

# Curriculum in clinical pharmacology for medical undergraduates of India

**B. Gitanjali, C.H. Shashindran\***

Department of Pharmacology, JIPMER, Puducherry-605 006.

\*Department of Clinical Pharmacology, Pondicherry Institute of Medical Sciences,  
Puducherry-605 014. India.  
E-mail: gitanjali@jipmer.edu

## **Background**

The WHO sponsored survey on teaching clinical pharmacology in medical colleges in India, conducted by Dr. Hardayal Singh had shown that there is no standard, consistent, planned teaching programme in the subject in medical colleges throughout India. It has been shown that there is a need to introduce clinical pharmacology at the undergraduate level in order to improve rational prescribing of medicines. This life-long skill needs to be inculcated at the beginning of clinical training, nurtured during internship and residency and sharpened during later years. The ICMR has held several brainstorming meetings with experts and has shown its interest in promoting this activity. The WHO also sponsored workshops in Belgaum and Nagpur and at the annual conference of the Indian Pharmacological Society in Chennai last year to sensitize teachers in various medical colleges on different aspects of clinical pharmacology.

The graduate medical curriculum 1997<sup>[1]</sup> has been revised in 2002 and is to be revised yet again in 2007. This provides the pharmacologists in India to use this window of opportunity to introduce a revised curriculum in clinical pharmacology which is need based and will teach students the essential skill of rational use of medicines. The Indian Pharmacological Society prepared a draft curriculum, received comments using the modified Delphi technique and after numerous revisions to the initial draft has now come out with the final version. This version carries the comments, ideas, thoughts and experiences of more than a thousand pharmacologists. We can indeed feel proud to be a part of this fraternity if the MCI chooses to adopt this curriculum and incorporates it into the revised curriculum of 2007.

**1. Period of training:** 3rd, 4th and 5th semester

**2. Duration of training:** Approximately one and a half years

**3. Eligibility:** Must have cleared Phase I (anatomy, physiology, biochemistry)

**4. Introduction:** Clinical pharmacology and therapeutics encompasses all aspects of use of medicines in therapy ranging from basic mechanisms to practical prescribing. This curriculum envisages undergraduate medical students will be able to plan, select, communicate and effectively guide patients throughout their illness to optimally use medicines and other devices. The focus will be on commonly encountered clinical

conditions and medicines used in the national health programmes. The curriculum described permits teachers to orient their teaching towards emphasizing the clinical application of pharmacology.

**5. Goal:** The broad goal of teaching undergraduates clinical pharmacology is to impart the knowledge skills and attitudes that a student should learn in order to prescribe drugs safely and effectively and to maintain this competence throughout his/her professional life.

## **6. Objectives:**

### *(a) Knowledge and intellectual skills*

The learner, after completing the course in clinical pharmacology, should be able to:

1. (a) Select and prescribe drug(s) based on suitability, tolerability, efficacy and price according to the need of the patient for prevention, diagnosis and treatment of common ailments.  
(b) Choose the most appropriate dosage form for the clinical condition.
2. Prescribe rationally, in a legible manner, using appropriate format and terms, medicines for common ailments and all National Health programmes.
3. Use antimicrobials prudently for therapy and prophylaxis.
4. Foresee, prevent and manage adverse drug events and drug interactions.
5. Prescribe drugs for the control of fertility and be aware of the effects of drugs on the foetus.
6. Describe the clinical presentation, pharmacokinetic basis, diagnosis and management of common poisonings, bites and stings.
7. List the general principles of drug action and handling of drugs by the body in normal individuals, in children and elderly, during pregnancy and lactation and other disease states such as renal and hepatic disease.
8. Apply pharmacokinetic principles in clinical practice pertaining to the drugs used in commonly encountered clinical conditions and essential medicines.
9. Calculate the drug dosage using appropriate formulae for an individual patient.
10. Analyse critically, drug promotional literature for proprietary preparations, in terms of the (a) pharmacological actions of their ingredients (b) claims of pharmaceutical companies (c) economics of use (d) rational or irrational nature of fixed dose drug combinations.

11. Retrieve drug information from appropriate sources.
12. Practise, based on the best available evidence.
13. Critically assess methodology of clinical trials with respect to ethical aspects, trial design, statistical analysis and interpretation.

*(b) Psychomotor skills:*

The learner, after completing the course in clinical pharmacology, should be able to:

1. Recognize and report adverse drug reactions to suitable authorities.
2. Load the required dose of medicines accurately in hypodermic syringes, inject medicines by the intradermal, subcutaneous, intramuscular and intravenous routes using aseptic techniques.
3. Set-up an intravenous drip and adjust the drip rate according to required dosage.

*(c) Attitudes and communication skills:*

The learner, after completing the course in clinical pharmacology, should:

1. Appreciate the essential drugs concept and translate it in terms of drug needs for a given community and health care setting.
2. Communicate to patients regarding the optimal use of medicines, devices and other formulations and how to store medicines.
3. Be aware of the drug treatment guidelines laid down for diseases covered under the National Health Programmes and be capable of initiating, monitoring treatment, recording progress, and assessing outcomes.
4. Exercise caution in prescribing drugs likely to produce dependence and recommend the line of management.
5. Be aware of the legal aspects of prescribing drugs.
6. Be able to evaluate the ethics, scientific procedures and social implications involved in the development and introduction of new drugs.
7. Motivate patients with chronic diseases to adhere to the line of management outlined by the health care provider.
8. Appreciate the relationship between cost of drugs and patient compliance and consider patients' economic status while prescribing drugs.
9. Take care to write prescriptions legibly, using proper format, in order to prevent dispensing errors.
10. Be aware of the hierarchy of evidence and be able to discriminate between the different levels.
11. Avoid polypharmacy wherever appropriate.
12. Update his/her knowledge regularly in order to keep abreast of recent advances and changing scenario of health in the community.

**7. Teaching–Learning (T-L) Methods:** The following objectives will be covered using theory lectures, small group discussions, clinical case scenarios and any other teaching learning method which the teacher chooses to select. An overlap between theory and practical classes will serve to reinforce and complement the two. Points not covered in theory can be covered during practical classes.

**Integration:** During the 8th and 9th semesters, modular teaching can be conducted wherein, various departments will come together over a period of a few afternoons and discuss common clinical problems such as anemia, diarrhea, malaria and so on. The focus will be on therapeutics.

**Time available for teaching:** 300 hours

**Break-up of topics:**

T-L Method	Topic	Time (hours)
<b>1. Theory</b>		
a. Lectures	Clinical Pharmacology – core concepts	16
	General Pharmacology principles as applicable to individual system drugs*	6
	ANS	14
	CVS	15
	Blood and Autacoids	11
	GIT	6
	CNS	25
	Chemotherapy	30
	Endocrines	13
	Skin, eye, ear	1
	Antiseptics and Disinfectants	1
	Chelating agents	1
	Vaccines and Immunoglobulins	1
	Vitamins and Miscellaneous	1
	Respiratory system	3
	<b>Total</b>	<b>144</b>
<b>b. Other T-L methods</b>		
	Computer Assisted Learning (CAL)	8
	Tutorials	26
	Revision	7
	<b>Total</b>	<b>41</b>
<b>2. Practical</b>	Clinical Pharmacology	<b>75</b>
<b>3. Tests</b>		<b>40</b>
	<b>Total</b>	<b>300</b>

\*These lectures may be taken with any system – either before or after. It also serves as a buffer, so that if any extra lectures are required for any system these can be utilized.

Theory classes 144 hours  
 Practical classes 75 hours  
 Time spent for conducting tests 8 X 5 = 40  
 (8 hours for each test)

*(Theory test - 2 h, Practicals - 5 h, Discussing answers and feedback - 1 h)*

Total number of lectures in clinical pharmacology (core concepts) 16 out of the 144 lectures. 128 lectures will be taken for all other systems.

41 hours will be used for tutorials, CAL, revision classes. Individual departments are free to increase the number of hours spent for tutorials and decrease the number of lecture classes for the various systems.

8 hours to be spent in CAL – which is used to teach students to search for information, reinforce concepts learnt in theory, recording data and drawing conclusions from data generated (using computer simulated animal experiments). Simulated Patient Management Programmes on key aspects of therapy can also be used. Time should be given outside of the curricular hours for students to use computers for self study.

Theory classes: Approximately 16 lectures will be devoted to core components of clinical pharmacology. Each lecture to be one hour duration. Encouragement to be given for self learning.

### Topics of lectures in clinical pharmacology

Title of lecture	Number of hours
Introduction, definition, history and scope and relevance of clinical pharmacology	1
Pharmacokinetics – Absorption, Distribution, Metabolism, Excretion	4
Pharmacodynamics - How drugs act, efficacy, potency and factors modifying drug action	2
Routes of administration of drugs	1
Bioavailability, bioequivalence, therapeutic index, calculation of basic pharmacokinetic parameters and its relevance to therapeutics	1
Adverse drug reactions, Pharmacovigilance	1
Factors modifying drug dosage	1
Factors affecting rational drug use	1
Clinical trials and New drug discovery	1
Therapeutic drug monitoring and Adherence	1
Essential drugs and fixed dose drug combinations, Pharmacoeconomics	1
Pharmacoepidemiology, Drug Regulation and Drug Acts, Legal aspects, Inventory Control	1
<b>Total</b>	<b>16</b>

### Practical classes in clinical pharmacology

S.No.	Title of practical class	Number of classes (each-2½ hours)
1.	Dosage forms: Oral, Parenteral, Topical and Others	3
2.	Routes of drug administration	1
3.	Calculation of drug dosage, setting up an	

intravenous drip	1
4. Sources of drug information – how to retrieve information	1
5. ADR monitoring	1
6. Therapeutic drug monitoring	1
7. Treatment of common poisons, animal bites, stings	1
8. Critical appraisal of drug promotional literature	1
9. Clinical trials	1
10. Communicating to patients on the proper use of medication	2
11. Selection of P drug	2
12. Prescription writing, prescription auditing and standard treatment protocols	2
13. Essential drugs list	1
14. Use of drugs in pregnancy, lactation children and elderly	1
15. Use of drugs in liver disease and renal disease	1
16. Ethics in clinical trials, therapy	1
17. Preparation of test dose for penicillin solution and use of oral rehydration solution	1
18. Critical appraisal of fixed dose drug combinations	1
19. General principles of antimicrobial use	1
20. Basic statistical principles used in clinical trials	1
<b>Total number of practical classes</b>	<b>25</b>

Total time spent in practicals **75 hours**

#### Note:

- All dispensing pharmacy practicals, such as preparations of ointments, emulsions, mixtures etc., will be deleted.
- No demonstrations of the method of preparing mixtures, ointments, pastes etc., will be performed.
- All animal experimentations using live animals/tissues will be deleted, instead five experiments using CAL will be done by students
- Practical classes can be in the form of small group discussion, problem solving exercises, debates, role-play and other T-L methods best suited to achieving the objectives.

#### 8. Evaluation:

##### Examination regulations

**8.1. Attendance:** 75% attendance is compulsory, provided 80% in practicals and non-lecture teaching. Condonation on health grounds alone is valid upto 70% wherein student submits a leave letter during the illness.

##### 8.2. Internal assessment:

(a) Number of notified tests - There will be five tests (including the send up examination) conducted during the course of three semesters. For calculation of internal assessment, the average marks obtained by the student in four out of five tests will be considered. Lowest total score (aggregate of theory, practicals and orals) will be ignored for the purpose of computation of internal assessment. Due to administrative problems such as delayed admissions, departments may conduct a lesser number of tests. However the minimum number is three.

Each test will have a theory, practical and oral component.

Theory	: 80 marks
Orals	: 20 marks
Practicals	: 100 marks
Total	: 200 marks

Theory: The theory paper for at least three out of the five tests will be conducted as MCQ. Each MCQ test should have at least 80 items in order to ensure reproducibility of results. There should be at least three different types of MCQs in each paper. Other test(s) will have short answer or short essay type questions.

Practicals: Practicals will have an Objective Structured Practical Examination (OSPE) component in addition to the seat viva.

80 marks will be for the practicals conducted, and 20 for the record and the daily evaluation during practical classes, tutorials, CAL exercises and workup of bedside case. The break-up of these 20 marks will be left to individual departments. However, the marks for record should not exceed 10 out of the twenty. Record marks will be based on regular submission of practical work done and daily evaluation at the practical class.

Orals: Oral examination will be structured to cover all the portions covered during the period and test the student on applications, problem solving, rather than recall only.

The marks obtained as internal assessment (200 per test for three/four tests) will be consolidated at the end of the last semester (fifth semester) and internal assessment calculated out of 60 with the following break-up.

Internal assessment:

Theory	: 24
Practicals including record	: 24
Orals	: 12
Total	: 60

(b) Weightage of internal assessment is 20% of the total marks.

(c) Student must secure 50% of the total marks fixed for internal assessment in order to be eligible to appear in the final university examination and must obtain 50% in aggregate, with a minimum of 50% in theory and 50% in practicals.

(d) Internal assessment shall be transparent, uniform, objectively assessed, recorded and feed-back given to students within two weeks of completing the test.

(e) Even though it is desirable to fix the pass percentage for MCQ at a higher level than for tests with SAQ and essay type questions, this is not being done due to the difficulty departments may have in computing and fixing the pass/fail. Hence the pass minimum is kept as 50%.

### 8.3. University Examinations

Marks break-up for university examination:

Theory	160
Practicals	40
Orals	40
Internal assessment	60
<b>Total</b>	<b>300</b>

#### (i) Theory

There will be two papers, each of two hours duration. Each paper will have two sections of one hour duration.

Paper 1	Section 1	Max. marks	40
Paper 1	Section 2	Max. marks	40
Paper 2	Section 1	Max. marks	40
Paper 2	Section 2	Max. marks	40
<b>Total theory marks</b>			<b>160</b>

#### (ii) Practicals

S.No	Item	Max. marks
1.	Prescription writing	5 marks
2.	Comment, correct & rewrite a given prescription for a case scenario	10 marks
3.	An exercise based on any one of the practicals conducted, for e.g. Filling up an ADR report, Critique of drug promotional literature, Comment on an irrational fixed dose drug combination	5 marks
4.	Demonstration of skill – setting up an IV drip, injecting IV into a model, loading a syringe, preparation of penicillin test dose, injecting intramuscularly	10 marks
5.	Communication skills – communicating with a patient regarding the use of a medicine / device	10 marks
<b>Total marks for practicals</b>		<b>40 marks</b>

#### (iii) Orals

Viva voce (oral) examination 40 marks

Each of the four examiners (two internal and two external), will examine a student separately, on different sections for a maximum of 10 marks. Each student will be examined for a minimum of ten minutes by each examiner.

**(iv) Internal assessment marks - 60** (as explained above)

#### (v) Pass

Student must secure 50% in theory and 50% in practicals separately in the university examination to be declared as having passed the examination in addition to 50% of the total aggregate.

### 9. Suggested reading

Departments may decide and suggest the names of textbooks to be used by students.

Suggested Reference books:

1. Goodman and Gilman's The Pharmacological Basis of Therapeutics, Mc-Graw Hill, New York, USA, 11th Edition, 2005
2. Avery's Drug Treatment: Principles and Practice of Clinical Pharmacology and Therapeutics, ADIS International Ltd; Auckland, 4th edition, 1997

3. Oxford Textbook of Clinical Pharmacology and Drug Therapy, Oxford University Press, USA, 3rd Edition, 2003.
4. WHO Model Formulary, World Health Organization, 2004
5. Guide to good prescribing, World Health Organization, Geneva, 1994
6. British National Formulary, BMJ Publishing Group and RPS Publishing, U.K., 2006

### **MINIMUM STANDARD REQUIREMENTS FOR THE DEPARTMENT OF PHARMACOLOGY**

(Based on the "Minimum requirements for 150 MBBS admissions annually regulations 1999")<sup>[2]</sup>

#### **Schedule I – Accommodation in the medical college**

##### **A.1.5. Lecture theatres:**

Each lecture theatre should have an LCD projector and a computer. Large white screens, document camera, cordless microphones (at least two), amplifiers and speakers. Chalk board, white board and magnetic board.

Accommodation for Dept. of Pharmacology

(A) Lecture theatre – As per A1.5 given above

(B) Demonstration room – There shall be adequate number of demonstration rooms, each room to be of 40 sq. metre area, to accommodate 25 students at a given time for small group teaching. There should be sufficient rooms to conduct small group teaching for the whole batch.

Each demonstration room will be equipped with the following:

1. Tables – eight tables 3'X2' size
2. Chairs – 35 chairs
3. Cabinet to keep the PC and LCD projector
4. Cupboards to keep the A-V equipment
5. LCD projector
6. Computer with standard accessories
7. Document camera
8. OHP
9. White screen – for projection
10. Chalk board
11. Cordless microphones, amplifiers and speakers
12. Laser pointer
13. White board
14. Magnetic board

(C) Practical laboratories – Not needed – **to be deleted**

(The present undergraduate curriculum does not include any experimentation. Hence there is no need for any of the laboratories. The space may be utilized for the demonstration rooms by making partitions and sound proofing the rooms within).

(D) Museum - Not needed – **to be deleted**

(The reasons for deleting the museum is that all images of plants, formulations, dosage forms are available on the internet. Hence a museum serves no purpose to a student at

this point of time and in the years to come. A virtual museum can be assembled by those interested in teaching students some of the examples from the past. However this should be left to individual departments)

(E) Departmental library – Departmental library cum seminar room (30 sq. metre area) with latest editions of books pertaining to the subject. At least 80-100 books, not more than two copies of each book to be counted towards computation of the total number of books. In addition, there should be at least three computers with internet connection and printers. One photocopier and one scanner for the use of the department.

(F) Research: One research laboratory (60 sq. metre area) for research purposes supporting research in any two or three areas in which the faculty want to work in and to provide an opportunity for UG students to cultivate interest in research. All latest equipment to support research should be provided along with disposables and consumables.

(G) Accommodation for staff – No change

(H) Computer Assisted Learning (CAL) lab – **To be included**

The CAL lab should be 100 sq. metres in size (minimum) It must have 30 computers with standard configuration and connected to internet.

There should be an LCD projector and screen for demonstration.

Each computer should be so placed to have enough space for three people to sit in front of the screen.

Each computer should be placed at a distance of not less than 6' from each other.

The lab should be airconditioned.

High speed internet (broad band) access should be given freely to all students.

CAL programmes and other software for teaching pharmacology should be loaded into the computers.

This laboratory should give students access to the National Essential Drug Lists, Standard Treatment Protocols (STP), Banned Drugs List of the CDSCO, Price Controlled Drugs List, Antibiotic Guidelines, Hospital formulary and other learner resource material which the student can use for self-study. The lab can also be used by all hospital faculty for searching for drug information. This lab can be shared by other departments for teaching.

#### **Schedule II – Staff requirements**

Staff strength to remain same.

The post of pharmaceutical chemist is redundant in view of the proposed curriculum. This post may be converted to lecturer in pharmacology.

The office staff and technicians should have a basic knowledge of computers.

#### **Schedule III – Equipment**

**List of items required (for 100 admissions) – to be included**

#### **a. Furnitures and fixtures for the demonstration rooms**

Each demonstration room to be equipped with the following:

1. Tables – eight tables 3'X2' size
2. Chairs – 35 chairs
3. Cabinet to keep the PC and LCD projector
4. Cupboards to keep the A-V equipment

#### **b. Equipment for demonstration rooms**

Each demonstration room to be equipped with the following:

1. LCD projector
2. Computer with standard accessories
3. Document camera
4. OHP
5. White screen – for projection
6. Chalk board
7. Cordless microphones, amplifiers and speakers
8. Laser pointer
9. White board
10. Magnetic board
11. Dummies (manikins) for demonstration of intravenous injection, enema, intramuscular injections and intracardiac injection.

#### **c. CAL laboratory**

1. It must have 30 computers with standard configuration and connected to internet.
2. There should be an LCD projector and screen for demonstration.
3. Each computer should be so placed to have enough space for three people to sit in front of the screen.
4. Each computer should be placed at a distance of not less than 6' from each other.
5. The lab should be airconditioned.
6. High speed internet (broad band) access should be given freely to all students.
7. CAL programmes and other software for teaching pharmacology should be loaded into the computers.  
This laboratory should give students access to the National Essential Drug Lists, Standard Treatment Protocols (STP), Banned Drugs List from the CDSCO, Price Controlled Drugs List, Antibiotic Guidelines, Hospital formulary and other learner resource material which the student can use for self-study.

#### **d. Equipment for department office**

The office should have a computer, printer, photocopier which will be used for typing of question papers and printing them, photocopying them and maintenance of internal assessment marks.

#### **Items to be deleted from the list of equipment.**

(Ref: Minimum standard requirements for the medical college, For 150 admissions annually, Regulations 1999, Medical Council of India, New Delhi, Pages 47 – 53)

#### **ALL OF THE FOLLOWING ITEMS ARE TO BE DELETED**

#### **a. Furnitures and fixtures**

1. Museum almirahs, gas points, operation tables

#### **b. Experimental pharmacology**

1. Starling's long extension kymographs with time markers
2. The Ideal Respiratory pump
3. Brodie's operation tables
4. Assembly perfusion for mammalian heart
5. Standard power tables
6. Assembly for mammalian classes
7. Automatic recording drums
8. Mechanical Stromhur
9. Gaddum's outflow recorder
10. Centrifuge
11. Calorimeters
12. Cannulas (different types)
13. Cautery machine, electric blenstone
14. Varnishing tray with foot lever
15. Four unit isolated organ bath Palmer E67
16. Analgesimeter
17. Smoking Burners Palmer A291 & A 265
18. Tracheal cannula metal Palmer E.76
19. Condon's drop recorder Palmer B-75
20. Prof. Inchleys drop recorder - Palmer B-78
21. Animal Weighing:
  - (a) Machine for small animals like rats and guinea pig
  - (b) Machine for big animals like dogs
22. Dissection instruments
23. Kymograph (students) Electric independent unit
24. Electric motor ¼ with split pulleys
25. Shafting steel rod ¾" diameter & 18" long
26. Standard shafting & fittings
27. Pulleys
28. Muffs coupling for joining 2 pieces of the above mentioned shafting rods
29. X-blocks
30. Hook grip rods
31. Plain stand
32. Apparatus for isolated rabbit intestine etc.,
33. Jacquets graphic chronometer
34. Frog boards – Palmer C-120
35. Jackson's enterograph
36. Hair Aesthesiometer - Palmer W-290
37. Long extension for paper Palmer A-130
38. Animal balance triple beam
39. Manometers mercury Palmer C-200
40. Metronome Palmer B-5
41. Oncometer kidney
42. Oncometer heart
43. Copper trays (10"X8"X1")
44. Thermometer (upto 110 degree Celsius)
45. Distillation apparatus
46. Microscopes ordinary
47. Working tables with racks each table 36' long
48. Chemical balance – ordinary apothecary's
49. Chemical balance – sensitive
50. Dissection instrument
51. Plethysmograph assorted

52. Pneumograph Palmer E
53. Piston recorder Palmer C.51
54. Tambours Mareys Palmer C.5 & C.11
55. Tetanus Set Palmer H.20
56. Stop watches Jaquets
57. Oxygen cylinders with trolleys
58. Carbon dioxide cylinder
59. Operating lamps – Philips
60. Animal trolley with 12 cages

#### Miscellaneous

61. Electrodes, ordinary & non polarizable, insulated wires, time markers, electric signals, mercury manometer, perfusion apparatus, myograph lever, small pulley's upright stands and chemicals etc.,

#### **(c) Pharmacy laboratory:**

62. Dispensing balance with metric system weights
63. Pill tiles
64. Suppository moulds
65. Porcelain dishes
66. Crucible with tongs
67. Pestle and mortar
68. Iron spatula
69. Measure glass – all sizes
70. Water bath, metal

#### Miscellaneous

71. Chemicals, drugs, glass rods, funnels and filter paper etc.,

#### **(d) Special Chemicals & Pharmacological Equipment:**

72. Stimulator Electronic Arthus Thomas
73. Balance Semi micro analytical Pan Mettler
74. Electrocardiograph
75. Spectrophotometer Model Du-Beckman (UV visible range)
76. Skin and rectal thermometer Braun
77. Antihistamine chamber with manometer
78. Flame photometer
79. Stop clock
80. Water bath 4 hole electrically heated
81. Bell Jars assorted
82. Petri dishes
83. Museum drugs specimen jars
84. All glass distillation apparatus cap. 2 litres
85. Centrifuge Electric International R.P.M. 3000
86. Microscope students type with mechanical stage and oil immersion
87. Microscop lamps
88. Magnetic stirrer B.T.L.
89. Autoclave electric
90. Waring Blender M.S.E
91. Hot air oven size 14"X14"X14"

92. Incubator electric size 14"X14"X14"
93. Vacuum & Pressure Pump Cenco
94. Instruments sterilizer Electric size 12"X8"X6"
95. B.P.Apparatus
96. Distilled water Still Manesty Electrical Cap. 2 gallons per hour
97. Stethoscope
98. Multimeter
99. Temperature controlled bath 37°C
100. Razore hone
101. Electric hot plate
102. Deionizer capacity 20 litres per hour and six litres per hour (mixed bed type) connected in series
103. Physiographs with transducers and other relevant accessories
104. Vortex mixer
105. Actophotometer
106. Rotarod assembly
107. Electro convulsimeter
108. Cook's pole climbing apparatus
109. Metabolic cages (Diuretic study)
110. Digital ph meter
111. Tablet disintegration machine
112. Glass tubing (length of 6 feet)
113. Glass rods – assorted sizes of 6 ft.
114. Glass mortar & pestles capacity of 500 and 200 cc
115. Cork borer set of 12
116. Holder for platinum wire loop
117. Lancet spring (disposable)
118. Lamp for microscope
119. Magnifying glass with metal handle
120. Metal mincing machine
121. Postmortem instrument sets complete
122. Suction pumps
123. Filtering apparatus sietz filter and Millipore filter
124. Dessicators
125. Vacuum dessicator
126. Apron plastic for postmortem
127. Apron rubber for postmortem

Please note that items 116 to 127 do not appear to be related to pharmacology, however, since they appear under the Department of Pharmacology they have been left so.

These minimum requirements are only for the undergraduate course and are not for the postgraduate course in pharmacology.

#### **References**

1. Medical Council of India. Regulations on Graduate Medical Education. New Delhi 1997.
2. Medical Council of India. Minimum standard requirements for the medical college for 150 admissions annually regulations. New Delhi 1999.

