EDUCATION REGULATIONS 1972

FOR THE

DIPLOMA COURSE IN PHARMACY

(Regulations framed under section 10 of the Pharmacy Act, 1948)

PHARMACY COUNCIL OF INDIA
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EDUCATION REGULATIONS OF THE PHARMACY COUNCIL OF INDIA

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PHARMACY COUNCIL OF INDIA

New Delhi, the 6th December 1972

No. 14-21/71-*PCI.*—In exercise of the powers conferred by section 10 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government, hereby makes the following Regulations, namely :—

CHAPTER 1

1. *Short title and commencement.*—(1) These Regulations may be called the Education Regulations, 1972.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. *Qualification for a Pharmacist.*—(1) The minimum standard of education required for qualification as a pharmacist shall be Diploma in Pharmacy (Part I) and Diploma in Pharmacy (Part II) or any other qualification approved by the Pharmacy Council of India as being equivalent to Diploma in Pharmacy (Part I) or Diploma in Pharmacy (Part II), as the case may be.

(2) Diploma in Pharmacy (Part I) shall consist of a certificate of having passed the course of study given in Chapter 2 of these Regulations.

(3) Diploma in Pharmacy (Part II) shall consist of a certificate of having completed a course of practical training as given in Chapter 3 of these Regulations.

CHAPTER 2

Diploma in Pharmacy (Part I)

3. *Minimum qualification for admission to the course.*—Any person who wishes to be admitted as a student to the course of study for Diploma in Pharmacy (Part I), shall produce to the head of the institution, imparting the training in accordance with these Regulations, evidence of having passed :—

(a) Matriculation Examination or a High School Examination or a Secondary School Leaving Certificate Examination with

(i) Science—(which should cover an elementary training in atleast two of the following four branches :

(1) Chemistry,
(2) Physics,
(3) Biology,
(4) Physiology and Hygiene, and

(ii) Mathematics (taught and examined as a separate subject), as two of the subjects, of a recognised Indian University or a duly constituted Board, or

(b) any other examination accepted by the Pharmacy Council of India as equivalent to any of the above examinations.

4. *Duration of the course.*—The course of training shall be of two academic years' duration consisting approximately one thousand hours (including the time spent on Sessional Examinations) in each academic year spread over a period of about one hundred and eighty working days.

5. *Courses of study .*—(1) The first year and second year courses of study for Diploma in Pharmacy (Part I) shall include the respective subject as given in the Table below. The number of hours to be devoted to each subject for its teaching (lecture and practical), shall not be less than that noted against it in columns (2) and (3) of the said Table :—

TABLE

First Academic Year

(1) *Subjects to be taught*	(2) *No. of hours of lecture*	(3) *No. of hours of practical work*
General (Inorganic and Physical) Chemistry	100	150
Physics	75	100
Biology—		
Botany	50	100
Zoology	25	50
English	75	—
Anatomy, Physiology and Health Education	50	50
	375	450

Second Academic Year

(1) *Subjects to be taught*	(2) *No. of hours of lecture*	(3) *No. of hours of practical work*
General Pharmacy	75	100
Dispensing Pharmacy	50	150
Forensic Pharmacy, Pharmaceutical Economics and Ethics	40	—
Pharmaceutical Chemistry including General Organic Chemistry	100	150
Pharmacognosy	125 (including practicals)	—
Pharmacology	60 (including demonstrations)	—
	450	400

(2) The detailed syllabus of each of the subjects in the said Table shall be at least as specified in Appendix A to these Regulations.

6. *Special provisions relating to certain pharmacists*:—For the first five years from the date of taking effect of the Education Regulations, if any, in force in any State immediately before taking effect of these Regulations in such State or from the date of taking effect of these Regulations in any State, whichever is earlier, the pharmacist practising for not less than two years in hospitals, dispensaries and other institutions where regular dispensing of drugs is done and possess Matriculation or other equivalent qualification and are desirous of taking up the course of training for Diploma in Pharmacy (Part I), shall be permitted to appear at the preliminary and the final examinations for Diploma in Pharmacy (Part I) at intervals of six months, only if they have to the satisfaction of the head of the institution attended in substance the regular course in an approved institution imparting full-time or part-time tuitions by day or evening classes :

Provided that after the said period the Pharmacy Council of India may on an application made to it by a State Government permit pharmacists to appear at the preliminary and the final examinations for the Diploma in Pharmacy (Part I) at intervals of not less than six months, if they complete in substance the Diploma course in Pharmacy (Part I) in an approved institution, to the satisfaction of the head of the institution concerned, subject to the following conditions, namely :—

(a) that they possess matriculation or other equivalent qualification,

(b) prior to September, 1964, they had undergone a course for Compounders or Dispensers approved by the State Government; and

(c) that they have been practising for not less than two years in hospitals, dispensaries or other institutions where drugs are regularly dispensed.

7. *Approval of course of study*:—The course of regular academic study given under Regulation 5 shall be conducted by an authority in a State, which shall be approved by the Pharmacy Council of India under sub-section (1) of section 12 of the Pharmacy Act, 1948, only if it provides adequate arrangements for teaching in regard to building accommodation, equipment and teaching staff as specified in Appendix B to these Regulations.

8. *Examinations*:—There shall be two examinations, the preliminary examination for Diploma in Pharmacy (Part I) to examine students in the first year course and the final examination for Diploma in Pharmacy (Part I) to examine students in the second year course. Each may be held twice every year. The examinations shall be of a written and practical (which may include oral) nature as indicated in the Table in Regulations 9 and 10.

9. *Eligibility for appearing at the Preliminary Examination for Diploma in Pharmacy (Part I)*:—Only such student who produces certificates from the head of the institution concerned in proof of his having regularly and satisfactorily followed the first year course of study by attending not less than 75 per cent of the classes held (both in theory and in practical separately of each subject) shall be eligible for appearing at the preliminary examination for Diploma in Pharmacy (Part I) which examination shall be conducted in accordance with the scheme in the following Table :

TABLE

Preliminary Examination for Diploma in Pharmacy (Part I)

Subjects of examination	*Total marks for theory including sessional*		*Total marks for practical examination including sessional*	
General (Inorganic and Physical) Chemistry		100		100
Physics		100		100
Biology—				
Botany	75	100	75	100
Zoology	25		25	
English		100		—
Anatomy, Physiology and Health Education	80 20	100		100
		500		400

Note:—All written examinations shall be of three hours' duration.

Examiners will be at liberty to examine students orally during the practical examinations and take cognisance of their performance when marking their papers.

10. *Eligibility for appearing at the final examination for Diploma in Pharmacy (Part I).*—Only such student who produces certificates from the head of the institutions concerned in proof of his having regularly and satisfactorily followed the second-year course of study by attending not less than 75 per cent classes held (both in theory and in practical separately of each subject) and having successfully passed the preliminary examination for Diploma in Pharmacy (Part I) shall be eligible for appearing at the final examination for Diploma in Pharmacy (Part I) as given in the following Table. If, however, the student has completed the first year course and appeared in all subjects in the preliminary examination his failure in not more than two subjects shall not debar him from attending the second year course :

Provided that a student who has passed—

(i) the Intermediate Examination in Science, or

(ii) the first year of a Three Years' Degree Course in Science, or

(iii) an examination accepted by the Pharmacy Council of India as being equivalent to any of the above examinations,

shall be eligible for admission directly into the second year class of the Diploma in Pharmacy (Part I):

Provided further that a student entering the course under the above proviso shall be required to attend classes, appear and pass in those subjects as prescribed for the first year in which he has not previously passed at an equivalent examination. This may be done simultaneously with or

independently of the second year course and examinations depending on the capability of the student and the facilities available to him before he becomes eligible for securing the Diploma in Pharmacy (Part I).

TABLE

Final Examination for Diploma in Pharmacy (Part I)

Subjects of examination	*Total marks for theory including sessional*	*Total marks for practical examination including sessional*
General Pharmacy	100	100
Dispensing Pharmacy	100	100
Forensic Pharmacy, Pharmaceutical Economics & Ethics	100	—
Pharmaceutical Chemistry including Gen. Organic Chemistry	100	100
Pharmacognosy	100	100
Pharmacology	100	—
	600	400

Note:—All written examinations shall be of three hours' duration.

Examiners will be at liberty to examine students orally during the practical examinations and take cognisance of their performance when marking their papers.

11. *Marks for passing in the examinations.*—(a) (i) A regular record of both theoretical and practical class works and examinations conducted in an institution imparting training for the course for Diploma in Pharmacy (Part I) shall be maintained for each student and 30 per cent of the total marks for each subject in theory and 40 per cent of the total marks for each subject in practical shall be allotted to these records.

(ii) There shall not be less than three periodic examinations during the year. The highest aggregate of minimum of two performances shall form the basis of calculating the average for computation of sessional marks.

(iii) The following system should be followed in allotting marks for the sessional practical examinations :

The actual performance in the examination 60%

Day-to-day class work including journal records upto the day of the examination 40%

The average sessional marks thus calculated should be made available to all examiners in a practical subject at the commencement of the relevant examination in both the preliminary and the final examinations for Diploma in Pharmacy (Part I).

(b) A student shall not be declared to have passed the above examinations unless he secures at least 33% marks in English and 40% marks in each of the remainlng subjects separately in the written and practical tests (including sessional record) and 45% marks in the aggregate of all subjects.

Candidates securing 75 per cent marks or above in any subject, or subjects shall be declared to have obtained distinction in that subject or those subjects provided the student passes in all the subjects in the same examination.

(c) A student who appears in all the subjects but fails in not more than two subjects at the preliminary examination for Diploma in Pharmacy (Part I) may at his option take the examination in parts in one or both of the subjects in which he has failed, or in whole, on the condition that he passes in all the subjects prescribed for the examination in three consecutive examinations, or within a period of two years, including the examination at which he first appeared. If he does not pass the full examination within a period of two years as mentioned above, he shall have to take the whole examination in all the subjects at the time, when he next appears at the examination.

(d) A student who fails in the final examination for Diploma in Pharmacy (Part I) may, at his option, take the examination in parts, in one or more subjects in which he has failed, or in whole, on the condition that he passes in all the subjects prescribed for the examination in three consecutive examinations, or within a period of two years, including the examination at which he first appeared. If he does not pass the full examination within a period of two years as mentioned above, he shall have to take the whole examination in all the subjects at the time when he next appears at the examination.

12. *Approval of examinations*:—The examinations mentioned in regulations 8 to 10 shall be held by an authority hereinafter referred to as the examining authority in a State which shall be approved by the Pharmacy Council of India under sub-section (2) of section 12 of the Pharmacy Act, 1948. Such approval shall be granted only if the examining authority concerned fulfils the conditions as specified in Appendix C to these Regulations.

13. *Certificate of passing final examination for Diploma in Pharmacy (Part I)*.—A certificate for having passed the final examination for the Diploma in Pharmacy (Part I) shall be granted by the examining authority to a successful student.

CHAPTER 3

Diploma in Pharmacy (Part II)

(PRACTICAL TRAINING)

14. *Period and other conditions of practical training*.—(1) After the satisfactory completion of the Diploma in Pharmacy (Part I) or any other course accepted as being equivalent by the Pharmacy Council of India, a person shall be eligible to undergo the practical training in an institution,—hospital, pharmacy or manufacturing house recognised by the Pharmacy Council of India.

(2) The institution, hospital, pharmacy or manufacturing house which fulfils the conditions specified in Appendix D to these Regulations shall only be eligible to impart practical training.

(3) In the course of practical training, the person shall acquire :—

(i) working knowledge of keeping of records required by various Acts affecting the profession of pharmacy, and

(ii) practical experience in—

(a) the manipulation of pharmaceutical apparatus in common use ;

(b) the recognition by sensory characters of chief crude drugs and chemical substances used in medicine ;

(c) the reading, translation and copying of prescriptions including checking of doses ;

(d) the dispensing of prescriptions illustrating the commoner methods of administering medicaments; and

(e) the storage of drugs and medical preparations.

(4) The practical training period shall be not less than seven hundred and fifty hours spread over a period of not less than three months.

15. *Procedure to be followed prior to commencing of the training.*—(1) The head of an academic training institution, on application shall supply in triplicate "Practical Training Contract Form for qualification as a Pharmacist" (hereinafter referred to as the Contract Form) to persons eligible to undertake the said practical training. The Contract Form shall be as specified in Appendix E to these Regulations.

(2) The head of an academic training institution shall fill SECTION I of the Contract Form. The trainee shall fill SECTION II of the said Contract Form and the Head of an institution agreeing to impart the training (hereinafter referred to as the Apprentice Master) shall fill SECTION III of the said Contract Form.

(3) It shall be the responsibility of the trainee to ensure that one copy (hereinafter referred to as the first copy) of the Contract Form so filled is submitted to the head of the academic training institution and the other two copies (hereinafter referred to as the second copy and the third copy) shall be filed with the Apprentice Master (if he so desires) or with the trainee pending completion of the training.

16. *Certificate of passing Diploma in Pharmacy (Part II).*—On compeltion of the apprentice period, the Apprentice Master shall fill SECTION IV of the second copy and third copy of the Contract Forms and cause it to be sent to the head of the academic training institution who shall suitably enter in the first copy the entries from the second copy and third copy and shall fill SECTION V of the three copies of Contract Forms and thereafter hand over both the second copy and third copy to the trainee. This, if completed in all respects shall be regarded as a certificate of having successfully completed the course of Diploma in Pharmacy (Part II).

17. *Transitory Provision.*—For the first five years from the date of taking effect of the Education Regulations, if any, in force in any State immediately before taking effect of these Regulations in such State or from the date of taking effect of these Regulations in any State, whichever is earlier, the experience gained by pharmacist practising for not less than two years in hospitals, dispensaries and other institutions where regular dispensing of drugs is done, shall be treated as being equivalent to the practical training under these Regulations.

CHAPTER 4

18. *Certificate of Diploma in Pharmacy.*—A certificate of Diploma in Pharmacy shall be granted by the examining authority to a successful candidate on producing certificates of having passed the Diploma in Pharmacy examination (Part I) and Practical Training for Diploma in Pharmacy (Part II).

19. *Miscellaneous.*—(a) Any course of pharmaceutical training which does not cover in full the courses of study included in these Regulations shall not be considered for approval under section 12 of the Pharmacy Act, 1948.

(b) Persons who have passed a course of study in pharmacy not covering in full the subjects containing in these Regulations shall not be considered as having passed the final examination for Diploma in Pharmacy (Part I), unless they produce a certificate from an approved institution that they have passed an examination in such subjects as required by these Regulations.

20. *Repeal and savings.*—(1) The Education Regulations (hereinafter referred to as the said Regulations) published under the notification of the Government of India in the late Ministry of Health No. 7-12/53-DS, dated the 11th July, 1953, are hereby repealed.

(2) Notwithstanding such repeal—

(a) anything done or any action taken under the said Regulations shall be deemed to have been done or taken under the corresponding provisions of these Regulations ;

(b) a person who was admitted as a student under the said Regulations to the course of training for Diploma in Pharmacy and who had not passed the examination at the commencement of these Regulations shall be required to pass the examination in accordance with the provisions of the said Regulations as if these Regulations had not come into force.

APPENDIX A

[*Regulation 5* (2)]

1. The entire syllabus (except for Dispensing, Forensic Pharmacy and Pharmaceutical Economics and Ethics) should be treated in an elementary manner supplemented by practical demonstrations.

2. Books referred to in the syllabus are meant to be the latest editions.

3. For first year subjects, the standard should fall between the standard of the Central Board of Secondary Education and that of Inter Science of the Indian Universities. The standard for second year course has been indicated at the end of the syllabus on each subject.

GENERAL (INORGANIC & PHYSICAL) CHEMISTRY

(THEORY)

A. INTRODUCTION TO MODERN CHEMISTRY

1. Science and Scientific Measurements :

Natural Sciences, Matter and energy, Heat energy, Potential energy, Kinetic Energy, Nuclear Energy, Radiant Energy, Inter-Relationships of Chemistry and Physics; Important Measurements, Metric System, Units of Measurements, Recording of Measurements, Chemical and Physical Properties of substances.

2. Atomic Theory :

Historical background. Present ideas about Atoms; Components of atoms; Arrangements of electrons, Diagrams of simple atoms: H, Li, Be, C, N, O, F, Ne, Na, Mg, Al, Si, P, S, Cl, Ar, K, Ca, and He. Isotopes. Standards of atomic weight. Hydrogen and its Isotopes.

3. Atoms, Ions and Molecules :

How atoms combine, transfer of electrons, sharing of electrons; Electrovalent and covalent compounds, Valency, Classes of matter, Individual Particles in Matter. Properties of compounds, chemical changes. Constant composition by weight. Conservation of Mass and Energy (including Modern Law of Conservation).

4. States of Matter : Kinetic Theory, Behaviour of Gases :

Compressibility, Effect of temperature, Diffusion, Liquefaction. The gaseous states, Individual Particles in gases, Ideal gas Law, Sublimation, the Vapour Pressure, Boiling, Critical Temperature, Calculations involving gas Laws.

5. Classes of Compounds : Formulas and Equations :

Electrovalent and Covalent Compounds; Organic and Inorganic Compounds; Electrolytes (Strong and Weak) and Non-electrolytes, Sources of Ions; Acid, Bases and Salts (including present theories), Naming of Compounds, Chemical Equations.

6. Hydrogen and Oxygen :

Preparation, properties and uses of Hydrogen, Oxygen and their compounds, Oxidation and Reduction, Valency, Ions, Acidic and basic Oxides. Preparation, properties, uses of Hydrogen Peroxide and Heavy Water.

7. Carbon and Compounds of Carbon and Silicon :

Organic Chemistry and Biochemistry, Elementary Carbon: its allotropic forms and their properties. Preparation of CO_2 and CO, Fuels, Organic Acids; Acetic acid, Chemical reactions of Organic compounds, Carbon Cycle in Nature, Simple compounds of Silicon: their preparation, properties and uses.

B. CHEMICAL THEORY :

8. *Ionic Valence and Electrolysis.* Ions and Ionic Valence. Stable ions. Structure of an ionic crystal. Periodic table. Electrolysis of molten sodium chloride.

9. (A). Electrolysis of aqueous solution. Faraday's Law of Electrolysis, Electrolytic production of elements. *Oxidation—Reduction Reactions.* Electronic definitions of Oxidation and Reduction. Oxidation number of atoms, Oxidation number and Chemical Nomenclature. Balancing of Oxidation—Reduction reactions.

9 (B). *Solutions*, Solute and Solvent. Types of Solutions. Saturated and Supersaturated solutions. Effect of temperature. Methods of Expressing concentrations.

10. *Properties of Solutions.*—Electrolytes and Non-electrolytes, Ideal Solutions. Arrhenius theory and the modern Ionization theory. Osmosis. *Chemical Equilibrium.* Reversible reactions, Le Chatelier's Principle, the Equilibrium Constant: Influence of a Catalyst.

11. *Equilibria involving ions.*—Ionization of weak acids. Ionization Constants, Strength of Acids and Bases. Modern theory of acids and bases. pH; indicators: Hydrolysis: Common ion effect; Buffered Solutions. Solubility product Constant.

12. *Periodic Table, Atomic Structure, and Nuclear Chemistry:*— Atomic Number; Atomic Numbers and Properties of the Elements; Atomic Number and Atomic Volume. The Periodic Law: Periodic Table and General Plan of Arrangement; Group resemblances and Family resemblances. Atomic number and Atomic weight. Value of the Periodic Table. *Radioactivity.* Nature and properties of the rays. Radioactive elements and the Periodic Table. *Physical and Chemical* properties of elements and compounds in the light of their atomic structure: Electrovalent and Covalent compounds; Electrovalence of complexions; Radiotracers. Artificial radioactivity.

C. SOME NON-METALLIC ELEMENTS AND THEIR COMPOUNDS:

13. *The Halogens :*—Family Properties: Physical and Chemical. Preparation and use of the Halogens. The halides, Interhalogens Metal halides; Non-metal and Metalloid halides. The Oxyacids and Oxy-salts. Oxy-

ions of chlorine. Preparation of some Oxy-halogen compounds and their properties; bleaching powder, chlorine dioxide an odd molecule; Chloric acid and its salts; Perchloric acid and perchlorates; potassium iodate.

14. *The Sulfur family* :—Allotropic states of Sulfur. The oxidation states of sulfur; Hydrogen sulfide and the sulfides of metals; Sulfur dioxide and sulfurous acid; preparation and electronic structure; Structure of sulfur trioxide. Manufacture of sulfuric acid, its properties and reactions. Sodium thiosulfate: its preparations, properties and reactions.

15. *The Nitrogen Family* :—Properties of the Nitrogen family: Physical and Chemical, Oxidation state. Trend from non-metals to metals; Tendency to form simple cations; acid base-forming tendencies. Preparation and uses of the Nitrogen Elements. Preparations, properties and reactions of representative compounds: Ammonia, ammonium compounds, nitric acid, phosphoric acid; complex ions containing ammonia; Structural formulas of oxides and oxyacids of nitrogen. Hydrogen cyanide and its salts. Nitrogen cycle in nature.

D. SOME METALS, ALLOYS AND COMPOUNDS OF METALS :

16. *Alkali and Alkaline Earth Metals* :—Physical and Chemical Properties, Preparation and characteristic reactions of Na. Mg, Ca, Alloys. Hardness of water. Softening of water and De-ionised water.

17. *Transition Metals and their Neighbours* : A study of the general properties and of reactions of important metals and their compounds with special reference to their use in qualitative chemical analysis. *e.g. Cr. Mn.* Fe, Co, Ni, Zn, Cd, Hg, Al, Sn and Pb; Cu and Ag. Corrosion. Principles of Metallurgy.

GENERAL (INORGANIC AND PHYSICAL) CHEMISTRY

(PRACTICAL)

1. Gas Burners. Study the manipulation of bunsen burner and flame.

2. Assemble a Wash bottle. Learn the following operations:

Cutting of glass tubing, bending, rounding, reducing the diameter of glass tubing; making a dropping tube; inserting a tube in a stopper; sealing a platinum wire in a glass rod.

3. Weighing. Study the various parts of a chemical balance and determine the zero point; learn to weigh to the nearest milligram with and without the use of a rider.

4. Perform simple experiments to study the processes of filtration, distillation, drying of precipitates; solubility measurements; crystallisation; sublimation.

5. Determine the hardness of water.

6. Study the properties of crystals (i) determine the number of molecules of water of crystallisation; (ii) properties, deliquescence, efflorescence.

7. Find the proportion by volume of Nitrogen and Oxygen in the air.

8. Classify various substances, about ten in number, into Oxidising and Reducing agents.

9. Perform experiments to prove the following laws;

Law of Conservation of Matter; Law of Definite Proportions; Law of Multiple Proportions; Charles Law.

10. Find the equivalents of Metals by (i) by displacement of Hydrogen; (ii) by combination with Oxygen; (iii) by analysis of an oxide; (iv) by displacement of metals from solutions of their salts.

11. Study the properties of acid, bases and salts, carry out titrations of acids against bases and *vice versa*. Use two burettes; use exact number of significant figures in recording your readings and calculations.

12. Study the colour changes of various common indicators by using solutions of different pH and *vice versa*.

13. Simpler experiments in acidimetry and alkalimetry.

(i) To find the strength of a solution of hydrochloric acid by means of a standard solution of sodium carbonate.

Apparatus.—Burette, 25 ml. pipette, conical flask, 150 ml. beaker, wash-bottle, burette stand.

(ii) To find the strength in grams per litre of a solution of nitric acid by means of anhydrous sodium carbonate.

Apparatus.— Burette, 25 ml. pipette, conical flask, 150 ml. beaker, 250 ml. graduated flask, glass funnel, watch glass (6 cm. is suitable), wash bottle, burette stand.

(iii) To find the strength of a solution of sodium bicarbonate by means of a standard solution of hydrochloric acid.

Apparatus.—Burette, 25 ml. pipette, conical flask. 150 ml. beaker, wash bottle, burette stand.

(iv) To find the number of molecules of water of crystallisation in one molecule of crystallised sodium carbonate by titration with standard hydrochloric acid.

Apparatus.—Burette, 25 ml. conical flask, 150 ml. beaker, 250 ml. graduated flask, glass funnel, watch glass, wash-bottle, burette stand.

(v) To find the equivalent of calcium carbonate by back titration.

Apparatus.—Burette, 25 ml. pipette (or 50 ml. pipette, if available), beaker capacity 250 ml., conical flask capacity 250 ml., wash bottle, burette stand.

14. Perform tests for metals and common acidic radicals by wet tests, also study flame tests of various elements.

Note.—During the practical examination, student will be allowed to refer to any laboratory manual for qualitative analysis.

GENERAL (INORGANIC AND PHYSICAL) CHEMISTRY
(THEORY)

Books indicating the general scope of the subject :

1. *Keenan and Wood.* General College Chemistry—Oxford Book Co., Oxford and I.B.H. Publishing Co. No. 9.36, Chowringhee Road, Calcutta—700001.

2. (a) *Chemistry.*—An experimental Science—National Council of Educational Research and Training, New Delhi—110016.

(b) *Teacher's Guide to an Experimental Science.*—National Council of Educational Research and Training, New Delhi—110016.

REFERENCE BOOKS :

1. *Schaum.*—Theory and Problems of College Chemistry, Schaum Publishing Co. 257, Park Ave., New York N.Y. 10010.

2. *Lewis.*—First-year College Chemistry—Barnes & Noble Inc. 105, Fifth Avenue, New York, N.Y. 10005.

3. *Sharp.*—Inorganic Chemistry, Baillere Tindall & Cox., Henrietta Street (London) W.C. 2.

4. *Schroff, M.L.*—Pharmaceutical Chemistry Part I & II, National Book Centre, P-76, Dr. Sundari Mohan Avenue, Calcutta-700012.

GENERAL (INORGANIC AND PHYSICAL) CHEMISTRY
(PRACTICAL)

1. *Jenkins C.*—Practical Chemistry for Schools—Cambridge University Press, Cambridge.

2. *Garret Haskins, Rubin., Verhock.*—Chemistry for Laboratory, Ginn.

3. *Schroff et al.*—Semi-Micro Qualitative Analysis.

4. *Chemistry—An Experimental Science Laboratory Manual*—National Council of Educational Research & Training, New Delhi 110016.

PHYSICS
(THEORY)

SECTION A (*MECHANICS*)

1. *Introduction to Vectors.*—Definitions of : A scalar quantity, A vector quantity. The resultant, The equilibrant; Parallelogram method of vector addition, Vector Polygon method of vector addition, A component of a Vector.

2. *Equilibrium of Parallel Forces.*—The Moment of a Force; Equilibrium, conditions for equilibrium of Parallel forces; a couple Equilibrium of Non-parallel forces, Conditions for equilibrium.

3. *Velocity and Acceleration.*—Speed and Velocity; Acceleration; Motion with constant acceleration, Acceleration due to Gravity. Standard equations for uniformly accelerated motion.

4. *Force, Momentum and the Laws of Motion.*—Force; Newton's Law of Motion; Absolute Units of Force; Gravitational Units of Force; Relation between Dyne and Gram of Force; Law of Universal Gravitation. *Systems of Units.* Absolute systems of Units; Gravitational systems of Units; Conservation of momentum; Centrifugal force.

5. *Work and Machines.*—Work; Units of Work; Principle of Work; Mechanical advantage; Efficiency of a Machine; Simple Machines; The lever. The wheel and axle, Pulleys, the inclined plane, The Screw.

6. *Energy, Power and Friction.*—Energy : Potential and Kinetic. Power: Units of Power. Friction: Coefficient of Friction.

SECTION B (*HYDROSTATICS AND PROPERTIES OF MATTER*)

7. *Pressure, Density and Specific Gravity, Floating Bodies.*—Pascal's Principle; Archimede's Principle. Balloons and Airships. Determination of the specific gravity of solids and liquids.

8. *Pressure of Gases.*—The Mercury and the Aneroids Barometers. Manometers and Pressure Gauges.

9. *Hydrostatic Machines and Pumps.*—The Hydraulic Press, the Syphon, the Common pump, the Force Pump, Air pumps, the filter pump.

10. *General properties of Matter.*—Elasticity : Hooke's Law. Young and Bulk Shear modulous. Surface Tension. Surface Energy. Rise of liquid in a Capillary Tube.

SECTION C (*HEAT*)

11. *Measurement of Temperature.*—Thermometric Scales. Alcohol Thermometers. High temperature thermometers. Maximum Thermometers. Clinical thermometers.

12. *Expansion of Solids and Liquids.*—Linear Expansion of solids. Cubical expansion of solids. Expansion of Liquids. Expansion of water; Hope's Experiment.

13. *Measurement of Quantity of Heat.*—Heat Unit. Thermal Capacity, Specific heat of solids and Liquids and its measurement.

14. *Change of State : Fusion.*—Determination of Melting point by Cooling Curve. Latent heat of fusion and its determination. Effects of Pressure on melting point.

15. *Evaporation.*—Latent heat of vaporisation and its determination. Vapour Pressure; Saturated and Unsaturated Vapours; Vapour pressure of a solution; Variation of boiling point with pressure, Atmospheric Humidity; Dew Point; Hygrometers (Regnaults Wet and Dry bulb); Isothermal Curves; Refrigeration.

16. *Heat and Work:*—Mechanical Equivalent of Heat and its determination. *Modes of Transmission of Heat* Convection, Conduction and Radiation. Thermal Conductivity and its measurement. Radiating and Absorbing powers of a Surface. The Vacuum flask.

SECTION D (*LIGHT*)

17. *Rectilinear Propagation of Light:*—Luminous and Non-luminous bodies. Formation of Shadows. Rays of Light emitted by a source. Illumination of a surface. Inverse Square Law. Photometry, Photometer, Rumfords, Grease spot.

18. *Reflection of Light:*—Laws of Reflection. *Plane Mirrors* : Mirrors

inclined to one another at a fixed angle. *Spherical Mirrors* Principal focus. Mirrors Equation. Size of image.

19. *Refraction of Light:*—Refraction. Critical Angle. Refraction through a Prism. Totally Reflecting Prisms. *Lenses*; type of lenses; thin lenses and thin prisms. Focal length of a lens. Object and Image Relations. Lens Maker's Equation. Lens Power in diopters. Lenses in Contact.

20. *The Eye and Optical Instruments*:—The Eye; Defects of vision and their correction by spectacles. The astronomical telescope, Binoculars. The *Compound Microscope*. The Projection Lantern.

21. *Dispersion of Light*:—Spectrum.

22. *Polarisation of Light*:—Specific Rotation and measurement.

23. *Wave, Motion and Sound*:— Longitudinal and Transverse Waves. Frequency, Wavelength, Speed, Intensity and loudness.

SECTION E (*ELECTRICITY AND MAGNETISM*)

24. *Magnets and Magnetic Fields*:—Natural and Artificial Magnets. Molecular theory of magnetism. Magnetic Induction. Magnetic substances. Permanent magnets and electromagnets. Law of Inverse Squares. Pole strength. Magnetic field Strength. Lines of Magnetic Force. The Earth's Magnetic Field.

25. *Electrostatics*:—Electrification by friction. Conductors and Insulators. The Goldleaf Electroscope; Electrification by Induction. Distribution of charge over the surface of a conductor. Force between two charges : Law of Inverse Squares. Electric Field Strength and Lines of Electric Force. Potential at any point. Condensers in Parallel, in Series; Energy in Condenser. Capacitance in Farads.

26. *Current Electricity:*—Magnetic effect of an electric current. Corkscrew rule. Magnetic Field due to a circular coil carrying a current. Magnetic field due to a solenoid Electromagnets. Electric bell, Fleming's Left hand rule. Force exerted on one circuit by another. *Measurement of current.* Galvanometers. Quantity of Electricity. Potential Difference and Electromotive Force. The CGS Electromagnetic or Absolute system. Practical System of Electrical Units. *Ohm's Law*. Resistances in Series and Parallel. Resistivity or Specific Resistance. Shunts. Cells connected in Series and in Parallel. Ammeters and Voltmeters. Comparison of e.m.f's by Potentiometers. Wheatstone Bridge. Measurement of Resistance by Ammeter and Voltmeter.

27. *Electrical Power, Energy and Heat* :—Power in Watts; Energy in Joules; Heat in Calories. The Joule Effect. Transmission of Electrical Energy, Incandescent Electric Lamps. The Electric Arc. Discharge lamps. Thermocouple.

28. *Electric Cells* :—The simple Voltaic cell. The Leclanche Cell and the Daniell Cell. Storage Battery.

39. *Electro-magnetic Induction*:—Faraday's Laws, Lenz's Law. Principle of Dynamo.

30. *X-Ray:*—Elementary idea.

PHYSICS
(PRACTICAL)

Experiment 1:—Errors and Significant figures. Study the types of errors encountered in experimental work and methods of computing percentage error, and study the meaning of significant figures and their application in the observations, and computations of experimental work.

Apparatus—Metre stick, rectangular block of wood.

Experiment 2:—Measurement of Length and Mass. Learn the use of (i) the Vernier caliper and the micrometer in measuring length and (ii) the laboratory balance in the determination of mass.

Apparatus:—Laboratory Balance; Vernier caliper, micrometer caliper, metal cylinder, small steel sphere, metre stick, set of weights.

Experiment 3:—Balanced torques and Centre of Gravity. Study the conditions of equilibrium of a rigid bar and locate the centre of gravity of a non-uniform bar.

Apparatus:—Metre stick, balance support, weight for loading the metre stick, unknown weight, set of weights, metre stick clamp, Laboratory balances, supply of thread or string.

Experiment 4:—A study of Friction. Study the relation of the frictional force to the force pressing the surfaces together and the effect of the area of contact, and determine the coefficient of friction.

Apparatus:—Set of weights, friction block, 2 cans (sand containers) metre stick, tower, 2 rulers, graph paper (furnished by the student). Friction board with pulley, supply of sand, supply of string, laboratory balances, support rod, table clamp, small rod and clamp.

Experiment 5:—Archimede's Principle and Specific Gravity. Determine specific gravity of solids heavier than water, lighter than water, of liquids.

Apparatus:—Metal cylinder, irregular solid, Vernier caliper, rectangular block of wood, displacement vessels, set of weights, hydrometer, hydrometer jar. Laboratory balance; supply of unknown liquid.

Experiment 6:—Methods of measuring specific gravity of liquids.

Apparatus:—Specific gravity bottle, constant-weight hydrometer, constant-volume hydrometer, set of weights, 2 hydrometer jars, piece of metal, towel, pinch clamp, metre stick.

Supply of liquid to be measured; thread, laboratory balances, supply of lead shots, beaker for hot water, burner and stand.

Experiment 7:—Gas pressure and Boyle's Law. Learn the use of a manometer in measuring gas pressures and then study the pressure-volume relation of a gas at constant temperature.

Apparatus:—U-tube manometer, rubber tube, two ruler, towel, graph paper. Boyle's Law apparatus, table clamp, barometer, thermometer.

Experiment 8:—Young's Modulus of a wire. Study Hook's Law in connection with the stretching of a wire and measure Young's Modulus for the material of which the wire is made.

Apparatus:—Telescope with stand and scale, optical level, 2-metre stick, micrometer caliper, 2 rulers, graph paper, A wire suspended from a rigid support with the lower and supporting a weight of 15 to 25 pounds, 10 or more kilogram weights.

Experiment 9:—A study of the simple pendulum. Study the relationship of the period of a simple pendulum to the length, the amplitude, and the kind of the material of the bob.

Apparatus:—Two-metre stick pendulum clamp, 2 pendulum bobs (one of lead or iron and one of wood), 2 rulers, string or thread (about 2m. long.) stop watch (or watch with second hand furnished by the student), graph paper (furnished by the student). Table clamp and rod.

Experiment 10 :—Linear Coefficient of expansion of metals.

Apparatus:—Burner and hose, metre stick, can or beaker to catch condensed steam, towel, 2 metal rodes of different materials, thermometer. Expansion apparatus, boiler and hose, boiler stand.

Experiment 11.—Specific heat and temperature of a hot body. Determine specific heat of lead shots bythemethod of mixture, andalso determine the temperature of a red-hot piece of metal whose specific heat is known.

Apparatus:—Burner, calorimeter (complete with stirrer), metal cup containing about 400 g. of shots, piece of metal with copper wire hook, support rod for the piece of metal, thermometer in C., thermometer in tenths of degrees C., set of weights, towel, boiler, boiler stand, laboratory balances.

Experiment 12:— (i) Humidity. Determine the dew point with WET and DRY hygrometer and relative humidity in the room. (ii) Latent heat of fusion of ice.

Apparatus:— Calorimeter (complete) thermometer, 2 cans for water, burner, set of weights, towel. Boiler stand, wet and dry-bulb hygrometer, laboratory balances, supply of ice.

Experiment 13:— The molecular nature of Magnetism. Study some simple magnetic phenomena in support of the molecular theory of magnetism.

Apparatus :-- Bar magnet, horse shoe magnet, knitting needle, compass small nail, bunsen burner, piece of copper wire, piece of metal to be used as. a hammer, iron rod, permalloy rod, permalloy foil, hammer, dip needle, mounted magnetic needle.

Experiment 14:—Magnetic effects of electric current. Study the nature of the magnetic field about a straight wire carrying a current and the magnetic effect of coils and electromagnets.

Apparatus :—Bundle of connecting wires, can of iron fillings; rheostat (20—25 ohms). reversing switch, 4 compasses, iron core, protective resistance (bare wire of about 0.5 ohms), small copper wire (about 5 ft. long), 2 brass connectors, wooden frame, U-shaped iron rod, electric buzzer, Source of direct current (about 6 volts), unknown current arrangement.

Experiment 15:—Measurement of resistance with a slide-wire Wheatstone bridge. Study the principle of Wheatstone bridge and its use in measurining electrical resistances.

Apparatus :—Bundle of connecting wires, dry cell, resistance box. set of coils for unknown resistance, galvanometer, tapping key, Slide-wire Wheatstone bridge.

Experiment 16:—Resistivity and a study of the Laws of Resistance. Learn to operate a dial-type Wheatstone bridge and study the relation of resistance to the length. cross-sectional area, and kind of material of wires.

Apparatus:— Dial-box, Wheatstone bridge, dry cell, galvanometer, set of coils, bundle of connecting wires.

Experiment 17:—Measurement of potential difference with a potentiometer. Study the principle of potentiometer. measure electromotive forces of cells with the potentiometer, and determine the terminal voltage of cells and internal resistance of cells when furnishing currents.

Apparatus :—Rheostat (15—20 ohms), portable galvanometer, resistance box (10,000 ohms), bundle of connecting wires, Voltmeter, 2 or 3 cells for unknown cell, simple switch, double pole double-throw switch, sliding-contact switch, Slide-wire potentiometer (1 to 2m long), storage battery.

Experiment 18 :—(i) A study of the Voltmeter and Ammeter connections in measuring resistance, Learn to measure resistance by Voltmeter—Ammeter method. Also study the methods of connecting these instruments in the circuit so as to avoid the necessity of making corrections in the resistance computation.

(ii) A study of the Laws of circuits (series and parallel).

Apparatus :—Voltmeter, Ammeter, Milliammeter, rheostat (20—25 ohms), bundle of connecting wires, switch, 25-watt lamp and socket, low-resistance coil (0.5-1 ohm), 2 Fahnstock connectors, (Voltmeter to be a relatively low resistance meter, say 200 to 300 ohms per volt). Storage battery or dry cell.

Experiment 19:—The Heating effect of an electric current. (a) Determine the amount of heat developed in a coil by an electric current; (b) compare the electrical energy which is heated by the current.

Apparatus:—Bundle of connecting wire, voltmeter, ammeter, electric calorimeter, thermometer, rheostat (2 to 5 ohms), switch, set of weights, 2 rulers, graph paper, storage battery or other 6-volt direct current source.

Experiment 20:—Reflection and Refraction of Light. Study the Laws of reflection and refraction.

Apparatus:—Plane mirror, mirror support, 5 pins, ruler, protractor, rectangular glass plate, cardboard, prism.

Experiment 21:—Study of the image forming properties of a concave mirror and determine its focal length.

Apparatus:—Metre stick, 2 optical-bench supports, concave mirror, mirror holder, light source, object screen, image screen, screen holder, 2 object and image markers ruler, main supply outlets if the light source is an electric lamp.

Experiment 22:—Study of the image forming properties of a converging lens, and determination of the focal length of a single lens and also of a combination lens.

Apparatus:—Metre stick, 2 optical-bench supports. 2 convex lenses of

different focal lengths, lens holder, light source, object screen, image screen, screen holder, 2 object and image markers, plane mirror, mirror support.

Experiment 23 :—Optical Instruments employing one and two lens: Simple magnifier, the projection lantern, and the camera.

Apparatus:—A 1-metre stick, a 2-metre stick. 2 rulers, 2 optical bench, supports, light source, object screen, cardboard screen, screen holder 4 lenses (focal lengths 5, 10, 15 and 30 cm.) 2 lens holders, 2 object and images markers (one being tall).

Main supply outlets if an incandescent lamp is used as a light source.

Experiment 24 :—Optical instruments employing two lenses : Measurement of magnifying power microscopes and telescopes.

Apparatus :— 2 metre sticks, 2 rulers, 2 optical-bench supports, light source, object screen cardboard screen, screen holder, 5 lenses (convex with focusses of 5, 10,15 and 30 cm respectively and concave with focus of 10 cm), 3 lens holders.

Note : During the practical examination, students shall not be allowed to refer to any book other than Logarithmic Tables.

Books indicating the general scope of the syllabus:

PHYSICS

(THEORY)

1. Physics,—National Council of Educational Research and Training, New Delhi-110016.
2. Laboratory Guide for Physics,—National Council of Educational Research & Training, New Delhi-110016.
3. *Gamow:* Physics—Foundations and Frontiers; Prentice Hall of India, Pvt., M-97, Aggarwal Building, Connaught Circus, New Delhi-110001.
4. *Stead*—Elementary Physics,—J & A Churchill, Ltd. 104, Glouces-ter Place London, W.I.
5. *Schaum*—Theory and Problems of College Physics—Schaum Publishing Co; 257 Park Ave, New York NY 10010.

REFERENCE BOOKS

1. *Green*—Principle of Physics,—Prentice Hall of India, Pvt. Ltd., Connaught Circus, New Delhi-110001.
2. Physics Teacher's Resource Book & Guide. (Four Vols)—National Council of Educational Research & Training, New Delhi-110016.

PHYSICS

(PRACTICAL)

REFERENCE BOOKS

Bernard C.H.—Laboratory experiments in College Physics—Ginn & Co.

BIOLOGY
BOTANY
(THEORY)

1. Relation of Botany to Pharmacy—
The broad divisions of the Plant Kingdom, Botanical Nomenclature.

2. General Morphology of—
   (a) Roots and their modifications (with emphasis on their storage properties.)
   (b) Stems and their aerial and subterranean modifications.
   (c) Leaves.
   (d) Flowers.
   (e) Fruits.
   (f) Seeds and spores and their germination.

3. Elementary structure and formation of—
   (a) Cells including mechanical and chemical modification of cell-walls.
   (b) Tissues and tissue systems.
   (c) Non-living cell-contents especially starch, calcium oxalate crystals cystoliths etc.

4-A. General histology of—
   (a) Monocotyledon and Dicotyledon stems illustrated by Maize and Sunflower stems.
   (b) Monocotyledon and Dicotyledon roots as illustrated by Maize and Sunflower roots.
   (c) Leaves.
   (d) Hairs and glands.

4-B. General Knowledge of secondary-growth, including annual rings and autumn and spring wood with reference to sunflower plant.

4-C. Study of permanent slides including those of longitudinal sections of stems and roots to have complete integrated picture of structure and form of cells and their arrangement.

5. General Characters of the following angiospermic families :—

Liliaceae, Solanaceae, Apocyanaceae, Umbelliferae, Compositae and Leguminosae.

6. Elementary Plant Physiology (illustrated by demonstrations).
   (i) Food material of plants and their sources and form.
   (ii) Absorption of water.
   (iii) Movement of water and gases within the plant.
   (iv) Transpiration.
   (v) Nutrition & metabolism.
   (vi) Digestion and respiration.
   (vii) Growth.

BOTANY

(PRACTICAL)

1. Morphological description of the parts of plants.
2. Histological characters of the parts of plants, viz. root, stem and leaf.
3. Simple experiments on plant nutrition, transpiration, respiration and germination.

Note :— No reference books will be allowed during Practical Examinations.

ZOOLOGY

(THEORY)

I. (A) Cell
(1) Structure and ingredients.
(2) Cell division
(a) Mitosis
(b) Meiosis and differences between the two types of cell divisions.
(3) Tissues : Connective, Epithelial. Areolar, Muscular, Simple skeletal and Nervous muscle.
(4) Blood : Composition, properties, a broad outline of the four blood groups.

(B) Unicellular organisms :

Amoeba : (1) Structure, classification
(2) Food and feeding habits.
(3) Movements.
(4) Reproductive cycles & characters of invertebrates.

(C) An elementary outline of Coelenterata and Anneldda examplified by *Hydra* for diploblastic nature and *Earth worm* from triploblastic nature. Hydra : structure, feeding, reproduction,
Earthworm: structure, feeding & reproduction.

(D) Cockroach : Arthropodan characters, circulation, digestion, reproduction.

II. Characters of vertebrates and outline classification.

(a) Amphibia characters, examplified by Frog.
(i) General characters of Frog habits.
(ii) Food and feeding, respiration, process of digestion, circulation, Nervous system, Life history of Frog (Brain).

(b) Mammalian characters :
Rabbit : General structure.
or Rat : Digestion, respiration
or Guineapig : Circulation and Nervous system, emphasis on brain.

ZOOLOGY
(PRACTICAL)

Microscopical Examination :

(1) Amoeba and Paramecium.

(2) Cell and Divisions (Permanent slides).

(3) Eye of the Cockroach.

(4) Preparation for mounting connective areolar, modullated nerve fibre, voluntary and involuntary muscles, blood and cartilage of frog.

(5) Frog and any mammel (Rabbit, Guineapig, Rat).
Digestive system.
Arterial and Venous system.
Urino-genital system.
Nervous system (brain).

Books indicating the general scope of syllabus :

1. Biological Science—An enquiry into Life—National Council of Educational Research & Training, New Delhi-110016.
2. Biological Science—Students Laboratory Guide—National Council of Educational Research & Training, New Delhi-110016.

REFERENCE BOOKS :

1. *Stauffer, Andrew* : General Biology—Affiliated East West Press Pvt. Ltd., C-57, Defence Colony, New Delhi-110024.
2. *Buffalo, Nerl* : Principles of Biology—Prentice Hall of India Pvt. Ltd., New Delhi-110001.
3. Biological Science : Teacher's Manual—National Council of Educational Research & Training, New Delhi-110016.
4. Biological Science : Teacher's Manual for Student's Laboratory National Council of Educational Research and Training, New Delhi-110016.
5. *Taylor & Weber* : General Biology—Affiliated East-West Press Pvt. Ltd., C-57, Defence Colony, New Delhi-110024.

ENGLISH

There shall be only one paper of three hours' duration carrying 100 marks and consisting of two sections.

The first section shall consist of questions of a general, non detailed nature from a prescribed Textbook of English Prose Selections tallying with the general standard prevailing for the Intermediate Examination of Science or Pharmacy in the regional University or Board.

The second section shall be on composition consisting of questions on the correct use of the English idioms and construction and exercises on essay and precis writing. The aim of this section is to test the capacity of the students to write correct English.

Books recommended for the second section :

1. *Bartley and Banerjee*,—A guide to English Composition—Humphrey Milford, Oxford University Press, London.
2. *Henderson B L.K.*—The English Way—Macdonald and Evans, London.

ANATOMY, PHYSIOLOGY & HEALTH EDUCATION
(THEORY)

1. Scope of the subject.
2. The tissues.
3. The body as a whole.
4. The skeleton.
5. The joints or articulations.
6. The muscular system.
7. The circulatory system.
8. The blood.
9. The lymphatic system.
10. The digestive system.
11. Metabolism diet and nutrition.
12. The skin.
13. The respiratory system.
14. The urinary system.
15. The ductless glands or endocrine system.
16. The nervous system.
17. The organs of sensations.
18. The reproductive system.
19. Health education.

    (a) Spread and prevention of infectious diseases : Contageous diseases, venereal diseases, leprosy, droplet's infections, water borne diseases; air borne diseases carried by insects.

    (b) Population problem, family planning programme and the role that Pharmacist can play in motivating the public and in the implementation of the family planning programme especially in the hospitals, dispensaries, drug stores and other situations.

    (c) The principle underlying the family planning methods especially the chemical, oral and mechanical contraceptives.

    (d) The types of contraceptives and their developing trends, methods of their use and storage conditions.

    (e) A brief account of the manner in which the contraceptives are tested before they are approved as suitable for use.

ANATOMY, PHYSIOLOGY & HEALTH EDUCATION
(PRACTICAL)

1. Handling and care of Microscope.
2. Identification of various charts, models and microscopic slides illustrative of the theory work of Human Anatomy and Physiology. Blood counting and qualitative analysis of urine and stool.
3. Identification of various mechanical contraceptives.

Note:— Of the total time spent, at least half should be allotted to Physiology and the rest to Anatomy and Health Education. It is further suggested that in setting up questions, separate questions on Anatomy should not be set. Questions on Anatomy should whenever possible be linked up with question of Physiology.

Books indicating the general scope of syllabus :

1. *Sears W. Gordon*—Anatomy, Physiology for Nurses—Edward Arnold (Publishers) Ltd., 41, Meddox Street, London, W.I.

REFERENCE BOOKS:

1. *Best and Taylor*—The Living Bodies, Asia Publishing House, Bombay or Fourneax's Human Physiology—Longman Green & Co., London
2. *Mcnaught and Callander*—Illustrated Physiology—William and Wilkins, Baltimore, U.S.A.
3. *Pearce E.*—Anatomy and Physiology for Nurses—Faber and Faber Ltd., 24 Russel Square, London.
4. *Ross and Wilson*—Anatomy and Physiology—Hernsman, London.
5. Material published by the Ministry of Health, Family Planning and U.D. (Department of Family Planning) may be used.

GENERAL PHARMACY
(THEORY)

PRINCIPLES OF PHARMACY :

History of Pharmacy.

Heat.—Sources and uses of heat in Pharmacy. Control of heat, Water-bath, Steam-bath, Sandbath, Oil-bath, Air-Oven and different types of burners.

Heat Processes.—Fusion, Evaporation, factors influencing the rate of Evaporation, Ebullition, Desiccation, Exsiccation, Carbonisation, Calcination, Ignition, Refrigeration, Distillation, Reduced Pressure Distillation, Fractional Distillation, Fractionating or Distilling Columns. Fractional Distillation under reduced pressure, Steam Distillation, Florentine Receivers, Destructive Distillation, Sublimation, Different kinds of sublimates and Freeze drying.

Solutions.—Types-gases in liquids, liquids in liquids, solids in liquids, solubility, factors affecting the solubility of solids in liquids, heat of solution and other properties of solutions like osmosis, immiscible solvent—partition law, ionisation, pH, Buffers, acids, bases, isotonic solution (calculations), absorption, viscosity, surface-tension.

Colloidal State.—Elementary study of Colloids, Suspensoids and Emulsoids and properties of Colloidal State. Preparation of Colloidal solutions.

Mechanical Separations : Decantation, Filtration, Hot filtration, Suction filtration, Pressure Filtration, Centrifugal separation, Colation, Decolourisation and Elutriation.

Storage and Preservation of drugs and pharmaceutical preparations.

Mechanical sub-division of Drugs and Chemicals :—Communition and the means adopted for the purpose. Trituration, Sifting and Sieving different types of powders.

Extraction Processes : Expression, Simple and Pressure Presses, Infusion, Decoction, Lixiviation Maceration, Percolation, Diacolation, Diffusion. Apparatus used for the above processes.

Precipitation, Crystallisation and Granulation.

GALENICAL PHARMACY

Preparations of Indian Pharmacopoeial Aquas, Infusions, Spirits, Tinctures, Extracts, Liniments, Solutions (Liquors), Ointments, Plasters, Poultices, Syrups, Glycerines, Elixirs, Concoctions, Powders, Emulsions, and General composition of official preparations. Elementary study of the Surgical Dressings, Ligatures and Sutures and their standards.

BIOLOGICAL PHARMACY (Pharmaceutical Microbiology) :

Elementary knowledge of Bacteria, Rickettsiae and Viruses, immunity, Vaccines, Sera, Toxoids, Antitoxins, Antibiotics, Vitamins, Hormones, Dry Serum, Extract of liver, Extract of Pituitary (Post. Lobe), Protein, Hydrolysates. Preparation of injections and compositions of official injections. Sterilisation of medicaments, autoclaves and Bacterial Filters, Tests for Sterility, Pyrogens, Disinfectants, R.W. Coefficient and Transfusion sets.

GENERAL PHARMACY

(PRACTICAL)

(A) A scheme of 100 hours to include preparation of simple pharmaceutical products such as :—

Aqua Camphorae B.P., I.P.; Aqua Chloroformi B.P., I.P.; Aqua Mentha Piperitae (U.S.P. methods); Infusion of Quassia I.P., Concentrated Compound Infusion of Chirata, I.P., Concentrated Infusion of Quassia B.P.C. 1959; Glycerin of Tannic acid I.P.; Glycerin of Boric Acid; I.P. Compound Paint of Iodine B.P.C.; Poultice of Kaolin B.P., I.P.; Spirit of Pudina, I.P.; Aromatic Spirit of Ammonia I.P.; Tincture of Orange B.P., I.P.; Compound Tincture of Benzoin, I.P., Compound Tincture of Cardamom I.P., Liquid Extract of Glycyrrhiza I.P.; B.P.; Weak Solution of Iodine I.P.; Solution of Cresol with Soap, B.P. I.P.; Strong Solution of Lead Subacetate I.P.; Strong Solution of Ammonium Acetate I.P.; Arsenical Solution I.P.; Syrup of Orange, I.P.; Syrup of Tolu, I.P.; Compound Syrup of Ferrous Phosphate, I.P.; Mercury with Chalk; Compound Powder of Glycyrrhiza; Lotio Calamina; Non-staining Iodine Ointment.

Parenteral Preparations e.g.

(a) Water for Injection.
(b) Injection of Sodium Chloride.
(c) Injection of Dextrose.

Granules for the preparation of Tablets e.g.

(a) Aspirin Tablets.
(b) Compound Tablets of Sodium Bicorbonate.
(c) Tablets of Calcium Lactate.

B. Differentiation of Bacteria, Yeasts and Moulds; Examination of Bacterial Slides, Preparation of Culture Media, Tests of Sterility of different kinds of medicaments and surgical dressings, ligatures and sutures.

Note.—Pharmacopoeias, Codexes and Formularies may be allowed for reference during a practical examination.

Books indicating the general scope of the syllabus:

1. *Cooper & Gunn*—Tutorial Pharmacy—Pitman Medical Publishing Co., London.

REFERENCE BOOKS

1. Pharmacopoeia of India.
2. National Formulary of India.
3. The British Pharmacopeia and British Pharmaceutical Codex. The Pharmaceutical Press, 17, Bloomsbury Square, London W.C.1.
4. *Cook and Martin*—Remington's Pharmaceutical Sciences—Mack Publishing Co., Easton, Pennsylvania 18042.
5. *Arny and Fischelis*—Principles of Pharmacy—W.B. Saunders Co; Philadelphia.
6. *Cappari & Kelly*—A treatise on Pharmacy—Lea and Fabiger. Philadelphia.

DISPENSING PHARMACY

(THEORY)

PRINCIPLES OF DISPENSING

Prescription :—Definition, various parts of a prescription, dispensing routine, copies of prescription, repeat prescription.

Accuracy in dispensing, labelling, packing and containers for dispensed medicines.

A STUDY OF THE FOLLOWING :

Powders.—Importance, simple powders, method of weighing, wrapping, powders containing volatile, hygroscopic, vegetable, scale preparation and potent substances. Trituration and fractional powders, compound powders, liquids in powders, liquifying substances, extracts in powders, explosive mixtures, dusting powders, antacid powders, dentifrices, salines in powders, sterile powders, powders in bulk, effervescent powders and granules.

Mixtures.—Definition, importance, classification, simple mixture, vehicle, dispensing of simple mixtures. Substances easily soluble, substances difficultly soluble, treatment thereof. Various stages in dispensing simple mixtures.

Mixtures containing diffusible substances, method of dispensing; mixtures containing indiffusible substances, method of dispensing; various suspending agents, advantage and disadvantages of different suspending agents, mixture containing precipitate forming liquids, methods of dispensing thereof.

Miscellaneous mixtures.—Effervescent mixtures, quinine sulphate in acid mixtures, chlorine mixtures, mixtures containing small amount of menthol and thymol, mixtures containing small doses of potent substances.

Emulsions.—Definition, types of emulsion and their identification, emulsifying agents, methods of preparation, stability of emulsions. Hand emulsifying machine.

Incompatibility.—Definition, various types (i) Chemical (ii) Physical or Pharmaceutical (iii) Therapeutical, intentional and unintentional, tolerated and adjusted incompatibilities. Detailed study of chemical incompatibility under the heading (a) Evolution of a gas (b) Percipitation of an insoluble compound (c) Alkali acid neutralisation (d) Percipitation of an alkaloid (e) Formation of an undesirable compound.

Ointment.—Definition, physical properties, uses; composition, ointment bases, classifications, oily bases, absorption bases, emulsion bases and water soluble bases. Various techniques of preparation of ointments, eye ointment, paste and creams, and containers thereof. Technique of studying absorption and penetration of ointments.

Pills.—Definition, advantages, disadvantages, essential requirements of a good pill, massing, rolling, cutting, rounding, coating, varnishing, packing, excipients, enteric coating. Pills containing small doses, oxidising, substances, camphor-like substances. Oily substances, soft extracts and similar substances, water-soluble dry extracts and scale preparations, ferrous sulphate, quinine salts, liquid preparations, Indian Pharmacopoeial pills.

Pastilles.—Bases, mould, packing.

Lozenges.—Base and apparatus for preparation.

Capsules.—Soft and hard and their filling.

Liniments and lotions, Nasal drops, mouth washes, ear drops, gargles, pigments etc.

Suppositories.—Definition, types, bases, methods of making suppositories, study of calculation of displacement value of medicaments.

Percentage solutions, creams, dental preparations, plasters and dermatological preparations.

Tablets.—Elementary study.

Posology.—Detection of over doses in prescriptions, pharmaceutical Latin.

Dispensing of Biological preparations and storage of pharmaceuticals.

Pharmaceutical Arithmetic.—Different systems of weights and measures, calculations of doses, reducing and enlarging of recipes, percentage solutions, alligation, thermometric scales, proof spirit, dilution and concentration of solutions with special reference to isotonic solutions and their calculations.

DISPENSING PHARMACY

(PRACTICAL)

A scheme of 150 hours of Practical work including the following :—

(a) Dispensing of not less than 150 prescriptions covering a wide range of medicinal preparations including all the classes listed under "DISPENSING PHARMACY", maintaining complete record of each.

(b) Preparation and dispensing of the following official preparations:—

Mucilage of Acacia I.P., Mucilage of Tragacanth I.P., Compound Powder of Tragacanth, Soft Soap, Liniment of Turpentine, Liniment of Soap, Ointment of Boric Acid and Sulphur.

Note. No reference books other than the Indian Pharmacopoeia shall be allowed during the practical examination.

Books indicating the general scope of the syllabus:

1. *Cooper and Gunn*—Dispensing for Pharmaceutical Students,—Pitman Medical Publishing Co. London.
2. *Baillere-Tindall.*—Aids to Dispensing—Baillere Tindall & Cox, London, W.C.I.

REFERENCE BOOKS

1. The Pharmacopoeia of India.
2. National Formulary of India.
3. *Cook and Martin*; Remington's Pharmaceutical Sciences Mack Publishing Co., Easton, Pennsylvania, 18042.
4. Pharmacopoeia of United States—Mack Publishing Co., Easton, Pennsylvania.
5. British Pharmaceutical Codex.
6. *Lyman R.A.* American Pharmacy, (Vols. I & II,) J.B. Lippincot & Co. Philadelphia.
7. Sco *ville's*—Art of Compounding,—McGraw Hill Book Company, New York.
8. *Husa*-Pharmaceutical Dispensing,—Mack Publishing Co. Easton Pennsylvania-18042
9. The British Pharmacopoeia.
10. The Pharmacopoeia of U.S.S.R.

FORENSIC PHARMACY, PHARMACEUTICAL ECONOMICS & ETHICS

FORENSIC PHARMACY

Study of Dangerous Drugs Act of 1930; Opium Act, Poisons Act, Drugs and Cosmetic Act of 1940; Drugs Rules of 1945; Pharmacy Act of 1948; the Excise Act; and such other State Acts as materially affect the pharmaceutical profession.

Study of the Acts and Rules prescribed in the syllabus may be done in accordance with the following scheme :—

1. *Laws concerning Drugs.*—(i) Definitions, (ii) Drugs Technical Advisory Board—constitution and functions, (iii) Central Drugs Laboratory—Functions, (iv) Drugs Consultative Committee—Constitution and Functions, (v) Import of drugs—conditions and requirements, (vi) Manufacture, sale

and distribution of drugs—Licences; minimum requirements; records and registers. (vii) Government Analysts—qualifications and functions. (viii) Inspectors-powers and duties. (ix) Cognizance of offences. (x) Offences and penalties (xi) Labelling and packing requirements. (xii) Standards of quality—standardization. (xiii) Powers and functions of Central and State Governments.

2. *Laws concerning Dangerous Drugs.*—(i) Definitions (ii) Prohibition (iii) Control of Central Government on production and supply of opium; manufacture of manufactured drugs; import, export and transhipment. (iv) Control of State Government—internal traffic (v) Investigation of offences —procedures for (vi) Offences and penalties. (vii) Powers and functions of Central and State Governments.

3. *Laws concerning Advertisements.*—(i) Definitions (ii) Prohibition of advertisements (iii) Offences and penalties (iv) Powers of Central and State Government.

4. *Laws concerning Poisons.*—(i) Definitions (ii) Import and Sales restrictions (iii) Records and registers (iv) Powers of Central and State Governments.

5. *Laws concerning Pharmacists.*—(i) Definitions (ii) Pharmacy Councils—Central and State; constitution and functions (iii) Qualifications for registration (iv) Withdrawal of registration (v) Reciprocity (vi) Privileges (vii) Offences and penalties (viii) Powers and functions of Central and State Governments.

6. *Laws concerning Weights and Measures.*—(i) Definitions (ii) Weights and measures (iii) Procedure for certification (iv) Offences and penalties (v) Powers and functions of Central and State Governments.

7. *Laws concerning Shops and Establishments.*—(i) Definitions (ii) Registration (iii) Opening and closing hours (iv) Hygienic conditions (v) Conditions of service — wages, leave etc.

8. *Laws concerning Alcohol and Spirituous preparations.*—(i) Definitions (ii) Alcohol in manufacturing and compounding of prescriptions (iii) Denatured spirits (iv) Powers and functions of Central and State Governments.

Books indicating the general scope of the syllabus

1. *Mithal, B.M.*—A Textbook of Forensic Pharmacy—National Book Centre, P-76 Dr. Sundari Mohan Avenue Calcutta 700012

2. *Mazhar Hussain.*—Law relating to Drugs in India—Eastern Book Co., Lal Bagh Road, Lucknow 226001

3. *Consul, S.C.*—Manual of Drug and Cosmetic Laws—Metropolitan Book Co., Pvt. Ltd. Delhi 110006.

PHARMACEUTICAL ECONOMICS AND ETHICS

SECTION A. ELEMENTS OF DOUBLE ENTRY BOOK-KEEPING AND ACCOUNTING

General Principles of Double Entry Book-keeping. Journal, Ledger, Cash Book and element of Balance Sheet. Forms of

Invoice. Bank Reconciliation statement, Stock Book—Inventory. Record.

SECTION B. DRUG STORE ORGANISATION (MANAGMENT)

Business correspondence and filing, Location of Pharmacies and Drug Stores Rural and Urban. Types of Stores—Unit, Departmental. Functions—Retail. Wholesale. Stock Control—Ordering of Stocks. Stock record and control. Basic Ideas about fundamentals of Economics, Definitions and explanation of basic terms. Want, Welfare, Price, Utility, Value, Demand, Supply etc. Advertisement, Window display, Posters etc. Types of Ownership Sole Trader, Partnership etc.

SECTION C. ETHICS IN PHARMACY

Pharmaceutical Profession and its responsibilities; Institution of Pharmacy in relation to society; Pharmacists in relation to Doctors, Nurses, Patients, Customers, the Public, Whole-sale Dealers, Employers and Employees; Codes of Conduct in Dispensing and advertising of drugs and medicines with special reference to poisons, narcotics, abortifacients and contraceptives; Rule of receiving; dispensing, checking and delivery of prescriptions; Fair pricing and fair service as indicated in the Code of Ethics framed by the Pharmacy Council of India.

Books indicating the general scope of the syllabus:

1. *Benham* or *Sen and Das* or *Devit and Singh* or *Vakil and Pathak*—Principles of Economics.
2. *Paul C. Olsen*—Marketing of Drug Products—Sir Issac Pitman & Sons, London.
3. *Peterson A. F.*—Pharmaceutical Selling, Detailing and Sales Training—Heathcote Woodbridge. Inc., Heathcote Station, Searsdale, New York.
4. *Russel and Beach*—Text Book of Salesmanship (Chapter 16) McGraw Hill, New York.
5. *Convers and Jones*—Introduction to Marketing (Chapters 1, 2, 3, 12, 13, 14, 19 to 26).
6. Code of Pharmaceutical Ethics—Pharmacy Council of India, P.B. No. 337, New Delhi-110001.

PHARMACEUTICAL CHEMISTRY INCLUDING GENERAL ORGANIC CHEMISTRY

(THEORY)

SECTION A. (PHARMACEUTICAL INORGANIC CHEMISTRY)

1. An elementary study of inorganic substances official in the Pharmacopoeia of India with special reference to their preparation, tests of purity and standards.

SECTION B. (GENERAL ORGANIC CHEMISTRY)

2. *General Principles.*—Atomic structure; Atomic Bonding; Polarity of Bonds; Fundamental Chemical Particles; Equilibrium and reversibility. Molecular Structural Formulas. General Structure and Nomenclature. General Classes of Compounds; Analysis of Organic Compounds; Qualitative and Quantitative. Purification and Indentification.

3. *Aliphatic Hydrocarbons.*—Classification. Alkanes; Isomerism, Nomenclature, Cycloalkanes, Physical Properties, Preparations and reactions of alkanes. Petroleum, Paraffins and Vaseline.

4. *Olefins and Acetylene.*—Molecular structure, Isomerism: Nomenclature. Physical properties. Preparation, reaction; Markownikoff's Rule Polyolefins; Conjugated dienes.

5. *Aromatic Hydrocarbon.*—Molecular structure of Benzene, Resonance structures for Benzene. Nomenclature of substitution products. Polynuclear hydrocarbons, Naphthalene; Anthracene and Phenanthrene. Preparation of Aromatic hydrocarbons. Reactions and directive influence of substituents: activating and De-activating groups. Some reactions of alkyl benzenes.

6. *Organic Halogen Compounds.*—Structure and nomenclature, preparation and reactions of Monohalogens compounds. Grignard reaction. Displacement reactions; Dehydrohalogenation. Behaviour of Arylhalides. *Polyhalogen compounds.*—Structure and nomenclature, physical properties. preparation and reactions. Some important polyhalides: Ethylene dichloride, Carbon tetrachloride. Chloroform, D.D.T., Benzene Hexa Chloride (BHC), Iodoform, Chloral hydrate.

7. *Alcohols, Phenols, Ethers.—Alcohols*: Structure, nomenclature. physical properties, preparations and reactions. Some useful alcohols: Methyl and ethyl alcohols, Glycols, Glycerol. *Phenols.* Structure, nomenclature and physical properties of Phenol, Cresols, Resorcinol, Hydroquinone, Naphthols. Preparation and reactions of Phenol.

Ethers.—Structure, Nomenclature, physical properties, preparation and reactions of ethers. Reactions of Ethylene Oxide. Analogous Sulfur Compounds. Detailed study of ethyl ether.

8. *Aldehydes and Ketones.*—Structure, nomenclature, physical properties, preparation and reactions and uses. Differentiation between aldehydes and ketones.

9. *Organic acids.*—Carboxylic and Sulphonic acids. Monocarboxylic acid: formic, acetic, and benzoic. Structure, nomenclature, physical properties, preparation and reactions. Unsaturated monocarboxylic acids. Monoprotic Sulphonic acids; physical and chemical properties. Preparation and properties of Saccharin and Chloramine, simple Nitrogen acids. *Organic Diprotic acids.* Structure, nomenclature, physical properties and preparation Oxalic acids, Adipic acid, Malonic and Succinic acids. Some important useful reactions. Unsaturated dicarboxylic acids.

10. *Organic Acid Derivatives.*—Salts and esters. Structure, nomenclature, Preparation, properties and reactions, uses. *Acid Halides and Anhydrides.*—Preparation, nomenclature. physical properties, reactions. *Amides and Nitriles.*—Preparation nomenclature, physical properties, reaction. Urea; Barbituric acid; Phenobarbital.

11. *Fats and Oils ; Waxes : Detergents.*—Glycerides. Chemistry of fats and oils. Analysis: Saponification number, Iodine number, Reichert-Miessl number. Waxes : paraffin wax, Japan Wax, carbowax, beeswax, carnuba wax, spermaceti. *Detergents.* Chemistry of Soap; Synthetic detergents; cleansing action of detergents.

12. *Polyfunctional Compounds.*—Hydroxy acids. Preparation, properties and reactions of important acids: lactic, B-hydroxypropionic, gamma-hydroxy-butyric; citric, tartaric, salicylic.

Optical Isomerism.—Difference between structural isomerism and optical isomerism. Optical activity and its basis. Van't Hoff's rule. Stereoisomerism of Tartaric acid. Resolution; significance.

13. *Carbohydrates.*—Monosaccharides. Standard configuration. Synthesis, properties of glucose, fructose, glycoside formation.

Polysaccharides.—Dissaccharides: sucrose, lactose, maltose, starch and cellulose.

14. *Organic Nitrogen Compounds.*—Preparation, properties and reactions of Nitro compounds, amines; diazocompounds. Study of Nitrobenzene, Aniline, Sulphanilic acid. Trinitro Toluene (TNT).

15. *Amino acids and Proteins.*—Essential (indispensable and dispensable) amino acids and their formula. Physical properties of aminoacids. Preparation and reactions. *Proteins*, their classification, molecular weights, physical properties, tests and uses.

16. *Dyes* and colour of medicinal use.

17. *Natural Products.*—General Properties and uses of terpenes, Camphor and Menthol; alpha pinene. Simple heterocyclic compounds; their nomenclature. Nicotinic acid. Purine compounds; uric acid and caffeine. Some characteristic tests for alkaloids; their uses, Enumeration, properties and uses of antibiotics, sulpha drugs; hormones, enzymes, vitamins.

SECTION C. (PHARMACEUTICAL ORGANIC CHEMISTRY)

18. Elementary study of such organic substances studied in section B as are official with special reference to their tests of purity and identity and standard. Also the study of the following compounds, salts of organic acids: Sulphonal and Trional; Hexamine, Chlorobutol, Glyceryl trinitrate. Ethyl nitrate, Spirit of Nitrous ether, amyl nitrite. Urethane, Acetanilide, Amphetamine, Phenacetin, Thymol, Adrenaline; Benzyl benzoate, Benzocaine, Procaine, Orthocaine, Amylocaine, Methyl salicylate. Acetyl salicylic acid, Mandelic acid, Salol acid, Tannic Acid.

PHARMACEUTICAL CHEMISTRY INCLUDING GENERAL ORGANIC CHEMISTRY
(PRACTICAL)

The candidate must be able to conduct simple chemical operations as applied to substances in frequent use in Pharmacy including the following:—

1. Identification and test of purity of pure official inorganic compounds.
2. Assay of important drugs using simple volumetric methods. Estimation of Sulphate and Magnesium by gravimetric methods.
3. The performance of limit tests for the presence of As, Pb., Cl. Fe, and SO_4.

4. Purification of solids and liquids, preparation of simple organic substances, ethyl acetate or benzoate, acetanilide, aspirin, iodoform; hydrolysis of ethyl benzoate or methyl salicylate; reactions of typical groups of compounds; tests for elements; identification of simple organic substances, performance of limit and purity tests of the above official compounds studied in theory.

5. Tests for alkaloids, proteins, carbohydrates, glucosides & tannins.

Note. 1. The candidate is required to bring for inspection to the practical examination his original laboratory journal duly signed by a member of the teaching staff and certified at the end of the year by the Head of the Department.

2. The candidate shall be permitted the use of any pharmacopoeia and practical text book in the practical examinations.

Books indicating the general scope of the syllabus

1. *Estok*: Organic Chemistry: A short text—Saunders & Co. W.B. Philadelphia.
2. *Mutheham*: Aids to Pharmaceutical Chemistry—Bailliere Tindall & Cox., W.C. 2. London.

REFERENCE BOOKS

1. Pharmacopoeia of India.
2. *Bentley and Driver*: Pharmaceutical Chemistry—Oxford University, London.
3. Roger's Inorganic Pharmaceutical Chemistry—Lea & Fabiger, Philadelphia.
4. *Schroff M.L.* : Pharmaceutical Chemistry. (Pt. II)—National Book Centre P-76, Dr. Sundari Mohan Avenue, Calcutta-700012.

PHARMACOGNOSY

(THEORY)

A. INTRODUCTION

(i) Meaning and scope of Pharmacognosy.
(ii) Brief history of its development as a field of study including different systems of classification in Pharmacognosy.
(iii) Relationship to allied fields of study.

B. SYSTEMATIC STUDY OF THE DRUGS INCLUDED IN THE PRIMARY LIST:

(i) Official titles, Indian and English synonyms, Biological origin.
(ii) Geographic sources.
(iii) Cultivation, Collection, Drying, Preparation for Market and Storage.
(iv) Macroscopic (Physical and Organoleptic) characters.
(v) Gross anatomical characters.
(vi) Commercial varieties, substitutes and adulterants.
(vii) Main constituents.

(viii) Chemical and microchemical tests.
(ix) Therapeutical and pharmaceutical use.

C. A BRIEF STUDY OF THE SECONDARY LIST WITH REFERENCE TO THE FOLLOWING:

(i) Official titles, Indian and English synonyms, Biological origin.
(ii) Active constituents.
(iii) Therapeutic and pharmaceutical use.

PRIMARY LIST

Organised natural products:

Wood—Quassia.
Barks—Cinchona & Cinnamon.
Leaves—Indian Senna, Digitalis.
Flower—Clove.
Seeds—Nuxvomica, Lsapgol.
Fruit—Fennel, Cardamom fruit.
Entire organism—Ergot, Ephedra, Belladonna herb.
Underground organs—Glycyrrhiza (Liquorice), Rauwolfia.

Unorganised natural products:

Dried Juices, Latex and Extracts—Aloe, Opium, Agar.
Carbohydrates, Gums—Starch, Acacia.
Resins, Gum-resins and Oleo-resins—Colophony, Asafoetida, Balsam of Tolu.
Fixed Oils and Waxes—Castor Oil, Shark Liver Oil, Bees Wax.
Fibres—Cotton.
Volatile Oils—Oil of Terpentine, Oil of Mentha.

SECONDARY LIST

Aconite
Alginate (Sodium)
Arjuna Ashoka
Bael
Benzoin
Belladonna Root
Cannabis
Capsicum
Caraway
Cascara Sagrada
Catechu (pale & black)
Colchicum Corm
Colchicum Seed
Colocynth
Datura Herb
Kaolin
Kurchi
Lemon Peel
Linseed
Male Fern
Myrrh
Nutmeg
Orange Peel
Podophyllum (Indian)
Pyrethrum
Rhubarb
Senega (Indian)
Senna Fruit (Indian)
Storax

Dill
Gelatin
Gentian
Ginger
Honey
Hyoscyamus
Ipomoea
Jalap
Kaladana
Strophanthus
Tamarind
Tragacanth
Urginea (Indian)
Valerian (Indian)
Vasaka
Wild Cherry bark
Yeast

PHARMACOGNOSY

(PRACTICAL)

1. Record the macroscopical and gross anatomical characters of a drug by studying transection, whether included in the syllabus or not.
2. Identify the drug in entire or broken condition listed in the Primary List.
3. Identify unorganised natural products of the Primary List by macroscopical characters and chemical tests.
4. Identify drugs mentioned in the Secondary List.
5. Chemical tests for mucilage, anthraquinone and cyanogenetic glycosides, saponins, alkaloids and tannins.

Note. No reference book shall be allowed during the practical eaxmination.

Book indicating the general scope of syllabus

Denston T.C.—A text book of Pharmacognosy—Sir Issac Pitman & Sons; London.

REFERENCE BOOKS

1. *Wallis T.E.*—A Text book of Pharmacognosy—J.A. Churchill & Co., 104, Gloucestor Place London, W.I.
2. *Trease G.E.*—A Text book of Pharmacognosy—Balliere Tindall & Cox. 7 Henrietta Street, London, W.C. 2.
3. *Youngken*—A Text book of Pharmacognosy.
4. *Wallis T.E.*—Practical Pharmacognosy—J.A. Churchill & Co., 104, Gloucestor Place, London W.I.

PHARMACOGNOSY
(THEORY)

1. Meaning growth and scope of Pharmacology. Relationship to Pharmacy. Nature and sources of drugs. Pharmacopoeia. Drug Standards, Assay of drugs. Dosage forms. Nomenclature of drugs.

2. Administration of drugs : Local, systematic and other effects, Methods available. Fate of drugs in the body. Excretion of drugs.

3. Dose of a drug and factors influencing dosage.

4. Drug Action : Nature of drug action. Explanation of terms employed in connection with drug action. Factors influencing drug action.

5. Water and Salts :—General Principles. Water, Osmotic Pressure and Salt action. Osmotic pressure of blood plasma. Diuretics, Plasma substitutes, Blood transfusion.

6. *Cation of the blood : Acids and Alkalies :*—Introduction, Sodium Potassium, Calcium, Ammonium, Magnesium, Acids, and Alkalites.

7. *Heavy Metals :* Local action of heavy metals. Copper, Zinc, Aluminium, Silver, Lead; Mercury, Iron. Metalloids : Bismuth, Antimony, Arsenic.

8. *Drugs acting on the Elementary System :*—Digestents, Carminatives, Adsorbents, Antacids, Emetics, Cathartics, Astringents, Chologogues.

9. *Drugs acting on the Central Nervous System :—*

9.1. *Stimulants :* Medullary, Cerebral and Spinal.

9.2.1. *Depressants :* Alcohol, General Anaesthetics, Premedication and Basal anaesthetics.

9.2.2. *Depressants :* Hypnotics, Sedatives, Anticonvulsants, Drugs used in Parkinsonism. Drugs used for motion sickness.

9.2.3. *Depressants :* Opium alkaloids, Synthetic morphine like compounds, Salicylates and related compounds. Derivatives of aniline. antipyretics of the phenacetin group.

9.3 *Psychotropic Agents* : Psychotomimetics. Tranquillisers.

10. *Drugs acting on Sensory Nerves* : Stimulants, counter-irritant or rubefacients, depressants, local anaesthetics.

11. *Drugs acting on the Autonomic Nervous System*:—

A. Autonomic Ganglia (Preganglionic, Nerves) *Stimultants :* Nicotine, Choline esters, *Depressants :* Ganglionic Blocking drugs.

B. Sympathetic Nervous System (Post Ganglionic) *Stimultants :* Adrenergic Agents : Adrenaline, Noradrenaline, Ephedrine, Amphetamine, Isoprenaline, *Depressants :* Adrenergic blocking agents.

C. Parasympathetic Nervous System (Post Ganglionic) *Stimulant:* Cholinergic Agents : Choline Esters, Anticholine esterases.

Depressants : Cholinergric Blocking agents.

12. *Drugs acting on Skeletal Muscle*:

A. Neuromuscular stimulants.

B. Neuromuscular blocking agents.

13. *Drugs acting directly on Involuntary Muscle*:—*Stimulants*: Ergot Pituitary, Histamine, etc. *Depressants* : Nitrites, Nitric esters, Papaverine.

14. *Drugs acting on the Cardiovascular System*:— Digitalis group: Quinidine, Antihypertensive Agents.

15. *Drugs acting on the Respiratory System*:— *Stimulants* of the respiratory centre. Drugs acting on the cough centre. Drugs acting on the bronchial secretion. Drugs acting on bronchial muscle. Therapeutic and other gases.

16. Drugs which influence Metabolism, Blood. (Iodides, Colchicum, Coagulation of Blood).

17. *Hormones & Vitamins* :—Thyroid gland and antithyroid drugs, Parathyroid gland, the pancreas : Insulin and Oral antidiabetics. Adrenal Cortex. Pituitary gland (Anterior Lobe) Female sex hormones, Male sex hormones : Testosterone, Vitamins A, B Group.

18. Phenol and allied aromatic compounds : Phenol chlorocresol, Hexachlorophenol, Resorcinol, & Volatile Oils, Stearoptenes.

19. *Drugs used in Bacterial Infections*: Local anti-infectives, Alcohols, Phenols,Heavymetals, Chlorine, Chloramine, Iodine, Dyes, Oxidizing agents, Detergents, Fungistatic drugs.

20. *Antitoxins, Vaccines, and Toxins*:

A. Passive Immunization: Antitoxins.

B. Active Immunization: Vaccines, Toxins and Toxoids, Anaphylaxis.

21. *Chemotherapy*:—General considerations and Drug tolerance acquired by micro-organisms.

22. *Drugs used in Bacterial Infections*:—Systemic anti-infectives: Sulphonamide, Sulphones. Penicillins. Tuberculostatic drugs.

Chloramphenicol, Tetracyclines. Miscellaneous agents.

23. *Drugs used in Protozoal infections*:—Leishmaniasis, Malaria, Amoebic dysentry.

24. *Drugs used as Anthelmintics and Insecticides*:—Anthelmintic: Tapeworm, Round worm, Thread worm, Hook worms, Filaria.

Insecticides and insect repellants: Scabies, Pediculosis, Insect-repellants, Insecticides.

25. Aids to diagnosis and direct observations.

26. Antagonisms and antidotisms: Histamine and antihistaminics.

DEMONSTRATIONS (Only suggestions)

A. *ANIMAL EXPERIMENTS*:

27. Osmosis:—Through frog's skin. Intestinal Loops.

28. *Peristalsis*:—
(a) On frog.
(b) On earthworm
(c) Isolated intenstine of rabbits.

29. Emesis:—
On pigeon (Digitalis emesis in pigeon) .
On dog.

30. Anthelmintics on earthworm.

31. Effect of drugs on Heart.
On frog's heart—Drop method and Perfusion method.
Digitalis assay by frog's heart-Systolic Standstill.

32. C.N.S. Depressants.
Chloral narcosis on frog.
Volatile anaesthetics on frog.
Morphine on frog.
Mag. Sulph. narcosis on frog.

33. Convulsants and anticonvulsants on frog.

34. Determination of the value of local anaesthetics. Surface anaesthesia—frog's foot.
Rabbit's conjunctiva.
Nerve Block—Sciatic nerve of frog.

35. Mydriatics and Miotics on rabbit's eye or frog's eye. Fluorescein Sodium on rabbit's eye.

36. Anaphylactic shock in guineapig —(with Horse Serum or Egg White) and effect of Antihistaminics.

37. Effect of Neuromuscular agents on Frog's Rectus or other preparation.

38. Chlorpromazine: Taming effect on animals.

B. *HUMAN EXPERIMENTS* :

39. Absorption and Excretion of drugs taken orally-Test the urine and Saliva afer administration of suitable drugs—salicylates, Pyridium, Pot. Iodide.

40. Counter irritants and Emollients—Mustard plaster and fixed oils.

41. Local anaesthetics—On Cornea or Skin.

42. Effects of Amylnitrite, Nitroglycerin (Tab.) on Blood pressure.

43. Effects of different Purgatives.

44. Effects of oral diuretic agents.

Books indicating the general scope of syllabus.

Hopkins—Drugs and Pharmacology for Nurses—E. & S. Livingstone Edinburgh, London.

REFERENCE BOOKS

1. *Gaddum J.H.*—Pharmacology—Oxford University Press, London.
2. *Birendra Nath Ghosh*—Pharmacology—Materia Medica and Therapeutics—Hilton and Co., Calcutta-700001.
3. *Lavis*—Introduction to Pharmacology—E. & S. Livingston Ltd., Edinbugh, Lodon.

APPENDIX B

(Regulation 7)

CONDITIONS TO BE FULFILLED BY THE ACADEMIC TRAINING INSTITUTION

Any authority in India applying to the Pharmacy Council of India for approval of courses of study for pharmacists under sub-section (1) of section 12 of the Pharmacy Act, 1948, shall provide:

A. ACCOMMODATION: (With adequate ventilation, lighting and other hygienic conditions)

GENERAL	FLOOR AREA
1. Head of the Department's Room, Staff Room and Office. (together or in different rooms)	1. Adequate
2. Library & Reading Room and Museum (together or in different rooms).	2. Six square feet per person consisting of the total number of students and members of the teaching staff, subject to a minimum of six hundred sq. ft.
3. Store Room.	3. Adequate
4. Students Common Room.	4. Three square feet per student consisting of the total number of students in the Institute, subject to a minimum of four hundred square feet.
5. Class Room.	5. Ten square feet per student, subject to a minimum of four hundred square feet. If the time-table shows that more than one class has to be conducted simultaneously, one room of four hundred square feet for each class should be provided. The area should be proportionately increased if more than forty students attend a class.

LABORATORIES:

For the maximum efficiency, laboratory of each subject should be separate. When this is not possible, at least four separate laboratories are recommended:

1. Chemistry
2. Physics and Biology
3. General Pharmacy
4. Dispensing

Of these, for an institution running the full two-year course, at least three separate laboratories are mandatory.

For an institution running only the second-year course, at least two laboratories are mandatory.

Certain flexibility in the use of the same laboratory should be permissible for more than one subject but a laboratory assigned to Dispensing, should preferably be not used for any other subject. In any event, Dispensing laboratory must not be used for any subject other than—

(a) Quantitative and Physical Chemistry experiments

(b) Pharmacognosy

(c) Pharmacology demonstrations.

Floor area of a laboratory should be calculated on the basis of 25 sq. ft. per student required to work in the laboratory at any given time, subject to a minimum of 500 sq. ft.

The laboratories will be fitted with the benches so that each student required to work at any given time has at least six square feet of clear bench space. Gas and water fittings, shelves, fume cupboards should be provided wherever necessary.

The Dispensing laboratory must be so fitted up and constructed that it can be kept reasonably clean. The table tops in particular must be fitted up with hard surface material free from cracks, so that it can be kept scrupulously clean.

STAFF

In Science Colleges except for the General Pharmacy and Dispensing laboratories, all other laboratories and rooms may be shared with other departments if available and adequate.

The Principal shall not be engaged in teaching for more than three hours a day, so that he is left with adequate time for administrative work.

The teaching staff may be employed on a full-time or a part-time basis.

No teacher will have teaching duties of more than six hours a day as also more than twenty-four hours a week.

No teacher will take more than two theory classes a day.

Demonstrators will not be allowed to take theory classes.

One teacher may take up more than one subject provided he has the basic qualifications required.

Staff/Student ratio in a theory class should not exceed 1: 80. If this happens the class will be split into sections approximately equal in number.

Staff/Student ratio in a practical class will be 1:20. A practical class will always be conducted by a Lecturer and when required assisted by adequate number of Demonstrators.

A statement showing the minimum qualifications of Head of the Department or Institution and teachers is given on next page.

B. STAFF (*Coutinued*)

Head of the Department or the Institution. Basic Pharmaceutical degree with post graduate qualification.

Subject	Minimum qualifications of Teachers in order of preference:		
	I	II	III
1. General Chemistry	M. Pharm. (Pharm Chemistry)	M. Pharm.	M.Sc (Chemistry).
2. Physics	M.Sc.(Physics)	B.Sc.(Physics, Hons).	B.Sc. (Physics) with two years teaching experience in Physics.
3. Biology	M.Sc.(Botany or Zoology)	M. Pharm. (Pharmacognosy)	B. Pharm. or B.Sc. with Botany or Zoology.
4. English	M.A. (English)	B.A. with five years teaching experience in English.	—
5. Anatomy, Physiology & Health Education	M.B.B.S. with two years teaching experience in Physiology	M. Pharm. (Pharmacology) with teaching experience of three years in Physiology.	M. Pharm. (Pharmacology) or M.B.B.S.
6. General Pharmacy	M. Pharm. (Pharmaceutics)	M. Pharm, with teaching experience of one year in General Pharmacy.	B. Pharm. with teaching experience of two years in General Pharmacy.
7. Dispensing Pharmacy	M. Pharm. (Pharmaceutics)	M. Pharm. with teaching experience of one year in Dispensing.	B. Pharm. with teaching experience of two years in Dispensing.

Subject	Minimum qualifications of Teachers in order of preference:		
	I	II	III
8. Forensic Pharmacy, Pharmaceutics Economical & Ethics	M. Pharm. (Pharmaceutics) with two years experience in the enforcement of the Drugs Act etc. or two years experience in teaching of the Forensic Pharmacy.	B. Pharm., LL.B.	B. Pharm. with experience of two years in the enforcement of Drugs Act, etc. or two years experience in teaching of the Forensic Pharmacy.
9. Pharm. Chemistry	M.Pharm.(Pharm.Chemistry)	M. Pharm with two years teaching experience in Pharmaceutical Chemistry.	B. Pharm. or M.Sc, with three years teaching experience in Pharm. Chemistry.
10. Pharmacognosy	M. Pharm.(Pharmacognosy)	B. Pharm. with three years teaching experience.	B. Pharm.
11. Pharmacology	M. Pharm. (Pharmacology) with two years teaching experience in Pharmacology or M.B.B.S., with two years teaching experience in Pharmacology.	M. Pharm. (Pharmacology) with one year teaching experience or M.B.B.S. with one year teaching experience in Pharmacology.	M. Pharm. with two years teaching experience in Pharmacology.

C. EQUIPMENT:

(i) The following equipment in adequate number and quantity in addition to general apparatus and chemicals and other laboratory outfits and equipments generally needed for the teaching of Physics, Chemistry and Biology to Inter Science students should also be provided:

LIST A

Items	*Nos. required*
Conical Copper Percolator (large)	1 for the institution.
Conical Copper Percolator (Small)	1 for the institution.
Tincture Press (Small)	1 for the institution.
Hand Grinding Mill	1 for the institution.
Small Centrifuge	1 for the institution.
Tablet Machine	1 for the institution.
Tablet Coating Pan (Small)	1 for the institution.
Tablet Hardness Tester (Monsanto Type)	1 for the institution.
Disintegration Testing Apparatus	1 for the institution.
Collapsible Tube Filling equipment	1 for the institution.
Capsule filling equipment	1 for the institution.
Platform Balance	1 for the institution.
Seitz Filter	1 for the institution.
Bacteria-proof Filter-Candle	1 for each ten students*
Bacteria-proof Sintered Glass Filter	1 for each two students.
Refrigerator	1 for the institution.
Incubator	1 for the institution.
Autoclave	1 for each twenty students.
Emulsifier (whisk type)	1 for the institution.
Homogenizer	1 for the institution.
Sieves of different numbers	4 sets for the institution.
Granulating Sieves	4 sets for the institution.
Glass Percolators	1 for each student.
Dispensing Scale	1 for each student.
Ointment Slab and Spatula	1 for each student.
Ampoule filling and sealing device	1 set for the institution.
Dispensing Mortar and Pestle (Large)	1 for each student.
Dispensing Mortar and Pestle (Small)	1 for each student.
Suppository Moulds	1 for two students.
Pill-Making Tiles	1 for two students.
Pastilles Moulds	1 for two students.
Lozenge Punches	1 for two students.
Tablet Triturate Mould	1 for four students.
Pill-Making equipment consisting of mass divider, rounding, polishing and coating devices.	1 set for two students.

LIST B

Not required separately if classes are conducted in a Science College and the equipments are available for the training of students of Pharmacy:

Items	*Nos. required*
Chemical Balance	1 for two students.
Dissecting Microscope	1 for two students.

Student's Compound Microscope	..	1 for two students.
Bacteriological Microscope	..	1 for the institution.
Biological Charts and Models	..	To cover the entire syllabus.
Bacteriological Charts & Slides	..	Showing different forms of micro-organisms.
Recording Drum Equipment for Pharmacological demonstrations	..	1 for the institution.

*In the above lists A & B, wherever the word 'student' appears the numbers of such students should be regarded as the number required to work

(ii) *Museum*

Every institution shall maintain a museum of crude drugs, herbarium sheets, botanical specimens of the drugs and plants mentioned in the course. In addition, the following are recommended:

1. Coloured slides of medicinal plants;
2. Display of popular patent medicines; and
3. Containers in common usage in medicines.

(iii) *Library*

Every institution shall maintain a library which should contain books mentioned in the syllabus as also the current pharmaceutical journals. There should be adequate place in the library for students and staff to refer to books.

APPENDIX C

(Regulation 12)

CONDITIONS TO BE FULFILLED BY THE EXAMINING AUTHORITY

1. The Examining Authority shall be either a statutory Indian University or a body constituted by the Central or State Government. It shall ensure that discipline and decorum of the examinations are strictly observed at the examination centres.

2. It shall permit the Inspector or Inspectors of the Pharmacy Council of India to visit and inspect the examinations.

3. It shall provide:

(a) adequate rooms with necessary furniture for holding written examinations;

(b) Well-equipped laboratories for holding practical examinations;

(c) an adequate number of qualified and responsible examiners and staff to conduct and invigilate the examinations; and

(d) such other facilities as may be necessary for efficient and proper conduct of examinations.

4. It shall, if so required by a candidate, furnish the statement of marks secured by a candidate in the examinations after payment of prescribed fee, if any, to the examining authority.

5. It shall appoint examiners whose qualifications should be similar to those of the teachers in the respective subjects as shown in Appendix B.

6. In pursuance of sub-section (3) of section 12 of the Pharmacy Act, 1948 the Examining Authority shall communicate to the Secretary, Pharmacy Council of India not less than six weeks in advance the dates fixed for examinations, the time-table for such examination, so as to enable the Council to arrange for inspection of the examinations.

APPENDIX D

[Regulation 14(2)]

CONDITIONS TO BE FULFILLED BY THE INSTITUTION TO BE RECOGNISED FOR GIVING PRACTICAL TRAINING

1. The Institution, where practical training is given to student pharmacists, shall from time to time, if required, furnish such information as may be needed by the Pharmacy Council of India about the staff, accommodation and equipment of the institution concerned and its working.

2. The Institution shall permit the Inspectors of the Pharmacy Council of India to inspect the premises at any reasonable time while the work is proceeding therein.

3. The Institution shall entrust some member or members of its staff, who shall be registered pharmacist, to look after the student pharmacists. Such members of the staff shall be responsible in this behalf to the Head of the Institution concerned.

4. The Institution shall provide such opportunity, accommodation, apparatus, materials and books of reference as may be required to enable the student pharmacists to undergo the practical training properly.

5. The number of student pharmacists that may be taken in any pharmacy or dispensary shall not exceed two where there is one registered pharmacist engaged in the work in which the student pharmacist is undergoing practical training; where there is more than one registered pharmacits similarly engaged, the number shall not exceed one for additional such registered pharmacist.

6. The Institution wishing to be recognised under Regulation 14 of these Regulations, shall apply in writing to the Secretary, Pharmacy Council of India stating its desire, to be so recognised.

7. Having satisfied that the institution shall follow the conditions laid down in these rules, the Pharmacy Council of India shall grant such recognition.

8. In the event of any question arising as to the interpretation or observance of these conditions the decision of the Pharmacy Council of India shall be final.

APPENDIX E

[Regulation 15(1)]

PRACTICAL TRAINING CONTRACT FORM FOR PHARMACISTS

SECTION I

This form has been issued to _____
(*name of the student pharmacist*)

son of/daughter of _____

residing at _____ who has produced evidence before me that he/she is entitled to receive the Practical Training as set out in the Education Regulations under section 10 of the Pharmacy Act, 1948.

Date: The Head of the Academic Training Institution

SECTION II

I, _____, accept _____
(*name of the student pharmacist*) (*name of the Apprentice Master*)

of _____ as my
(*name of institution, hospital or pharmacy*)

Apprentice Master for the above training and agree to obey and respect him/her during the entire period of my training.

Date:

_____
(Student Pharmacist)

SECTION III

I, _____, accept _____
(*name of the Apprentice Master*) (*name of the student pharmacist*)

as a trainee and I agree to give him/her training facilities in my organisation so that during his/her training he/she may acquire:—

1. Working knowledge of the keeping of records required by the various Acts affecting the profession of pharmacy; and
2. Practical experience in—

(a) the manipulation of pharmaceutical apparatus in common use;

(b) the recognition, by sensory characters, of chief crude drugs and chemical substances used in medicine;

(c) the reading, translation and copying of prescriptions including the checking of doses;

(d) the dispensing of prescriptions illustrating the commoner methods of administering medicaments; and

(e) the storage of drugs and medicinal preparations.

I also agree that a Registered Pharmacist shall be assigned for his/her guidance.

Date:

(Head of the Organisation or Pharmaceutical Division)
(Name and address of the Institution)

SECTION IV

I certify that ———————————————— has
(*name of the student pharmacist*)

undergone———————hours training spread over————————months in accordance with the details enumerated in SECTION III.

Date: (Head of the Organisation or Pharmaceutical Division)

SECTION V

I certify that ———————————————— has completed in all respect his practical training under Regulation 14 of the Education Regulations framed under section 10 of the Pharmacy Act, 1948. He had his practical training in an Institution approved by the Pharmacy Council of India.

Date: (Head of the Academic Institution)

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