch.

Study of zener diode. Symbol, biasing application of varactor diode, photodiode and LED.

(Periods 8) (Marks 10)

CHAPTER 3 : BIPOLAR JUNCTION TRANSISTOR (BJT) :-

Construction, principle of operation (PNP, NPN) CB, CE & CC configurations, input, output and transfer characteristics for CE configuration, Relation between alpha & beta. (D.C.)

(Periods 6) (Marks 8)

CHAPTER 4 : UNI-JUNCTION TRANSISTOR (UJT) :-

Construction, basic principle of working, equivalent circuit, characteristics, UJT as a switch and Relaxation Oscillator.

(Periods 6) (Marks 7)

CHAPTER 5 : FIELD EFFECT TRANSISTOR (FET) :-

Construction, basic working principle, Characteristics, pinch off voltage, use of FET as VVR.

Construction and Working of n channel depletion and enhancement type MOS FET's and their characteristics.

(Periods 8) (Marks 10)

CHAPTER 6 : SILICON CONTROL RECTIFIER (SCR) :-

Construction, Working, Equivalent circuit, Characteristics, use of SCR as a switch.

(Periods 4) (Marks 5)

REFERENCE BOOKS :

- | | | |
|-------------------------------------|---|-------------------|
| 1. Solid State Devices | : | Tapper (Vol -I) |
| 2. Basic Electronics | : | D.C.Tayal |
| 3. Basic Electronics for Scientists | : | James J. Brophy |
| 4. Electronics Principles | : | V.K.Mehta |
| 5. Basic Electronics | : | B.Grob. |
| 6. Electronics Principles | : | A.P.Malvino |
| 7. Semiconductor Devices | : | Millman & Halkias |

**PAPER II : SECTION B : SECOND TERM
BASIC ELECTRONICS CIRCUIT**

CHAPTER 1 : RECTIFIER CIRCUITS :-

Half wave, Full wave and Bridge rectifier Circuits, Filters (Capacitor input, Choke input and filters), Voltage doubler (Full wave).

(Periods 6) (Marks 8)

CHAPTER 2 : TRANSISTOR BIASING METHODS :-

Need of biasing, Fixed bias, Collector to base bias, Self bias Circuits.

(Periods 6) (Marks 8)

CHAPTER 3 : AMPLIFIER CIRCUITS :-

Single stage Transistor CE amplifier AC & DC load line. operating point.

h-parameters - concept of black box, Hybrid equivalent circuit of transistor in CE configuration and its performance (input impedance, current gain, voltage gain).

(Periods 7) (Marks 8)

CHAPTER 4 : OSCILLATORS & MULTIVIBRATOR CKTS :-

Positive and Negative feedback, effect of negative feedback, Barkhausen Criteria, Phase shift Oscillator, Hartley oscillator, Multivibrators - Astable, Monostable multivibrators (Transistorized).

(Periods 8) (Marks 10)

CHAPTER 5 : DIFFERENTIAL AMPLIFIER CIRCUITS :-

Black box concept, Common mode and differential mode, CMRR analysis of single ended differential input.

(Periods 5) (Marks 6)

CHAPTER 6 : OPERATIONAL AMPLIFIER CIRCUITS :-

Symbol, ideal characteristics, inverting and noninverting configurations, virtual ground, IC 741 pin connections and it's characteristics.

OP-AMP as an adder, Subtractor, diferentiator and integrator.

(Periods 8) (Marks 10)

REFERENCE BOOKS :

1. Electronic Principles : A.P.Malvino
2. Integrated Electronics : Millman & Hlkias
3. OP-AMP : G.B.Clayton
4. Pulse, digital & switching waveforms : Millan & Taub
5. Solid state devices : Tapper (Vol - II)
6. Electronic Devices & Circuits : Allen Mottershed
7. Electronic Principles : V.K.Mehta

SYLLABUS FOR F.Y.B.Sc. (ELECTRONICS)

PAPER : III (PRACTICALS)

Pre-requisista :-

- i) Demonstration of electrical & electronics components R.L.C. Switches, Relays, Transformers, Chokes, Diode, Transistor, BJT, UJT, FET, SCR.
- ii) Use of multimeter (analog & digital) for the measurement of resistance a.c., d.c. voltage, current.
- iii) Use of Signal generator/Function generator (frequency & amplitude).
- iv) Use of C.R.O. (for measurement of frequency, amplitude)
- v) Use of Power Supply (Single, Dual, Fixed, Variable & Current limit)

Note : Written sheets about the pre-requisites are essential in practical journal.

LIST OF EXPERIMENTS

Note : Perform atleast EIGHT experiments from EACH section.

FIRST TERM Section (A)

- 1) Study of electronic components (Resistors, Capacitors, Inductors, Transformers, Relays, Switches, Diodes, Transistors), Identification & types.
- 2) Verification of Thevenin's, Norton's, Maximum Power Transfer Theorem.
- 3) Design & fabricate a stepdown transformer of ratings : 230 V to 6-0-6 V, 250 mA.

- 4) Characteristics of Zener diode & it's application as a voltage regulator.
- 5) BJT Characteristics.
- 6) UJT Characteristics.
- 7) FET Characteristics.
- 8) UJT as Relaxation Oscillator.
- 9) Study of Rectifier Circuits with filter and load.
- 10) Study of Astable multivibrator using Transistors.
- 11) Study of low pass and high pass filter using R, L * RC circuit.

SECOND TERM Section (B)

- 1) Study of Logic Gates :
 - a) OR and AND gates using diode logic &
 - b) Logic gates - OR, AND, NOT, NAND, NOR using various IC's (Truth table verification).
- 2) Verification of D'Morgan's Theorems.
- 3) Half Adder & Full Adder Circuits.
- 4) Single stage RC coupled amplifier (with & without negative feedback)
- 5) Study of Flip-flops using NAND gates (R-S, CLOCKED R-S & J-K Flip-flops).
- 6) Study of Phase Shift Oscillator using transistors.
- 7) OP-AMP Parameters (Input, Output impedance & Bandwidth) measurement.
- 8) Study of Inverting & Non-inverting amplifiers using OP-AMP.
- 9) Basic operations using OP-AMP (Adder & Subtractor).
- 10) Astable multivibrator using IC 555.

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J/WS/SYLL/FYBSCELE

North Maharashtra University, Jalgaon

F.Y.B.SC. MATHEMATICS - SYLLABUS
(w.e. from June, 1997)
Paper-I Calculus and Differential Eq.

FIRST TERM

1. Continuity of a function of real variables. Properties of a continuous function on closed and bounded intervals -
 - (1) boundedness
 - (2) attains bounds
 - (3) intermediate value theorem . (6 Periods)
2. Differentiability of a function. Continuity and Differentiability. Rolles theorem. Lagrange's values Theorem, Cauchy's Mean Value theorem. (10 periods)
3. Successive Differentiation. n^{th} derivatives of Standard functions. Leibnity's theorem. (8 periods)
4. Taylor's theorem. Maclaurin's theorem. (5 periods)
5. Integration -
 1. Integration by partial fractions. Denominator involving
 - (1) Linear nonrepeated
 - (2) Linear repeated and
 - (3) One quadratic and non-repeated factor only. (Quadratic repeated factor not expected)
 2. Integration of irrational algebraic function of the form
$$\frac{1}{x \sqrt{y}}$$
When x is linear and y is linear or quadratic. (9 periods)
(Total 38 periods)

SECOND TERM

6. Applications of integration- Rectification, Area, Surface Area, Volume. of solid of revolution (Theory not Expected) (8 Periods)
7. Differential eqm. of First order and First degree - Homogeneous equations & non-homogeneous equations. Exact Equations. Integrating Factors. Linear equations Bernoulli's equations. (20 periods)
8. Equations of first order and higher degree
 - 1) Equations solvable for p
 - 2) Equations solvable for y
 - 3) Equations solvable for x
 - 4) Clairaut's equation. (8 periods)(Total 36 periods)

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PAPER -IIA GEOMETRY AND MATRICES

FIRST TERM - (MATRICES)

1. Adjoint and inverse - Adjoint of a square matrix and its properties, Inverse of a matrix, Existence uniqueness and other properties.
2. Rank of a matrices - Elementary transformations, Elementary matrices and their inverses, Rank of a matrix, Invariance of rank under elementary transformations, Reduction to normal form. Nonsingular matrix a produce of elementary matrices. Rank of product of Two Matrices.
(13 periods)
3. System of Linear equations - Consistency and solution of homogeneous and non-homogeneous equations.
($(A B) = (A)$ -proof not expected)
(6 periods)
4. Quadratic forms - Matrix of quadratic form, Linear transformations, Congruent matrices and congruent transformations. Reduction to canoniial form. Signature and index. Definite, Semidefinite and Indefinite forms.
(12 periods)
(Total 38 periods)

SECOND TERM

5. Co-ordinates of a point in space. Distance formula, Section formula, Change of origin, Direction cousins and direction ratios of a line, Angle between two lines, projection of a line segment.
(8 Periods)
6. Planes - General eqn. of a plane, Intercept form, point d.y.s. form, Normal form, Reduction of general eqn. to intercept form and normal formal, Angle bet two planes. Distance of a point form a plane.
(8 periods)
7. Lines - Line as intersection of two planes, Symmetric equations parametric eqm. Distance of a point from a line, Coplanar and Skew lines, Shortest Distance between two skew lines, Angle between line and plane.
(12 points)
8. Sphere - General and standard equations, centre-radius form section of a sphere by a plane, Equations of circle, Intersection of two spheres, tangent plane, condition of tangency.
(10 periods)
(Total 38 periods)

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**PAPER- II(B) DISCRETE MATHEMATICS
FIRST TERM**

1. Logic - Algebra of propositions statements and compound statement, conjunction, disjunction, negations, conditional and biconditional statements, propositions and Truth tables, Tautologies and contradiction, Logical equivalence Algebra of propositions, Logical Implication. Quantifiers :- Universal Quantifier, Existential Quantifiers, negation of propositions which contain quantifiers, counter examples.
2. Adjoint of a square matrix, Def, Theorems Inverse of a square matrix. Existence and uniqueness, inverse by adjoint method (upto order 3) Theorems on Inverse of a square matrix.
3. Rank of a matrix: Elementary Transformations, Elementary matrices, Rank of a matrix, Definition Reduction to normal form. Theorems on rank of a matrix.
4. Linear Equations : Homogeneous and Non-Homogeneous systems consistency and solutions.

**SECOND TERM
GRAPH THEORY**

5. Introduction : Graph, Simple graph, Hand shaking Lemma.
6. Paths and circuit : Isomorphism, walk, paths, Circuit, connected graphs, Disconnected graphs and components, Euler graph, operations on graphs, Hamiltonian paths and circuits. The Traveling salesman problem.
7. Trees and Fundamental circuits : Trees, Distance and centers in a tree, Rooted and binary trees, spanning trees, shortest spanning tree.
8. Cuts sets and cut vertices : Cut set fundamental cut set, connectivity and separability.
9. Planer Graph : kuratowski's two graphs, Geometrical dual Only Examples on planer graph, Kuratowski's two graphs and Geometrical dual.
10. Matrix Representation of Graphs : Incidence matrix Adgency matrix.
11. Directed Graph :- Directed graph, balanced digraph, Regular digraph, Incidence matrix & Adjacency matrix of digraph

Books (1) Graph Theory with application to Engineering and computer Science
By Narsingh Deo
Prentice - Hall of India Private Limited New Delhi.

**PAPER III
Practical course based on theory courses.

J/WS/SYLL/FYBSCMATH

NORTH MAHARASHTRA UNIVERSITY, JALGAON.
SYLLABUS FOR F.Y.B.Sc.
PHYSICS
TO BE IMPLEMENTED FROM JUNE, 1997
PAPER-I SECTION-I
MECHANICS AND PROPERTIES OF MATTER

- (1) SIMPLE HARMONIC MOTION :-
Definition of angular S.H.M. , differential equation of angular S.H.M. and its applications to compound pendulum and Kater's pendulum. (4 periods, 6 Marks)
- (2) Rotational Motion :-
Definitions of moment of inertia (M.I.) and radius of gyration, M .I. of spherical shell and solid sphere about diameter and tangent, M.I. of solid and hollow cylinder about their axes, study of flywheel (Torque and K.E.), velocity and acceleration of a body rolling down the inclined plane. (9 periods, 12 marks)
- (3) Elasticity :-
(Revision of stress , strain, elastic constants., Y.K.N.) ; relation between extension strain and compression strain at right angle to each other with shearing strain, poisson's ratio (6), determination of poisson's ratio for rubber, relation between Y.K. and n , limiting values of n ; Torsional oscillations, determination of n by torsional pendulum. (9 periods, 12 marks)
- (4) Viscosity :-
Streamline and turbulent flow , coefficient of viscosity, critical velocity, determination of η by stoke's method, Reynolds' number, Poiseuille's equation and its experiment for n , various forms of energy of the liquid, Bernoulli's theorem, Venturimeter. (8 periods, 12 marks)
- (5) Surface Tension :-
Definition of surface tension and angle of contact relation between surface tension pressure and curvature; particular cases such as liquid drop, air bubble; experimental determination of surface tension by Jaeger's method and Quinke's method , factors affecting surface tension, applications of surface tension. (6 periods, 8 marks)
- Total :- 36 periods , 50 marks)

REFERENCE BOOKS :-

- (1) Elements of properties of matter : D.S. Mathur.
- (2) Properties of Matter : Brijlal and subrahmanyam,
- (3) Physics Vol.1 : Halliday and Resnick

PAPER-I , (SECTION-II)
KINETIC THEORY, HEAT AND THERMODYNAMICS

- (1) Kinetic theory of gases :-
Mean free path (simple derivation), statement and graphical representation of Maxwell's velocity distribution law, average velocity , root mean square velocity, most probable velocity and their co-relation, transport phenomena, co-efficient of viscosity and thermal conductivity. (7 periods, 10 marks)

Equation of state, Andrew's and Amagat's experiments, van-de-Waas equation, discussion of Andrew's and Amagat's experimental results, critical constants, reduced equation of state, Boyle temperature. (7 periods, 10 marks)

(2) Heat and thermodynamics :-

Isothermal, adiabatic, isochoric and isobaric changes; work done on and by a gas, indicator diagram, equations of adiabatic change, work done during isothermal and adiabatic changes. (4 periods, 6 marks)

Carnot cycle, Ottocycle, Diesel cycle and their operations and efficiencies. (6 periods, 6 marks)

Reversible and irreversible processes, cyclic process, statement of first, second and third law of thermodynamics, entropy, entropy - temperature diagram, entropy of a perfect gas, dissipation of energy and increase of entropy in natural processes, change of phase first and second latent heat equations. (6 Periods, 8 Marks)

(3) Elements of refrigeration and air conditioning :-

Meaning of refrigeration, refrigeration systems (types only), of a simple refrigeration system with refrigerator, refrigerant, components their functions, refrigerator cycle on P-v diagram, uses of refrigerator, meaning of air conditioning, applications of air-conditioning. (6 Periods, 8 Marks)

Total 36 Periods, 50 Marks

REFERENCE BOOKS :-

- 1) Treatise on Heat : Sah and Srivastav
- 2) Text book of heat : J.B. Rajam
- 3) A course in refrigeration and air conditioning : S. Demkundwar, (Dhanpatrai & Sons, Delhi)
- 4) Principles of refrigeration : Roy J. Dossal- (John Wiley and Sons Inc., 1961)
- 5) Refrigeration and air conditioning : Jordan and Prinstley.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON
SYLLABUS FOR F.Y .B.Sc. PHYSICS

(TO BE IMPLEMENTED FROM JUNE,1997)

PAPER-II (SECTION-I)

MODERN PHYSICS

- 1) Charged Particles :- Motion of charged particle in uniform electric, magnetic fields and Lorentz force, Millikan's method for determination of charge on an electron. e/m by Thomson method.
(8 periods, 10 marks)
- 2) Matterwaves :- Dual nature of matter, de-Broglie hypothesis, wave packets, phase velocity, group velocity, particle velocity and relation between them. Electron diffraction, Davison and Germer experiment, uncertainty Principle ($\Delta x \Delta p \approx h$, $\Delta E \Delta t \approx h$ & $\Delta \lambda \Delta \theta \approx h$). Simple experimental illustrations.
(8 Periods, 10 Marks)
- 3) Theory of Hydrogen Atom :- Revision of Bohr's theory of hydrogen atom, Extension of Bohr's theory, Experimental (Frank and Hertz) verification of discrete atomic energy levels, correspondence principle, introduction to Bohr-Sommerfeld model.
(8 Periods, 12 Marks)
- 4) Lasers:- Laser and its principles, optical pumping, electrical pumping, population inversion, metastable state, spontaneous and stimulated emission, He-Ne laser (in brief), Applications of lasers.
(4 Periods, 6 Marks)
- 5) Solar Energy :- Energy crisis, alternative sources of energy, solar energy as an option, flat plate collectors, liquid flat plate collector.
Principle of photovoltaic conversion (P-N junction), solar cell and its principle, types of solar cells (names only), Materials used for solar cell, I-V characteristics of solar cell under dark and illuminated conditions, Open circuit Voltage (V_{oc}), short circuit current (I_{sc}), fill factor and efficiency of solar cell.
(8 Periods, 12 Marks)

Total 36 Periods, 50 Marks)

REFERENCE BOOKS

- 1) Concepts of modern Physics : S.L. Gupta & S. Gupta
- 2) Atomic Physics : J.B. Rajam
- 3) E. Modern Physics :- Atma Arya
- 4) Solar Energy : S.P. Sukhatme.
- 5) Fundamental of Solar Cell : M.A. Green.
- 6) Lasers and Nonlinear Optics :- B.B. Land.
- 7) Concepts of Modern Physics :- Arthur Beiser (IIIrd edn)

PAPER-II (SECTION-II)
ELECTRICITY AND MAGNETISM

- 1) **Electrostatics :-**
Concept of dielectric, electrical polarization \vec{P} , electric displacement \vec{D} , use of dielectric in capacitor; introduction of electrical images and force between two point charges by the method of electrical images, Gauss's theorem in dielectrics, boundary conditions for \vec{E} and \vec{D} at interface of dielectrics, analogy of $\vec{E}, \vec{M}, \vec{H}$ with $\vec{D}, \vec{P}, \vec{E}$. (10 Periods, 14 Marks)
- 2) **Current electricity :-**
Loop analysis by kirchhoff's law's Thevenin's theorem, Norton's theorem with illustrations, maximum power transfer theorem (for D.C. source), current density vector, power consumption and Joule's law, idea of watt and kilowatt hour. (10 Periods, 12 Marks)
- 3) **Electromagnetic induction :-**
Self induction, mutual induction, principle of transformer, relation of turns ratio with current, voltage and impedance ratios, efficiency of transformer, discussion of losses in a transformer. (6 Periods, 8 Marks)
- 4) **Electrical D.C. circuits :-**
Growth and decay of current in a circuit containing L and R, charging and discharging of a condenser through a resistor, concept of time constant. (5 Periods, 8 Marks)
- 5) **Magnetic properties of materials :-**
Para-ferro-dia-magnetism, cycle of magnetization, hysteresis, energy loss due to hysteresis, materials for electromagnet and transformers..1s1 (5 Periods, 8 Marks)

Total 36 Periods, 50 Marks)

REFERENCE BOOKS :-

- 1) Basic electronics - B.L. Theraja
- 2) Electricity and magnetism.-A.Kip
- 3) Electrostatics - B.B. Laid

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS FOR F.Y.B.Sc. (PHYSICS)

(TO BE IMPLEMENTED FROM JUNE, 1997)

PAPER-III : PRACTICAL COURSE

SECTION-I

(Students are expected to perform any eight of the twelve experiments in this section)

- 1) Surface Tension by Jaeger's Method.
- 2) Constant Volume Air thermometer.
- 3) Young's Modulus by bending.
- 4) Viscosity by flow through capillary Method, (Poiseuille's)
- 5) Young's modulus by cantilever (Vibration method)
- 6) Probable Error.
- 7) Poisson's Ratio for Rubber.
- 8) Thermal conductivity of a bad conductor by Lee's method
- 9) Moment of Inertia of a Disc.
- 10) n and Y by using flat spiral spring.
- 11) 'J' by Callender and Barnes' Method. (Continuous flow Calorimeter)
- 12) Moment of Inertia of a Flywheel.

PAPER-III (SECTION-II)

(STUDENTS ARE EXPECTED TO PERFORM ANY EIGHT OF THE TWELVE EXPERIMENTS IN THIS SECTION)

- 1) Calibration of spectrometer
(Parallel light adjustment by distant object method)
- 2) Efficiency and Turn Ratio of a Transformer.
- 3) Study of LR circuit (Vector Diagram and Power Factor)
- 4) Study of Analog Multimeter
- 5) Verification of Kirchner's Laws.
- 6) Characteristics of a Semiconductor Diode.
- 7) Frequency of A.C. Mains (Using Vibrating Wire & Magnet)
- 8) Charging and Discharging of a Capacitor through resistor.
- 9) Determination of Refractive Index of a Prism by Spectrometer
(Parallel light adjustment by distant object method)
- 10) Hysteresis.
- 11) Resonance of an LCR Series Circuit.
- 12) Verification of maximum power transfer theorem.

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J/WS/SYLL/PHY97

NORTH MAHARASHTRA UNIVERSITY, JALGAON
F.Y.B.Sc. Zoology Syllabus (June 1997)
Paper I Section I Non chordate I

1. Principles of classification -
 - i) Importance of classification
 - ii) Binomial Nomenclature,
 - iii) Concept of species.

(Periods 5)

2. Define the following terms with suitable examples :-
 - i) Symmetry types - asymmetry, bilateral symmetry, radial symmetry.
 - ii) diploblastic, iii) Triploblastic, iv) Pseudo-coelomate, v) Coelomate, vi) Metamerism, vii) Hermaphroditism, viii) Sexual dimorphism, ix) Regeneration (in Hydra & Planeria)
 - x) Polymorphism. (in honey bees)

(Periods 5)

3. Study of cockroach *Periplanata americana*.
w.r.t. (i) Classification (ii) Habit and Habitat, (1 Period)
(iii) External characters - Head, thorax, abdomen, wings, legs, sexual dimorphism, (3 Periods) (iv) Internal Anatomy w.r.t. following systems -
 - Digestive system - food and feeding habits of nutrition structure of alimentary canal and digestion. (3 Periods).
 - Respiratory system - Spiracles, tracheal system and mechanism (2 Periods)
 - Circulatory system- Haemocoel, Haemolymph (with haemocyte types), Sinus, Heart, Segmental vessels, dorsal diaphragm, alary muscles, Pericardial cells, Mechanism of circulation of haemolymph. (7 Periods)
 - Excretory system - Malpighian tubules, structure and functions, Curate cells and moulting (Ecdysis). (3 Periods)
 - Nervous system - Structure and functions of Central (Corpora, cardiac, corpora allata), Visceral and peripheral. (3 Period)
 - Sense organs - Chemoreceptors, Mechanoreceptors, Auditory-receptors and photoreceptors. (3 Periods)
 - Reproductive system - Sexual dimorphism, male and female reproductive organs, mating, Ootheca (metamorphosis in cockroach) (5 Periods)

(40 Periods)

Paper I Section II Chordate I

1. General Topics -
 - I) Migration in animals - definition - Migration in Salmon fish (2 Periods)

- II) Definition of - (a) Herbivorous, (b) Carnivorous, (c) Omnivorous, (d) Sanguivorous, (e) Graminivorous, (f) Insectivorous, (g) Frugivorous, (h) Oviparous, (i) Viviparous, (j) Oviviparous, (k) Neoteny or Paedogenesis, (l) Hibernation, (m) Aestivation - with suitable examples. (3 Periods)
- III) Parental Cares - In Sea horse and in Pipa. (1 Period)
2. Animal Type - Study of frog (*Rana tigerina*) w.r.t. the following-
- i) Systematic position, ii) Habits and Habitat, iii) Breeding period, iv) External Characters. (2 Periods) v) Internal Anatomy
- a) Body wall-structure and functions (1 Period)
 - b) Endoskeleton - axial and appendicular (4 Periods)
 - c) Digestive system - Alimentary canal, digestive glands, food, feeding, digestion, absorption, assimilation in brief and ejection (histology of organs not expected)
 - *(Liver, pancreas and glands present in the wall of the alimentary canal) (6 Periods)
 - d) Respiratory system - Organs :- cutaneous respiration, buccal respiration, pulmonary respiration-mechanism. (2 Periods)
 - e) Circulatory system - Detailed structure of Heart, composition of blood, Arterial and venous system, of mechanism of circulation. (5 Periods)
 - f) Excretory System - Detailed structure of Kidney, mechanism of excretion. (2 Periods)
 - g) Nervous system, Central Nervous system, Peripheral nervous system, Autonomous nervous system. (3 Periods)
 - h) Sense organs - Structure and function of Eye and ear. (2 Periods)
 - i) Reproductive system - Sexual dimorphism, Male reproductive system, female reproductive system. (2 Periods)
 - j) Development - fertilization, Cleavage, Blastula, Gastrula formation, fate of three germ layers, and Metamorphosis. (5 Periods)
- (40 Periods)

Paper II
Environmental Biology and Genetics.
SECTION I - Environmental Biology

1. Introduction : What is an environment ? Concept, Scope and significance of environmental biology. (2 Periods)
 2. Biosphere : Components, Biotic and abiotic factors. (8 Periods)
 3. Ecosystem : Definition, Names of different ecosystems, Pond as an ecosystem. (2 Periods)
 4. Ecological energetic : Food chain, food webs, ecological pyramids. (3 Periods)
 5. Environmental adaptations : Definition, Types of Adaptations -
i) Aquatic - fresh water and marine water, ii) Terrestrial adaptations - cursorial, fossorial, aerial, arboreal, desert. (6 Periods)
 6. Names of Zoo - Geographical regions of world, and the animals found in them. (2 Periods)
 7. Animal association : Definition, Homospecific and Heterospecific, Types - Commensalism, Mutualism, Parasitism. (2 Periods)
 8. Resources : Renewable and non-renewable resources, energy crises. (3 Periods)
 9. Environmental pollution : Definition, Names of different types of pollutions -
Air pollutions - Air pollutants and their impacts on human being.
Water pollution - Water pollutants and their impacts on human being. (8 Periods)
 10. Conservation of Nature : Definition,
i) Preservation of species, extinction of species due to habitat, destruction, mass killing,
ii) Wild life conservation acts. (4 Periods)
- (40 Periods)

PAPER II
SECTION II - Genetics

1. Recapitulation : Monohybrid ratio and dihybrid ratio, Concept of Gene and mutations in brief. (3 Periods)
 2. Interactions of Genes : Types -
i) Complementary factor (9 : 7 Ratio)
ii) Supplementary factor (9 : 3 : 4 Ratio)
iii) Epistasis : Dominant, Recessive, Duplicate. (5 Periods)
 3. Lethal Genes : Definition, concept, Coat colour in mice (2:1 Ratio) (2 Periods)
 4. Linkage and crossing over :
i) Concept - complete and incomplete linkage,
ii) Crossing over - Mechanism of crossing over and its significance. (8 Periods)
 5. Sex determination : Types : XX - XY method, ZZ - ZW method, XX - XO method. Environmental sex determination (Bonellia) (5 Periods)
 6. Multiple Alleles : i) Definition, ii) Characteristics
iii) Inheritance of blood groups and its medico-legal applications, iv) Coat colour in Rabbit. (5 Periods)
 7. Polygenic Inheritance : Definition - Characteristics, Skin colour in Man. (3 Periods)
 8. Cytoplasmic Inheritance : Definition - examples - kappa particle, Snail. (3 Periods)
 9. Explain the terms : i) Eugenics, ii) Genetic counselling, iii) Gene cloning, iv) Genetic engineering. (6 Periods)
- (40 Periods)

Theory question paper I - Nonchordates I and chordate I
Section I - Nonchordate I

- Q.1. Long answer type questions - 16 Marks.
- OR
- Q.1. a,b,c. can be asked or one long answer type can be asked. 16 Marks
(5,5,6. Respectively)
- Q.2. Semi long questions - any two 16 Marks.
a) 8 marks, b) 8 marks, c) 8 marks.
- Q.3. A) Notes on any two out of four. 12 Marks.
B) Define/Explain/Compare/Sketch & label any three out of four 06 Marks.

Section II - Chordate I

- Q.4. Long answer type question. 16 Marks.
OR
Q.4. a,b,c. can be asked or one long answer type can be asked. 16 Marks.
(5,5,6.respectively)
- Q.5. Semi long questions any two. 16 Marks.
a) 8 Marks, b) 8 Marks, c) 8 Marks.
- Q.6. A) Notes on any two out of four. 12 Marks.
B) Define/Explain/Compare/Sketch and label, any three out of four. 06 Marks.

Theory question paper II - Environmental Biology and Genetics.
Section I - Environmental Biology.

- Q.1.)
Q.2.) As above.
Q.3.)

Section II - Genetics

- Q.4.)
Q.5.) As above.
Q.6.)

Syllabus for Practicals at F.Y.B.Sc. (Zoology)
to be implemented from July 1997

Practicals

Topic No.1.(E) Study of Taxonomic classification with binomial nomenclature of three animals from nonchordate and three from chordate.

Taxonomic classification should include Phylum, class, order, genus, species.

Nonchordates animals : Earthworm, lobster, pila, bivalve, scorpion, house fly, mosquito, starfish.

Chordate animals : Scoliodon, Labeo, Pomphret, frog or toad, any snake any blizzard any bird, any mammal.

Topic No.2.(D) Study of symmetry in following animals-
1) Amoeba, 2) Hydra, 3) Jelly fish, 4) Earthworm, 5) Pila, 6) Starfish, 7) any suitable vertebrate.

Topic No.3.(D) Study of following animals with reference to * body wall and coelome.

1) Hydra, 2) Sea-anemone, 3) Liverfluke/planaria/Tapeworm, 4) Ascaris/Earthworm/Nereis/Leech.

*(Body wall includes Ecto, Meso and endo term, types of cellular composition is not expected)

Topic No.4.(E) Dissection of Cockroach.

- 1) External characters, sexual dimorphism.
- 2) Study of following systems.
 - a) Digestive system with salivary gland.
 - b) Nervous system.
 - c) Male and female reproductive system.

3) Temporary preparation of following.

- a) Mouthparts, b) Antennae of male & female, c) Legs, d) Wings, e) Salivary gland, f) Spiracles - Thoracic and Abdominal, g) Trachea, h) Spermatheca, i) Cornea, j) Striated muscles from coxa, k) Gizzard.

(D) 4) Observation of male and female - Gonapophysis, Heart and salary muscles, Ootheca.

Topic No.5.(D) Study of migratory animals with suitable model/chart/specimen. e.g.salmon.

Topic No.6.(D) Study of parental care in following animals.

- 1) Sea horse, 2) pipa sp. with suitable model/chart/specimens.

Topic No.7.(D) Study of following systems from dissected frog -^{sy}

1) Digestive system - Internal structure of Buccal cavity, Alimentary canal.

2) Respiratory system - Lungs.

3) Circulatory system - Heart with truncus arteriosus, two main aortic arches and three vena cavae close to heart.

4) Excretory system - Kidney, ureter and urinary bladder.

5) Male reproductive system - Testis, vasa efferentia.

6) Female reproductive system - Ovaries, Oviduct, cloaca.

7) Nervous system - Brain - Dorsal and ventral view, and spinal cord.

Topic No.8.(D) Study of developmental stages in frog -

Uncleaned egg, two celled stage, four celled stage, Blastula, Gastrula and various prominent stages of development in Tadpole larva.

(D) Demonstration.

(E) Experimental.

PRACTICALS : ENVIRONMENTAL BIOLOGY

E 1) Estimation of O₂ and CO₂ from sample water.

E 2) Study of fauna from given water sample.

D 3) Experiment of Dust fall.

D 4) Study of adaptations in animals with respect to following habitats : by showing suitable specimens.

1) Aquatic - 2) Terrestrial -

3) Aerial - 4) Arboreal -

5) Cursorial - 6) Fossorial -

7) Symbiotic - 8) Commensals -

9) Parasitic -

D5) Compulsory visit to any ecosystem.

GENETICS

- E 1) Study of human phenotypes - Cheeks - Dimple and Non - Dimple cheeks, ear lobes, Hair pattern (curly and smooth) tongue - Roller and Non-roller.
- E 2) PTC tasting expt.
- E 3) Simple example of Monohybrid, dihybrid backcross by using coloured beads.
- D 4) Study of Normal male and female Drosophila.
- D 5) Study of Mutants of Drosophila - White eye, bar eye, vestigial wings, Sepia eye, Normal eye, curly wings.
- D - Demonstration.

E - Experimental.

F.Y.B.Sc. Practical Course - Allotment of Marks.

1.	Dissection	20 Marks.
2.	Mounting	10 Marks.
3.	Environmental Biology.	
	a) Any one experiment.	10 Marks.
	b) Study of aquatic fauna.	06 Marks.
	(Identification and ecological adaptations of minimum 3 forms are expected)	
4.	Identification of Nonchordates and chordate.	15 Marks. (5 spots)
5.	Identification of spots related to Environmental Biology (3 spots)	09 Marks.
6.	Identification of spots related to Genetics. (4 spots)	10 Marks.
7.	Journal and Tour report.	10 Marks.
8.	Viva Voce.	10 Marks.
	Total -	100 Marks.

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- 1) A Text book of Zoology - Invertebrate and Vertebrate Vol:1&2, 1992. 7th edition. Parker & Haswell, Edited by Marshall and William, CBS Publishers and distributors. New Delhi.
- 2) Life of Invertebrate, 1992, By S.N.Prasad. Published by vikas publishing House, New Delhi.
- 3) A Text Book of Zoology - Vertebrate, By S.N.Prasad, Published by Vikas Publishing House, New Delhi.
- 4) Invertebrate Zoology, E.L.Jordon, S.Chand & Company, New Delhi.
- 5) Vertebrate Zoology, E.L.Jordon, "-----" "-----" "-----"

- 6) Invertebrate Zoology, 1992, 4th Edition Reprint, P.S.Dhami and J.K.Dhami, R.Chand and Co. New Delhi.
- 7) Invertebrate structure and function. E.L.B.S. 2nd Edition 1979, E.J.W. Barington.
- 8) The Invertebrate, 1967, L.A. Borradaile and F.A.Potts. Cambridge University Press.
- 9) Life of Vertebrates - 3rd Edition, 1983. J.Z. Young. ELBS, Oxford.
- 10) The frog. An Introduction to Anatomy, Histology and Embryology. 12th Edition 1956, A.M.Marshall, MacMillan & Co. Ltd. London.
- 11) The Biology of frog. 4th Revised Edition, 1960. S.J.Holmes, The MacMillan Co.Ltd. New York.
- 12) The Biology of Amphibia, 1959. G. Kingsley Noble; Dover Publication Inc. New York.
- 13) Modern Text book of zoology - Vertebrate, 1992, R.L.Kotpal. Rastogi Publication.
- 14) The Frog : Its Reproduction and Development. 1951, Robert Rugh. McGraw Hill Book Co. Inc. New York.
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- 17) The Phylum Chordate, 1987, H.H.Newman, Distributor Satish Book Enterprise, Agra.

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- 1) Environmental Pollution - Causes, Effects and Control, 1991, Inderjeet Sethi, S.A.Equbai, Commen wealth Publishers, New Delhi.
- 2) Environmental Biology, 2nd Edition, 1993, K.C.Agrawal, Agro Botanical Publishers, Bikaner, India.
- 3) Pollution of our Atmosphere, 1984, Dr. B.Henderson. Selllers University of salford.
- 4) Impact of Environment. 1995. I.V.Trivedi.
- 5) Water Life and Pollution. 1990. purohit, Saxena. Agro Botanical publishers - Bikaner, India.
- 6) Environmental Problems, Prospects and Constraints, 1992. R.N.Trivedi, Anmol Publication, New Delhi.
- 7) Applied Environmental Biology - Resources and Management. 1990. M.M.Saxena, Agro Botanical Publishers - India.
- 8) Environmental Protection and Law 1994, P.R.Trivedi & V.K.Singh. Commen wealth publishers. New Delhi.

- 9) Concept of Ecology 3rd Edition, 1986, E.J.Kormonday.
- 10) Text Book of Ecology - by Virbala Rustogi.
- 11) Fundamentals of Ecology 3rd Edition - by Odum E.P. published by
Sunders College Publishing.
- 12) Zoogeography - by Darlington.
- 13) Ecology - by South week.
- 14) Dynamic Zoogeography (W.R.T. Land Animals) by Miklos D.F.Udvardy
Published by Van Nostrand Reinhold Co. New York.
- 15) Animal Ecology by A.S.Pearce, MacGraw - Hill Book Co. New York.
- 16) Animal Adaptation by Allison L Burnett and Thomas, Modern Biology
Series. Elsner.

REFERENCE BOOKS (Genetics)

- 1) Principles of Human Genetics. 1968, Curt stern. Eurasia
Publishing House, New Delhi.
- 2) Cytogenetics, The Chromosome in Division, Inheritance & Evolution
1982, Carl.P.Swanson. Timothy mer 2, William, J. Young. prentics
- all of India, New Delhi.
- 3) Introduction to Genetics. 1991. T.S. Gopalkrishna, Dr. Itta
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- 5) Principles of Genetics, 1990. Edmund W. Sinnott, L.C. Dunn &
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- 10) Cytogenetics and Evolution, 1988, R.S.Shukla and P.S.Chandel,
S.Chand and Company (Pvt) Ltd. New Delhi.
- 11) Genetics, 1990, C. Sarin. Tata MacGraw-Hill Publishing Co. New
Delhi.
- 12) Genetics, A survey of the Principles of heredity, 1967,
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- 13) Essentials of Cytology, 1983, C.B.Pawar, Himalaya Publishing House Bombay.
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J/WS/SYLL/FYBSZOO

NORTH MAHARASHTRA UNIVERSITY, JALGAON
 SYLLABUS TO BE IMPLEMENTED FROM JUNE 1997
 FYBSC- BOTANY
 PAPER-I BOT-1.1 CRYPTOGRAMS
 FIRST TERM
 LOWER CRYPTOGRAMS

TOTAL PERIODS 36

- 3
- I) VIRUSES
- 1) Introduction, structure and characters.
 - 2) Reproduction
 - 3) Diseases -
 - i) Plant diseases-
 - a) Yellow vein mosaic of Papaya or Lady's finger.
 - b) Leaf curl disease of Tomato or Little leaf of Brinjal
 - ii) Human diseases -
 - a) AIDS
 - b) Polio
- 4
- II) BACTERIA
- 1) Introduction - General Characters
 - 2) Structure
 - 3) Classification on the basis of shape
 - 4) Reproduction
 - 5) Economic importance including-
 - i) Plant diseases -
 - a) Citrus canker
 - b) Blackman disease of cotton
 - ii) Human diseases
 - a) Tuberculosis
 - b) Typhoid
 Emphasizing causal organisms & symptoms.
- 4
- III) ALGAE
- 1) Introduction
 - i) General characters of algae
 - ii) Habit and Habitat
 - iii) Structure of phallus
 - iv) Reproduction
 - v) Economic importance
 - 2) Classification of Algae with reasons according to G.M. Smith upto classes giving at least two examples of each class.

3
 - 3) Study of life cycle of NOSTOC
 - i) Classification with reasons
 - ii) Occurrence
 - iii) Structure of phallus, ultra structure of cell.
 - iv) Nutrition
 - v) Reproduction
 - vi) Economic importance

4
 - 4) Study of lifecycle of SARGASSUM
 - i) Classification with reasons
 - ii) Occurrence
 - iii) Structure - External and Internal
 - iv) Nutrition.
 - v) Reproduction
 - vi) Alternation of generations
 - vii) Economic importance

4
- IV) FUNGI
- 1) Introduction
 - i) General characters of Fungi, Mycorrhiza
 - ii) Occurrence
 - iii) Structure
 - iv) Nutrition
 - v) Reproduction

4

- vi) Economic importance
- 2) Classification of Fungi with reasons according to G.M.Smith upto classes giving at least two examples of each class. 3
- 3) Study of life cycle of RHIZOPUS. 3
 - i) Classification with reasons ii) Occurrence
 - iii) Structure of phallus iv) Nutrition
 - v) Reproduction
 - vi) Economic importance
- 4) Study of life cycle of AGARICUS 4
 - i) Classification with reasons
 - ii) Occurrence
 - iii) Structure - Internal and External
 - iv) Nutrition
 - v) Reproduction
 - vi) Economic importance.

**SECOND TERM
HIGHER CRYPTOGRAMS**

TOTAL PERIOD-36

2

I) BRYOPHYTA

- 1) Introduction
 - i) Distinguishing features of the group
 - ii) Alternation of generations
- 2) Classification of Bryophytes with reasons according to G.M.Smith upto classes giving atleast two examples of each class.
- 3) Study of life cycle of RICCIA.
 - i) Classification with reasons
 - ii) Habit and Habitat
 - iii) External and Internal structure of gametophyte
 - iv) Reproduction
 - v) Position and structure of sex organs
 - vi) Fertilization
 - vii) Structure of sporophyte (Development not expected)
 - viii) Structure and germination of spores
 - ix) Alternation of generations.
- 4) Study of life cycle of FUNARIA.
 - i) Classification with reasons.
 - ii) Habit and Habitat
 - iii) External and Internal structure of gametophyte
 - iv) Reproduction
 - v) Position and structure of sex organs (Development not expected)
 - vi) Fertilization
 - vii) Structure of sporophyte (Development not expected)
 - viii) Structure and germination of spores.
 - ix) Alternation of generations.

II) PTERIDOPHYTA

- 1) Introduction
 - i) Distinguishing features of the group.
 - ii) Alternation of generations
- 2) Classification of pteridophytes with reasons according to G.M.Smith upto classes mentioning atleast two examples of each class.
- 3) Study of life cycle of SELAGINELLA.
 - i) Classification with reasons
 - ii) Habit and Habitat
 - iii) External and Internal structure of sporophyte
 - iv) Reproduction
 - v) Position and structure of
 - a) Strobilus
 - b) Sporangium (Development not expected)
 - vi) Germination of spores and structure of mature gametophyte.
 - vii) Position and structure of sex organs (Development not expected)
 - viii) Fertilization
 - ix) Structure of mature embryo
 - x) Alternation of generations.
- 4) Study of life cycle of EQUISETUM
 - i) classification with reasons
 - ii) habit and habitat
 - iii) external and internal structure of sporophyte
 - iv) reproduction
 - v) Position and structure of
 - a) Strobilus
 - b) Sporangium (Development not expected)
 - vi) Germination of spores and structure of mature gametophyte.
 - vii) Position and structure of sex organs. (Development not expected)
 - viii) Fertilization
 - ix) Structure of mature embryo
 - x) Alternation of generations.

PAPER-II BOT-1.2
 MORPHOLOGY AND ANATOMY OF ANGIOSPERMS AND CELL BIOLOGY
 FIRST TERM
 MORPHOLOGY AND ANATOMY OF ANGIOSPERMS
 TOTAL PERIODS-36

- I) MORPHOLOGY 2
- 1) Introduction 2
- i) Plant body: Root system and shoot system
- ii) Definition, distinguishing characters and functions of
- a) Root b) Stem.
- 2) Leaf 4
- i) Definition, parts of typical leaf
- ii) Stipules
- iii) Venation
- iv) Modifications of lamina
- v) Simple and compound leaf
- vi) Phyllotaxy
- a) Alternate - Distichous, Tristichous, pentastichous, octastichous.
- b) Opposite - Superposed, Decussate.
- c) Whorled.
- 3) Inflorescence 4
- i) Definition ii) Types -
- a) Racemose b) Cymose c) Special-Cyathium, Verticillaster, Hypanthodium
- iii) Significance of inflorescence.
- 4) Flower 6
- i) Definition
- ii) Parts of a typical flower
- iii) Hypogyny, Epigyny, Perigyny
- iv) Calyx
- v) Calyx
- vi) aestivation
- vii) Androecium - cohesion and adhesion
- viii) Gynoecium - Placentation, Types of ovules.
- 5) Fruit 5
- i) Definition ii) Types-
- A) Simple fruits
- a) Dehiscent
- b) Indehiscent-fleshy and dry .
- c) Schizocarpic
- B) Aggregate fruits
- C) Composite fruits - Sorosis and Syconus. 7
- II) ANATOMY
- 1) Tissues
- i) Definition
- ii) Meristems- classification based on position and origin.
- iii) Permanent tissues
- a) Simple tissues b) Complex tissues
- c) Secretory tissues
- iv) Types of vascular bundles

2)	Primary structure of Dicotyledonous (Sunflower)	3
	i) Root ii) Stem iii) Leaf	
3)	Primary structure of Monocotyledonous (Marize)	3
	i) Root ii) Stem iii) Leaf	
4)	Comparative study of Dicot and Monocot	2
	i) Root ii) Stem iii) Leaf	

SECOND TERM

CELL BIOLOGY

TOTAL PERIODS-36

I)	Definition and scope	1
II)	Cell-	3
	1) Shape, size and general organization.	
	2) Types of cell -	
	1) Prokaryotic ii) Eukaryotic	
III)	Cell-wall-	4
	1) Middle lamella, primary wall & secondary wall	
	2) Chemical composition	
	3) Ultra structure of primary cell wall	
	4) Functions	
IV)	Plasma membrane	
	1) Chemical composition	
	2) Molecular organization/Ultra structure	
	3) Concept of unit membrane	
	4) Danielli - Dawson's model	
	5) Fluid mosaic model	
	6) Functions	
V)	Cell organelles.	2
	1) Endolasmic reticulum - origin Morphology, Ultrastructure, types and functions.	
	2) Ribosomes - Types, structure chemical composition and functions.	1
	3) Golgi complex - Shape, position, organization size, ultrastructure, chemical composition and functions.	2
	4) Lysosomes- Shape, size, structure, chemical composition (Enzyms) polymorphism and functions..pa	1
	5) Plastids	2
	a) Types- i) Leucoplasts ii) Chromoplasts	
	b) Ultra structure of chloroplasts, Origin & Functions.	
	6) Mitochondria.	3
	Size, shape, number, ultrastructure chemical composition and functions.	
	7) Nucleus.	3
	a) shape, number, size,	
	b) Ultrastructure (Interphasic)	
	i) Nuclear membrane - pore complex	
	ii) Nucleoplasm.	
	iii) Chromatin - Heterochromatin and Euchromatin	
	iv) Nucleolus - Structure, Chemical composition and functions.	
8)	Chromosome	6
	i) Definition	
	ii) Size, shape, number	
	iii) Structural organization	
	a) Pellicle - Matrix - Charomatid	
	b) Chromonema - Paranemic and plectonemic	
	c) Centromeres - Types of chromosomes based on centromeric position, arm ratio.	
	d) Secondary constriction.	
	e) Nucleolar organizer, SAT-chromosome.	
	f) Telomeres.	
	iv) Giant chromosome-	
	a) Polytene b) Lampbrush	
	v) Autosomes and sex chromosomes..pa	
VI)	Cell- Division	4
	i) Amitosis	
	ii) Mitosis - Definition, process and significance.	
	iii) Meiosis - Definition, process and significance.	

F.Y.B.SC. - BOTANY

Paper-III Bot 1.3 : PRACTICALS (BASED ON PAPER I & II)

P.S. - PERMANENT SLIDES

TOTAL PRACTICALS-21

- 1) Viruse and Bacteria
 - A) A study of following diseases with respect to Name of causal organism and symptoms.
 - i) Yellow vein mosaic of Papaya/Lady's finger/ Leaf curl of Tomato/Little leaf of Brinjal.
 - ii) Citrus canker/Black arm of cotton.
 - B) Gram staining in Bacteria
 - C) P.S. - Different forms of Bacteria
- 2) Study of Nostoc
- 3) Study of Sargassum
 - i) T.S. of axis
 - ii) P.S.-a) T.S. of secondary laterals (Leaf)
 - b) T.S. male conceptacle
 - c) T.S. female conceptacle.
- 4) Study of Rhizopus
P.s. - sexual stages (Zygospore)
- 5) Study of Agaricus
 - i) Morphology of sporocarp
 - ii) T.S. of gills
 - iii) P.S. -
 - a) L.S. of Sporocarp
 - b) T.S. of gills.Demonstration Practicals : (Practical Number 6 to 11)
- 6) Morphology of leaf
 - i) Parts of typical leaf
 - ii) Vention
 - iii) Phyllotaxy-
 - A) Alternate
 - B) Opposite
 - a) Superposed
 - b) Decussate
 - C) Whorled
 - iv) Simple and compound leaf
 - v) Modifications - Nepenthes and Utricularia
- 7) Study of inflorescence (as per theory syllabus)
- 8) Morphology of flower with reference to
 - i) Calyx
 - ii) corolla
 - iii) Aestivation
 - iv) Androecium
 - v) Gynoecium
 - vi) P.S.-
 - a) Placentation
 - b) Aestivation
 - c) Types of ovules.

- 10 & 11) Morphology of fruits (as per theory syllabus &
- 12) Study of tissues
 P.S. - i) Meristems (L.S. of stem apex)
 ii) Xylem and phloem (T.S. and L.S.)
 iii) Types of V.B.
- 13) Primary structure of Root T.S.
 i) Sunflower ii) Maize
- 14) Primary structure of stem T.S.
 i) Sunflower ii) Maize
 iii) P.S. - Leaf T.S.
 a) Sunflower b) Maize.
- 15) Study of Riccia
 i) Mounting of Rhizoids and scales ii) T.S. of thallus
 iii) P.S. - a) T.S. of thallus showing antheridia and
 archegonia.
 b) T.S. of thallus a showing sporophyte.
- 16) Study of Funaria
 i) Mounting of rhizoids, peristome teeth and spores.
 ii) P.S.-a) T.S. of stem
 b) V.S. of thallus showing antheridia and
 archegonia.
 c) V.S. of capsule. d) Protonema
- 17) Study of Selaginella
 i) T.S. of stem. ii) Mounting of spores
 iii) P.S. - a) T.S. of root.
 b) T.S. of Rhizophore c) V.S. of strobilus
- 18) Study of Equisetum
 i) T.S. of stem passing through th internode
 ii) Mounting of sporangiole and spores
 iii) P.S. - V.S. of strobilus
- 19) Mounting of
 i) Tomato pulp
 ii) Hydrilla leaf
 iii) P.S. - Polytene chromosome in Chironomus or Drosophila
 larvae.
- 20) Temporary squash preparation for mitosis using
 aceto-carmine/aceto orcein stain from onion (Allium cepa)
- 21) Study of different stage of mitosis and meiosis with the
 help of permanent slides.

COMPULSORY BOTANICAL EXCURSION SHOULD BE ARRANGED

-x-x-x-

J/WS/SYLL/BSCBOT

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS FOR F.Y.B.Sc GEOGRAPHY

PAPER-Ist

Course :- ELEMENTS OF PHYSICAL GEOGRAPHY

SECTION-I LITHOSPHERE

(WITH EFFECT FROM JULY,1997)

- 1) Origin and distribution of oceans & continents
Origin and distribution of oceans and continents-Wegener's continental drift theory, Plate-tectonic theory. (Periods 05)
- 2) Interior of the earth
 - i) Structure and composition of the interior of the earth
 - ii) Layers - Sial, Sima and Nife. (Periods 04)
- 3) Rocks
Materials of the earth's crust
 - i) Definitions of Rocks and Minerals
 - ii) Classification of rocks according to their mode of formation and their characteristics with Indian examples. (Periods 05)
- 4) Diastrophism
 - i) Definition of Diastrophism.
 - ii) Organic and Epeirogenic Movements
 - iii) Definition, causes and effects of earth quake and volcanoes
- 5) Weathering
 - i) Definition, types and characteristics of weathering.
 - ii) Types-Mechanical, Chemical and biological weathering. (Periods 05)
- 6) Work of Running water
 - i) Stream order and Drainage patterns.
 - ii) Erosional and Depositional features associated with river. (Periods 06)
- 7) Work of wind
 - i) Mechanism of wind erosion and deposition.
 - ii) Features produced by wind erosion and deposition with examples. (Periods 05)
- 8) Work of sea waves
 - i) Mechanism of sea waves, erosion and deposition.
 - ii) Erosional and Depositional features produced by sea-waves. (Periods 05)

SECTION-II : ATMOSPHERE AND HYDROSPHERE

- 1) Atmosphere
Definition, structure and composition of the atmosphere. (Periods 05)
- 2) Weather and climate
Definition of weather and climate, their elements and controlling factors. (Periods 04)
- 3) Temperature
i) Insolation, solar Radiation, Solar constant and Heat budget.
ii) Distribution of temperature Vertical & horizontal factors affecting the distribution of temperature.
iii) Inversion of temperature. (Periods 06)
- 4) Air pressure & winds
i) Global arrangement of pressure belts, their migration and effects.
ii) Winds-
a) Planetary
b) Monsoon
c) localwinds-land and sea bree-zes, Fohn, chinook. (Periods 06)
- 5) Humidity and precipitation-
i) Humidity - Definition, types-Absolute and Relative humidity.
ii) Process of condensation, forms of condensation.
iii) Precipitation - Types of precipitation.
iv) Types of rainfall- convectional, Orographic and cyclonic. (Periods 06)
- 6) Sub-marine relief
General structure of ocean floor. (Periods 02)
- 7) Properties of sea
i) Temperature and salinity of sea water.
ii) Factors affecting the distribution of temperature and salinity of sea-water. (Periods 06)
- 8) Ocean currents
i) Definition, origin, types and effect of ocean-currents.
ii) Ocean currents of Atlantic ocean. (Periods 05)

RECOMMENDED BOOKS :-

- 1) Physical Geography _ A.H. Strahler.
- 2) Morphology and Landscape _ Robinson.
- 3) Unstable earth - J.A.Steers.
- 4) Geomorphology - B.W.Sparks.
- 5) Introduction to Meteorology - Patterson.
- 6) Elements of Physical Geography - B.S.Negi.
- 7) An Introduction to water and climate Treawartha, G.T.
- 8) Climatology : Austine Millar.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON
SYLLABUS FOR F.Y.B.Sc. GEOGRAPHY

(WITH EFFECT FROM JUNE, 1997)

POPULATION GEOGRAPHY PAPER-II

SECTION -Ist

- 1) Introduction to population
Definition, Nature and Scope of Population Geography, Relationship of Population Geography with other disciplines of Geography. (Periods 10)
- 2) Population data
Types of population data, Sources of population data -
 - a) The census,
 - b) Vital registration,
 - c) Other sources, problems of population data (Periods 08)
- 3) Distribution and Density
Factors affecting the distribution of population-
 - a) Physical b) Cultural
 - c) Biotic, Definition of Density, Types of Density-Critical and Economic density, Significance of density of Population. (Periods 10)
- 4) Growth of population
History of World population growth, Trends of population growth, components of population growth fertility Mortality & Mobility, factors influencing fertility, Determinants of Mortality, Theory of Demographic Transition.

SECTION-IIInd

- 5) Migration
Meaning, Laws of Migration, Importance and Types of Migration, Determinants of migration, Consequences of migration, Brain migration-Brain Drain, Brainover flow, Brain Export, Brain Exchange. (Periods 12)
- 6) Pattern of Population
 - A) Biological characteristics of population, Racial and Ethnic composition of population, Determinants of Age composition- Age Pyramids, Age groups, Definition, of Sex Ration, Determinants of Sex composition.
 - B) Cultural characteristics of Population-Religious composition, Marital Status, Educational composition. (Periods 12)
- 7) Population characteristics Distribution of population in India of India. (Dense, Medium, Sparse), Causes of Population growth in India, causes of declining death rate in India, Problems of population. growth in India and its solutions.
- 8) Population and Resources Concept of optimum population, over population and under population, population resource relationship theories Malthus, Karl Marx. (Periods 06)

BOOKS

- 1) Introduction to population Geography - R.C.Chandana and Dr. Manjit Sidhu.
- 2) Fundamentals of Population Geography- B.N.Ghosh.
- 3) Population Geography - R .P.Mishra.
- 4) Principles of Population Studies - Asha A. Bhende, Tara Kanitkar.
- 5) A Geography of Population, world pattern - G.T.Trewartha.
- 6) Determinants and Consequences of population trends and population study - United Nations.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
SYLLABUS FOR F.Y.B.Sc.

PAPER-III PRACTICAL GEOGRAPHY

(WITH EFFECT FROM JULY, 1997)

- 1) Scales
 - 1.1 Definition.
 - 1.2 Types of scales
 - 1.3 Conversion of scales (V.S. to R.F. & R.F. to V.S.)
 - 1.4 Construction of scales
 - a) Simple graphical scale
 - b) Comparative scale.
 - c) Time & Distance scale

- 2) Representation of Relief
 - 2.1 Definition of relief
 - 2.2 Methods of Representation of relief
 - a) Quantitative methods
 - b) Qualitative methods.
 - 2.3 Relief features by contours-
 - a) Types of slopes :- Gentle, Steep, concave, convex and Terraced.
 - b) Land forms of elevation-Hill, Ridge, pass, plateau, cliff.
 - c) Land forms of depression-Groge, V-shaped valley, U-shaped valley, water fall.
 - 2.4 Profiles-
 - a) cross
 - b) longitudinal.

- 3) Topographical maps
 - 3.1 Introduction to S.O.I.
 - 3.2 Indexing of toposheet &
 - 3.3 Marginal information.
 - 3.4 Grid & Grid reference (four & Six fig. co-ordinate)
 - 3.5 Signs & symbols of S.O.I.
 - 3.6 Topographical map interpretation.
 - a) Hilly Mountainous area,
 - b) Plain Plateau area,
 - c) Desert area. (Physiographic factors, Drainage pattern, settlement, transport and communication etc.)

- 4) Weather maps &
 - 4.1 Introduction to I.M.D. map. instruments
 - 4.2 Weather symbols (I.M.D.)
 - 4.3 Isobaric pattern-
 - a) Cyclone & Anticyclone
 - b) Wedges & troughs.
 - c) Secondary depression & COL, Interpretation of IMD
 - 4.4 Weather maps- (One each for summer, winter & Rainy seasons)
 - 4.5 Functions, mechanism & uses of following weather instruments
 - a) Temperature :-
 - 1) Thermometer.
 - 2) Maximum & Minimum thermometer
 - 3) Thermograph.
 - b) Pressure :-
 - 1) Aneroid barometer
 - 2) Barograph

c) Humidity :-

- 1) Dry & Wet bulb thermometer
- 2) Hair-hygrograph

d) Wind & Rainfall : -

- 1) Wind vane
- 2) Cup-Anemometer
- 3) Rain guage.

Workload - 15 students per batch & 4 periods per week.

Unit	Periods	Marks
01	15	10
02	16	15
03	20	30
04	28	30
	80	85
Journal & Oral	--	15
		Total : 100

LIST OF BOOKS

- 1) Fundamentals of cartography - R.P. Mishra, A-Ramesh
- 2) Mapwork & Practical geography - Gopalsing.
- 3) Mapwork & Practical geography - R.L. Singh, L.R. Singh
- 4) Geographical interpretation of Indian topographical maps
Tamaskar & Deshmukh
- 5) Map-interpretation - R.Rammurty
- 6) Elements of Practical geography - R.L. Singh & Dutt P.K.
- 7) Maps & diagrams - Monkhouse F.J. & Willkinson H.
- 8) Practical Geography (Marathi) - Dr. A.P.Kumbhar.

NORTH MAHARASHTRA UNIVERSITY

Revised Syllabus of (F.Y.B.Sc.)
GEOLOGY

(To be introduced in July, 1997)

Scheme

Paper I	a) Mineralogy	1st Term
	b) Petrology	2nd Term
Paper II	a) General Geology	1st Term
	b) Palaeontology	2nd Term
Paper III	Practical	

List of Books

- i) General Geology by V. Radhakrishnan
- ii) Introduction to Geology by Sowani, Sharma & others.
- iii) Rutley's elements of Mineralogy by C.D. Gribble.
- iv) Palaeontology By H. Woods.
- v) Principles of Petrology by G.W. Tyrell.

	<u>Lecture Nos.</u>
1. Definition of Mineral	01
2. Classification of Minerals	02
i) based on anion groups	
ii) based on elements	
iii) based on industrial use	
3. Introduction to Silicate Structure- definition, types and mineral class.	02
4. Physical properties	
i) Characters dependent on light	02
a) Color b) Streak c) Lustre d) Transparency and Translucency e) Phosphorescence and Fluorescence.	
ii) Characters dependent upon atomic structure & state of aggregation	04
a) Form b) Hardness c) Tenacity	
d) Fracture e) Cleavage	
iii) Characters dependent upon Magnetism electric conductivity & Radioactivity	01
iv) Specific Gravity	02
i) Pycnometer ii) Walker's steel Yard Balance iii) Jolly's Spring Balance.	
5. Rock Forming Minerals	02
i) Silica Group - Silicate structure, chemical composition, mineral varieties & uses	
ii) Feldspar Group - Silicate structure, General chemical Composition, Mineral varieties, (K-feldspar ; Orthoclase & Microcline, Na-feldspar ; Albite, Ca-feldspar : Plagioclase & uses.	
iii) Pyroxene Group - Silicate structure General chemical composition Mineral varieties - Augite , uses	
iv) Amphibole Group - Silicate structure, General chemical composition, mineral varieties - Hornblende, uses.	

CRYSTALLOGRAPHY

1. Definition of Crystal	01
2. Unit Cell - Definition, Symmetry, Space Lattice & its 14 types.	02
3. External Morphology of Crystals - Faces, Edges, Solid angle, Forms, Inter facial angle. its measurement and Law.	02
4. Elements of Symmetry - Plane, Axis, Centre Crystallographic & Geometric symmetry	02
5. Crystallographic axes - lettering & ordering.	01
6. Parameters & Axial ratio, Parameter system of Weiss.	01
7. Indices and Miller's System of Indices - Law of rational Indices.	01
8. Classification of Crystals	01
9. Description of following Systems, Normal Class	03
i) Cubic System	
ii) Tetragonal system	
iii) Orthorhombic system	

OPTICS

1. Introduction - Nature of light, Ordinary light and Plane Polarised light	01
2. Introduction to Petrological Microscope Schematic sketch, parts & uses	01
3. Study of Optical properties of minerals - IPL : Color Form, Pleochroism, Cleavage. EXN : ISO/Anisotropism, extinction, D.R. Colors.	

List of Books :

1. Rulley's elements of mineralogy by C.D. Gribble.
2. Introduction to Geology by Sowani , Sharma & Others.

Paper - I PETROLOGYTERM - IINo. of Lectures

1. Introduction - Rocks & their Classification (Jg. Sed. Meta)	01
<u>IGNEOUS PETROLOGY :</u>	
2. Composition & Constitution of Magma	02
3. Forms of Igneous rocks	05
i) Extrusive - Lava flow & Puy	
ii) Intrusive - Concordant : Sill, Lapolith, Lapolith, Phacolith, batholith Discordant : dyke, ring dyke, cone sheet, Volcanic neck, batholith, stock & boss. Chonolith	
4. Structures & Textures in Igneous rocks	03
i) Structures : Vesicular, Amygdaloidal,ropy, flow	
ii) Texture, Equigranular, Porphyritic, glassy.	
5. Tabular classification of Igneous rocks	02
1. Introduction & Definition	01
2. Weathering Processes - i) Chemical Physical & Biological	02
3. Formation of sediments -	04
i) Modes of Transportation	
ii) Causes & processes of deposition	
iii) Marine & continental deposits	
4. Structure & Textures	03
i) Structure : Stratification, Current bedding Graded bedding, Ripple marks	
ii) Texture : Clastic & non-clastic	
iii) Classification	03
i) Basic & classification of sediments	
ii) Basic & classification of & description of sedimentary rocks types (arenaceous etc.)	

METAMORPHIC PETROLOGY

1. Definition and General characters of Metamorphism.	01
2. Agents and kinds of Metamorphism	01
i) Temperature	
ii) Kinds	
iii) Chemical Active Fluids	
3. Kinds of Metamorphism	02
i) Heat dominant	
ii) Stress dominant	
iii) Heat stress dominant	
iv) Uniform Pressure & heat dominant	
4. Depth zones & metamorphism	01
5. Grade of metamorphism	01
6. Structures—Granulose, schistose, Gneissose	02
7. Classification & nomenclature of metamorphic rocks	02

List of Books :

1. Introduction to Geology by Sowani, Sharma & Others.
2. Principles of Petrology by G.W. Tyrell.

<u>Paper II</u>	<u>GENERAL GEOLOGY</u>	<u>TERM - ...</u>	<u>no. lectures</u>
1. Scope & subdivisions of Geology			
2. Solar system & nine planets			01
3. The Planet Earth			04
i) Origin - Nebular & tidal Theory Big Bang theory			
ii) Age of the earth - Uranium's & ^{14}C method			
iii) Internal structure of the earth			
4. Concept of Geological Time scale - Era, Period & Epoch			02
5. Plate Tectonics			02
i) Concept, elements of Tectonism			
ii) Plate boundaries (convergent, divergent) Motion at present of Major plates			
6. Theories of Plate Tectonics			03
i) Convection current,			
ii) Thermal boundary layer concept			
iii) Hot plumes, hot spots & triple junction			
7. Continental Drift-			04
i) Concept			
ii) Taylor's concept			
iii) Wegner's concept & evidences - Geometric Paleontologic, stratigraphic, glacial, structural, polar wandering			
8. Sea floor spreading -			02
i) Theory & observations along sea floor			
9. Geosynclines			
i) concept			
ii) Kay's classification			
iii) Structure, sediments			
iv) Evolution - Wilson cycle			
10. Mountains - Diastropism			02
i) Types of mountains			
ii) Classification			
iii) Modern concept			
11. Isostasy			03
i) Hypothesis			
ii) Pratt's & Airy's & Heiskanen's hypothesis			
iii) Effects of isostasy & adjustments.			

12. Sea - level changes - Introduction & causes	01
13. Earthquake	03
i) Causes	
ii) Earthquake regions	
iii) elements of earthquakes	
iv) Classification	
v) Seismic waves &	
vi) Scale - intensity & magnitude	
14. Volcano	03
i) Definition	
ii) Structure of volcano	
iii) Classification based on state of volcano, mode of eruption	
iv) Products of volcano - Lava, Gases, Lapilli, pumice, scoria, volcanic breccia,	
v) Distribution of volcano (World & India)	
15. Glaciation through geologic time - world glaciation & glaciation in India.	03

List of Books:

1. General Geology by V. Radhakrishnan
2. Introduction to Geology by Sowani, Sharma & P others.
3. Elements of Geology by Power, Dixit, etal.

<u>Paper II</u>	<u>PALAEONTOLOGY</u>	<u>TERM-II</u>	<u>no. of lectures</u>
1.	Definition and branches of Palaeontology		01
2.	Fossils		09
	a) Definition b) Conditions of fossilisation		
	c) Modes of preservation of life		
	d) Techniques of collection, separation, preservation illustration & description of fossils		
	e) Uses.		
3.	Systematic position, geological & geographical distribution and study of morphology of hard parts of the following		
	i) Phylum - Mollusca		
	a) Bivalvia : hinge lines		04
	b) Gastropoda : forms		04
	c) Cephalopoda : Nautiloids, Ammonoids & Suturelines		05
	ii) Phylum - Brachiopoda - Brachial skeleton		03
	iii) Phylum - Echinodermata - apical disc		04
	iv) Phylum - Protozoa - Foraminifera - test		03
	v) Phylum - Trilobites		04

List of Books :

1. Introduction to Geology by Sowani, Sharma
& Others.
2. Invertebrate palaeontology by H. Woods.

I TERM

1. Physical Properties of Minerals of following Quartz crystal, rosy quartz, jasper, flint, chalcedony, Orthoclase, tale, muscovite, biotite, hornblende, beryl, tourmaline, olivine, kyanite, garnet, gypsum, spatise, fluorite, calcite, corundum,
2. Ore Minerals
Pyrite, Galena, Haem.ite, Graphite, Malachite, Bauxite.
3. Determination of Sp Gr of any 4 minerals by Walker's Steel Yard balance.
4. Crystallography
 - i) Cubic system - Galena type
 - ii) Tetragonal system - Zircon type
 - iii) Orthochombic system - Baryte type
5. Use of contact goniometer
6. Optical properties of minerals
7. Construction of Petrological Microscope
8. Reading of topasheets and symbols
 - i) temple ii) Mosque iii) church iv) fort
 - v) cliff vi) village, vii) R.F. & P.F.

II TERM

1. Study of contour maps
 - i) 2 Maps showing all land forms
 - ii) 6 Maps with horizontal beds.
2. Palaeontology - study of atleast 15 specimens with 2 from each phylum.
3. Petrology - Granite, Gabbro, Basalt, Pegmatite, Obsidian Stale, Marble, Quartzite, Mica-Garnet Schist, Hornblende schist, Biotite Gneiss, Conglomerate, Breccia, Sandstone, Mudstone, Limestone, Organic Limestone.