Competency Based Questions and Answers in

Anatomy

for First MBBS Professional Examination

Including

- General Anatomy
- Limbs
- Thorax
- Head and Neck
- Abdomen and Pelvis
- Neuroanatomy
- Histology
- Genetics
- Embryology
- Ethics

Compiled and designed as per CBME Guidelines | Competency Based Undergraduate Curriculum for the Indian Medical Graduate

- 103 Long Essays
- 695 Short Essays
- 630 Short Answers
- 809 MCQs

Editor

Tejaswi HL

SUSHRUTHA Academy

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Science and technology are constantly changing fields. New research and experience broaden the scope of information and knowledge. The authors have tried their best in giving information available to them while preparing the material for this book. Although, all efforts have been made to ensure optimum accuracy of the material, yet it is quite possible some errors might have been left uncorrected. The publisher, the printer and the authors will not be held responsible for any inadvertent errors, omissions or inaccuracies.

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to

MSR (M Shivaji Rao) Sir
My Teacher and Mentor
For inspiring me to achieve excellence in life and imparting the art of great teaching
and
My students
For their unconditional love and appreciation for my teaching

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Foreword

"Assessment drives learning"

The purpose of assessment is not just to assess learning but also assist learning. The new CBME curriculum proposed by the Medical Council of India (MCI)/National Medical Commission (NMC) calls for an outcome-based teaching–learning approach and transition from just acquisition of knowledge to application and practice of knowledge. Assessments need to be designed to suit the newer teaching—learning methods and to assess if the required competency has been achieved or not.

The main purpose of the editor in bringing out this book is to introduce the first MBBS students to the new format of questions that is most likely to be asked during the internal assessment and the University examination and equip them to face these examinations without fear. Students can use this book for self-assessment of learning, preparing for internal assessment and University examination.

It is heartening to know that the book has been compiled by a group of passionate teachers who have undergone MCI recognized training in revised basic medical education technologies and advanced course in medical education. The questions in this book have been arranged according to competencies as listed in the MCI curriculum document. Various types of questions including structured long essays, short essays, short answers, multiple-choice questions and fill in the blanks type questions have been included. These questions have been framed according to the guidelines set by the MCI with appropriate use of verbs at each level of Bloom's taxonomy of cognitive domain. The questions not only assess recall but also higher levels of learning.

I congratulate the editor/contributors for their hard work and efforts in bringing out this much needed book and wish them all success with this venture.

Happy reading to all learners.

Dr MG Shivaramu
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Preface

Most of the first MBBS students feel that anatomy is the toughest among all the preclinical subjects. This is because of multiple reasons. One of the reasons being, unlike in physiology and biochemistry where there are a maximum of one or two textbooks to read, anatomy has separate books for general anatomy, gross anatomy, neuroanatomy, histology, and embryology. Reading multiple textbooks before exams is often stressful. The other reason being, it is challenging for the students to decide how much information is needed for examinations and how this must be presented while answering.

There are **three main purposes** of bringing out this book. *The first one is to include all aspects of anatomy—general anatomy, gross anatomy, neuroanatomy, histology, and embryology in one single book that can be used as a ready reckoner to revise everything just the day before examinations. The second reason is to make the student familiar with the new type of questions that are being asked in University examinations for the CBME batch. The third and the most important reason is helping the students in structuring their answers.* The answers to questions have been framed in such a way that student will know how to present an answer effectively during the exam. **Remember, the presentation of your answer in examinations is as important as the content in it.**

This book includes all types of questions asked in anatomy examinations of various universities across the country, like traditional/unstructured long essays, modified/structured long essays, case-based questions, short essays, short answers, multiple-choice questions of various types and also one-mark questions in the form of the fill in the blanks. Care has been taken not to exclude any important topic that can be asked frequently in university examinations.

If a student can spend at least a couple of hours everyday, studying a minimum of ten pages from this book, the entire book can be revised thrice before appearing for the first professional examination. The editor/contributors also confidently feel/s that the contents in the book can be effectively and completely revised even the day before examinations because of the concise nature of the contents. Nothing can replace the luxury of having time to revise topics multiple times before examinations. We sincerely hope that this book will surely reduce the stress on first year students while facing any assessment in anatomy, including internal as well as university examinations.

We would like to request the readers to provide their valuable feedback and suggestions through e-mail.

We hereby wish the readers of the book all the best in their endeavors.

Happy Reading!

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I greatly acknowledge the support offered by my wife Dr Shilpashree YD, mother Vidya PS, father Dr Lokanathan HG, daughter Aadhya, son Anshul, sister Dr Shilpashree HL and Mrs Vatsala YD, brother-in-law Dr Raghava GS and Dr Srinivas AH, mother-in-law Mrs Lalitha YK and father-in-law Mr Dhanajaya YL in tolerating my self-absorption during the preparation of this book.

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I thank my departmental colleagues Dr Sharada B Menasinkai, Dr Asharani SK, and Dr Savitha V for their invaluable support, feedback, and suggestions in preparing this book.

I am grateful to my teachers, Dr Dakshayani KR, Dr Seema Deepak, Dr Poornima GC, Dr Chandra Shekhar KT and Dr Parashuram R who kindled my interest in anatomy and inspired me during my post-graduation.

I will always remain grateful to my past and present students who are and have been my real motivation to achieve excellence in teaching.

Special mention of Sri Paruchuri Gopala Krishna—a predominant screenplay, story, dialogue writer, actor, director, playwright, and orator in Telugu cinema—from whom I have realized the importance of "11th hour"!

I would like to acknowledge all the people who are involved in the preparation of this book, especially Mr SK Jain (Chairman and Managing Director), Mr Varun Jain (Director), Mr YN Arjuna (Sr. Vice President—Publishing, Editorial and Publicity), Mis Ritu Chawla (GM Production), Mr Neeraj Kumar Sharma (Copy Editor), Mr Parmod Kumar and Ms Jassi, and of CBSPD for their all-time support and bringing out this book in record short time.

I hereby wish all the readers of the book all the best in their endeavors.

Tejaswi HL

Contents

Details of the Number of Questions and MCQs Included as per the Competency

S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
		GENERAL ANATOMY				
		1. Anatomical Terminology				
1	AN 1.1	Demonstrate normal anatomical position, various planes, relation, comparison, laterality and movement in our body	—	02	03	02
2	AN 1.2	Describe composition of bone and bone marrow	—	01	02	02
		2. General Features of Bones and Joints				
3	AN 2.1	Describe parts, blood and nerve supply of a long bone	—	08	09	01
4	AN 2.2	Enumerate laws of ossification	—	—	02	01
5	AN 2.3	Enumerate special features of a sesamoid bone	—	—	01	01
6	AN 2.4	Describe various types of cartilage with their structure and distribution in body	—	01	02	02
7	AN 2.5	Describe various joints with subtypes and examples	—	03	05	02
8	AN 2.6	Explain the concept of nerve supply of joints and Hilton's law	—	—	01	02
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9	AN 3.1	Classify muscle tissue according to structure and action	—	03	02	02
10	AN 3.2	Enumerate parts of skeletal muscle and differentiate between tendons and aponeuroses with examples	—	—	01	02
11	AN 3.3	Explain shunt and spurt muscles	—	—	01	02
		4. General Features of Skin and Fascia				
12	AN 4.1	Describe different types of skin and dermatomes in body	—	01	01	02
13	AN 4.2	Describe structure and function of skin with its appendages	—	01	03	02
14	AN 4.3	Describe superficial fascia along with fat distribution in body	—	01	02	02
15	AN 4.4	Describe modifications of deep fascia with its functions	—	02	02	02
16	AN 4.5	Explain principles of skin incisions	—	—	02	02
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17	AN 5.1	Differentiate between blood vascular and lymphatic system	—	01	02	02
18	AN 5.2	Differentiate between pulmonary and systemic circulation	—	01	—	02
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20	AN 69.1	Identify elastic and muscular blood vessels, capillaries under the microscope	—	04	05	02
21	AN 69.2	Describe the various types ... vessel				02
22	AN 69.3	Describe the ultrastructure of blood vessels				02
23	AN 5.4	Explain functional difference between elastic, muscular arteries and arterioles	—	01	02	02
24	AN 5.5	Describe portal system giving examples	—	—	02	02
25	AN 5.6	Describe the concept of anastomoses and collateral circulation with significance of end-arteries	—	01	02	02
26	AN 5.7	Explain function of meta-arterioles, precapillary sphincters, arteriovenous anastomoses	—	01	01	02
27	AN 5.8	Define thrombosis, infarction and aneurysm	—	—	03	02
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28	AN 6.1	List the components and functions of the lymphatic system	—	01	01	02
29	AN 6.2	Describe structure of lymph capillaries and mechanism of lymph circulation	—	01	05	02
30	AN 6.3	Explain the concept of lymphoedema and spread of tumors via lymphatics and venous system	—	01	01	02
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31	AN 7.1	Describe general plan of nervous system with components of central, peripheral and autonomic nervous systems	—	01	03	02
32	AN 7.2	List components of nervous tissue and their functions	—	04	02	02
33	AN 7.3	Describe parts of a neuron and classify them based on number of neurites, size and function	—	03	05	02
34	AN 7.4	Describe structure of a typical spinal nerve	—	01	01	02
35	AN 7.5	Describe principles of sensory and motor innervation of muscles	—	01	—	02
36	AN 7.6	Describe concept of loss of innervation of a muscle with its applied anatomy	—	01	—	02
37	AN 7.7	Describe various type of synapse	—	01	—	02
38	AN 7.8	Describe differences between sympathetic and spinal ganglia	—	01	—	02

S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
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39	AN 8.1	Identify the given bone, its side, important features and keep it in anatomical position				02
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47	AN 9.3	Describe development of breast	—	01	02	02
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50	AN 10.3	Describe, identify and demonstrate formation, branches, relations, area of supply of branches, course and relations of terminal branches of brachial plexus	02	02	02	02
51	AN 10.5	Explain variations in formation of brachial plexus				02
52	AN 10.6	Explain the anatomical basis of clinical features of Erb's palsy and Klumpke's paralysis				02
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54	AN 10.7	Explain anatomical basis of enlarged axillary lymph nodes				02
55	AN 10.8	Describe, identify and demonstrate the position, attachment, nerve supply and actions of trapezius and latissimus dorsi	—	02	—	02
56	AN 10.9	Describe the arterial anastomosis around the scapula and mention the boundaries of triangle of auscultation	—	01	02	02
57	AN 10.10	Describe and identify the deltoid and rotator cuff muscles	—	08	02	02
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59	AN 10.12	Describe and demonstrate shoulder joint for—type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, muscles involved, blood supply, nerve supply and applied anatomy	01	01	01	02
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63	AN 11.3	Describe the anatomical basis of venepuncture of cubital veins	—	—	02	02
64	AN 11.4	Describe the anatomical basis of saturday night paralysis	—	01	—	02
65	AN 11.5	Identify and describe boundaries and contents of cubital fossa	—	02	—	02
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74	AN 12.8	Describe anatomical basis of clawhand	—	01	—	02
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S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
		13. General Features: Joints, Radiographs and Surface Marking				
82	AN 13.1	Describe and explain fascia of upper limb and compartments, veins of upper limb and its lymphatic drainage	—	02	01	02
83	AN 13.2	Describe dermatomes of upper limb	—	01	—	02
84	AN 13.3	Identify and describe the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, blood and nerve supply of elbow joint, proximal and distal radio-ulnar joints, wrist joint and first carpometacarpal joint	03	04	—	02
85	AN 13.4	Describe sternoclavicular joint, acromioclavicular joint, carpometacarpal joints and metacarpophalangeal joint	—	01	02	02
86	AN 13.5	Identify the bones and joints of upper limb seen in anteroposterior and lateral view radiographs of shoulder region, arm, elbow, forearm and hand	—	—	—	02
87	AN 13.6	Identify and demonstrate important bony landmarks of upper limb: Jugular notch, sternal angle, acromial angle, spine of the scapula, vertebral level of the medial end, Inferior angle of the scapula	—	—	—	02
88	AN 13.7	Identify and demonstrate surface projection of: Cephalic and basilic vein, palpation of brachial artery, radial artery, testing of muscles: Trapezius, pectoralis major, serratus anterior, latissimus dorsi, deltoid, biceps brachii, brachioradialis	—	—	—	02
89	AN 13.8	Describe the development of upper limb	—	01	02	02
		14. Features of Individual Bones (Lower Limb)				
90	AN 14.1	Identify the given bone, its side, important features and keep it in anatomical position	—	02	08	02
91	AN 14.2	Identify and describe joints formed by the given bone	—	—	04	02
92	AN 14.3	Describe the importance of ossification of lower end of femur and upper end of tibia	—	—	02	02
93	AN 14.4	Identify and name various bones in the articulated foot with individual muscle attachment	—	—	04	02
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95	AN 15.2	Describe and demonstrate major muscles with their attachment, nerve supply and actions	01	02	01	02
96	AN 15.3	Describe and demonstrate boundaries, floor, roof and contents of femoral triangle	01	02	05	02
97	AN 15.4	Explain anatomical basis of psoas abscess and femoral hernia	—	—	03	02
98	AN 15.5	Describe and demonstrate adductor canal with its contents	—	01	—	02
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100	AN 16.2	Describe anatomical basis of sciatic nerve injury during gluteal intramuscular injections	—	—	01	02
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102	AN 16.4	Describe and demonstrate the hamstrings group of muscles with their attachment, nerve supply and actions	—	04	02	02
103	AN 16.5	Describe and demonstrate the origin, course, relations, branches (or tributaries), termination of important nerves and vessels on the back of thigh	01	04	—	02
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105	AN 17.1	Describe and demonstrate the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the hip joint	01	01	01	02
106	AN 17.2	Describe anatomical basis of complications of fracture of neck of femur	—	—	02	02
107	AN 17.3	Describe dislocation of hip joint and surgical hip replacements	—	—	02	02
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108	AN 18.1	Describe and demonstrate major muscles of anterolateral compartment of leg with their attachment, nerve supply and actions	—	04	—	02
109	AN 18.2	Describe and demonstrate origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterior compartment of leg	—	03	—	02
110	AN 18.3	Explain the anatomical basis of footdrop	—	—	01	02
111	AN 18.4	Describe and demonstrate the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the knee joint	01	03	01	02
112	AN 18.5	Explain the anatomical basis of locking and unlocking of the knee joint	—	01	—	02
113	AN 18.6	Describe knee joint injuries with its applied anatomy	—	—	01	02
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115	AN 19.1	Describe and demonstrate the major muscles of back of leg with their attachment, nerve supply and actions	—	04	01	02
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S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
117	AN 19.3	Explain the concept of "peripheral heart"	—	01	—	02
118	AN 19.4	Explain the anatomical basis of rupture of calcaneal tendon	—	—	01	02
119	AN 19.5	Describe factors maintaining important arches of the foot with their importance	01	01	—	02
120	AN 19.6	Explain the anatomical basis of flatfoot and clubfoot	—	01	02	02
121	AN 19.7	Explain the anatomical basis of metatarsalgia and plantar fasciitis	—	—	03	02
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122	AN 20.1	Describe and demonstrate the type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply of tibiofibular and ankle joint	01	01	01	02
123	AN 20.2	Describe the subtalar and transverse tarsal joints	—	02	—	02
124	AN 20.3	Describe and demonstrate fascia lata, venous drainage, lymphatic drainage, retinacula and dermatomes of lower limb	—	02	02	02
125	AN 20.4	Explain anatomical basis of enlarged inguinal lymph nodes				02
126a	AN 20.5	Explain anatomical basis of varicose veins and deep vein thrombosis	—	01	—	02
126b	AN 20.6	Describe basic concept of development of lower limb	—	—	—	02
127	AN 20.7	Identify and demonstrate important bony landmarks of lower limb: Vertebral levels of highest point of iliac crest, posterior superior iliac spines, iliac tubercle, pubic tubercle, ischial tuberosity, adductor tubercle, -Tibial tuberosity, head of fibula, -Medial and lateral malleoli, condyles of femur and tibia, sustentaculum tali, tuberosity of fifth metatarsal, tuberosity of the navicular	—	—	—	02
128	AN 20.8	Identify and demonstrate palpation of femoral, popliteal, post-tibial, anti-tibial and dorsalis pedis blood vessels in a simulated environment	—	—	—	02
129	AN 20.9	Identify and demonstrate palpation of vessels (femoral, popliteal, dorsalis pedis, post-tibial), midinguinal point, surface projection of: Femoral nerve, saphenous opening, sciatic, tibial, common peroneal and deep peroneal nerve, great and small saphenous veins	—	—	—	02
130	AN 20.10	Describe basic concept of development of lower limb	—	01	—	02
		THORAX				
		21. Thoracic Cage				
131	AN 21.1	Identify and describe the salient features of the sternum, typical rib, 1st rib and typical thoracic vertebra				02
132	AN 21.2	Identify and describe the features of 2nd, 11th and 12th ribs, 1st, 11th and 12th thoracic vertebrae				02
133	AN 21.3	Describe and demonstrate the boundaries of thoracic inlet, cavity and outlet	—	08	15	02
134	AN 21.8	Describe and demonstrate type, articular surfaces and movements of manubriosternal, costovertebral, costotransverse and xiphisternal joints				02
135	AN 21.10	Describe costochondral and interchondral joints				02
136	AN 21.4	Describe and demonstrate extent, attachments, direction of fibres, nerve supply and actions of intercostal muscles				02
137	AN 21.5	Describe and demonstrate origin, course, relations and branches of a typical intercostal nerve				02
138	AN 21.6	Mention origin, course and branches/tributaries of: (1) Anterior and posterior intercostal vessels, (2) internal thoracic vessels	02	03	03	02
139	AN 21.7	Mention the origin, course, relations and branches of: (1) Atypical intercostal nerve, (2) superior intercostal artery, subcostal artery				
140	AN 21.9	Describe and demonstrate mechanics and types of respiration	—	01	01	02
141	AN 21.11	Mention boundaries and contents of the superior, anterior, middle and posterior mediastinum	—	04	02	02
		22. Heart and Pericardium				
142	AN 22.1	Describe and demonstrate subdivisions, sinuses in pericardium, blood supply and nerve supply of pericardium	—	04	03	02
143	AN 22.2	Describe and demonstrate external and internal features of each chamber of heart	04	01	04	02
144	AN 22.3	Describe and demonstrate origin, course and branches of coronary arteries				02
145	AN 22.4	Describe anatomical basis of ischemic heart disease	01	02	05	02
146	AN 22.5	Describe and demonstrate the formation, course, tributaries and termination of coronary sinus				02
147	AN 22.6	Describe the fibrous skeleton of heart in detail	01	—	—	02
148	AN 22.7	Mention the parts, position and arterial supply of the conducting system of heart	01	—	—	02
		23. Mediastinum				
149	AN 23.1	Describe and demonstrate the external appearance, relations, blood supply, nerve supply, lymphatic drainage and applied anatomy of esophagus	01	01	—	02
150	AN 23.2	Describe and demonstrate the extent, relations, tributaries of the thoracic duct and enumerate its applied anatomy	01	02	—	02
151	AN 23.7	Mention the extent, relations and applied anatomy of lymphatic duct				02
152	AN 23.3	Describe and demonstrate origin, course, relations, tributaries and termination of superior vena cava, azygos, hemiazygos and accessory hemiazygos veins	—	04	—	02
153	AN 23.4	Mention the extent, branches and relations of arch of aorta and descending thoracic aorta	—	02	—	02
154	AN 23.5	Identify and mention the location and extent of thoracic sympathetic chain	—	02	—	02
155	AN 23.6	Describe the splanchnic nerves				02
		24. Lungs and Trachea				
156	AN 24.1	Mention the blood supply, lymphatic drainage and nerve supply of pleura, the extent of pleura and describe the pleural recesses and their applied anatomy	01	04	02	02

S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
201	AN 31.2	Describe and demonstrate nerves and vessels in the orbit	—	04	01	02
202	AN 31.3	Describe anatomical basis of Horner's syndrome	—	01	—	02
203	AN 31.4	Enumerate components of lacrimal apparatus	—	02	—	02
		32. Anterior Triangle				
204	AN 32.1	Describe boundaries and subdivisions of anterior triangle	01	—	—	02
205	AN 32.2	Describe and demonstrate boundaries and contents of muscular, carotid, digastric and submental triangles	01	05	03	02
		33. Temporal and Infratemporal Regions				
206	AN 33.1	Describe and demonstrate extent, boundaries and contents of temporal and infratemporal fossae	05	01	01	01
207	AN 33.2	Describe and demonstrate attachments, direction of fibres, nerve supply and actions of muscles of mastication	01	01	01	02
208	AN 33.3	Describe and demonstrate articulating surface, type and movements of temporomandibular joint	01	01	—	02
209	AN 33.4	Explain the clinical significance of pterygoid venous plexus		—	01	02
210	AN 33.5	Describe the features of dislocation of temporomandibular joint	—	—	02	02
		34. Submandibular Region				
211	AN 34.1	Describe and demonstrate the morphology, relations and nerve supply of submandibular salivary gland and submandibular ganglion	01	04	01	02
212	AN 34.2	Describe the basis of formation of submandibular stones				02
		35. Deep Structures in the Neck				
213	AN 35.1	Describe the parts, extent, attachments, modifications of deep cervical fascia	01	05	02	02
214	AN 35.10	Describe the fascial spaces of the neck				02
215	AN 35.2	Describe and demonstrate location, parts, borders, surfaces, relations and blood supply of thyroid gland	01	02	—	02
216	AN 35.8	Describe the anatomically relevant clinical features of thyroid swellings				02
217	AN 35.3	Demonstrate and describe the origin, parts, course and branches of subclavian artery	01	04	01	02
218	AN 35.9	Describe the clinical features of compression of subclavian artery and lower trunk of brachial plexus by cervical rib				02
219	AN 35.4	Describe and demonstrate origin, course, relations, tributaries and termination of internal jugular and brachiocephalic veins	—	02	01	02
220	AN 35.5	Describe and demonstrate extent, drainage and applied anatomy of cervical lymph nodes	—	—	03	02
221	AN 35.6	Describe and demonstrate the extent, formation, relation and branches of cervical sympathetic chain	—	03	—	02
222	AN 35.7	Describe the course and branches of IX, X, XI and XII nerve in the neck	04	—	—	02
		36. Mouth, Pharynx and Palate				
223	AN 36.1	Describe the (1) morphology, relations, blood supply and applied anatomy of palatine tonsil, (2) composition of soft palate	03	01	03	02
224	AN 36.2	Describe the components and functions of Waldeyer's lymphatic ring	—	—	01	02
225	AN 36.3	Describe the boundaries and clinical significance of pyriform fossa	—	—	03	02
226	AN 36.4	Describe the anatomical basis of tonsillitis, tonsillectomy, adenoids and peri-tonsillar abscess	—	—	02	02
227	AN 36.5	Describe the clinical significance of Killian's dehiscence	—	—	01	02
		37. Cavity of Nose				
228	AN 37.1	Describe and demonstrate features of nasal septum, lateral wall of nose, their blood supply and nerve supply	02	02	02	02
229	AN 37.2	Describe location and functional anatomy of paranasal sinuses	—	01	—	02
230	AN 37.3	Describe anatomical basis of sinusitis and maxillary sinus tumours	—	—	02	02
		38. Larynx				
231	AN 38.1	Describe the morphology, identify structure of the wall, nerve supply, blood supply and actions of intrinsic and extrinsic muscles of the larynx	01	04	04	02
232	AN 38.2	Describe the anatomical aspects of laryngitis	—	—	01	02
233	AN 38.3	Describe anatomical basis of recurrent laryngeal nerve injury	—	01	—	02
		39. Tongue				
234	AN 39.1	Describe and demonstrate the morphology, nerve supply, embryological basis of nerve supply, blood supply, lymphatic drainage and actions of extrinsic and intrinsic muscles of tongue	02	03	02	02
235	AN 39.2	Explain the anatomical basis of hypoglossal nerve palsy				02

S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
		40. Organs of Hearing and Equilibrium				
236	AN 40.1	Describe and identify the parts, blood supply and nerve supply of external ear				02
237	AN 40.2	Describe and demonstrate the boundaries, contents, relations functional anatomy of middle ear and auditory tube	—	03	04	02
238	AN 40.3	Describe the features of internal ear				02
239	AN 40.4	Explain anatomical basis of otitis externa and otitis media				02
240	AN 40.5	Explain anatomical basis of myringotomy				02
		41. Eyeball				
241	AN 41.1	Describe and demonstrate parts and layers of eyeball				02
242	AN 41.2	Describe the anatomical aspects of cataract, glaucoma and central retinal artery occlusion	—	02	03	02
243	AN 41.3	Describe the position, nerve supply and actions of intraocular muscles				02
		42. Back Region				
244	AN 42.1	Describe the contents of the vertebral canal	—	01	01	02
245	AN 42.2	Describe and demonstrate the boundaries and contents of suboccipital triangle	—	02	—	02
246	AN 42.3	Describe the position, direction of fibres, relations, nerve supply, actions of semispinalis capitis and splenius capitis	—	02	—	02
		43. Head and Neck Joints, Histology, Development, Radiography and Surface Marking				
247	AN 43.1	Describe and demonstrate the movements with muscles producing the movements of atlanto-occipital joint and atlantoaxial joint	—	02	—	02
248	AN 43.2	Identify, describe and draw the microanatomy of pituitary gland, thyroid, parathyroid gland, tongue, salivary glands, tonsil, epiglottis, cornea, retina	—	09	06	02
249	AN 70.1	Identify exocrine gland under the microscope and distinguish between serous, mucous and mixed acini				02
250	AN 43.3	Identify, describe and draw microanatomy of olfactory epithelium, eyelid, lip, sclero-corneal junction, optic nerve, cochlea: Organ of Corti, pineal gland	—	03	—	02
251	AN 43.4	Describe the development and developmental basis of congenital anomalies of face, palate, tongue, branchial apparatus, pituitary gland, thyroid gland and eye	—	08	06	02
252	AN 43.5	Demonstrate: (1) Testing of muscles of facial expression, extraocular muscles, muscles of mastication, (2) palpation of carotid arteries, facial artery, superficial temporal artery, (3) location of internal and external jugular veins, (4) location of hyoid bone, thyroid cartilage and cricoid cartilage with their vertebral levels	—	—	—	02
253	AN 43.6	Demonstrate surface projection of—thyroid gland, parotid gland and duct, pterion, common carotid artery, internal jugular vein, subclavian vein, external jugular vein, facial artery in the face and accessory nerve	—	—	—	02
254	AN 43.7	Identify the anatomical structures in: (1) plain X-ray skull, (2) AP view and lateral view (3) plain X-ray cervical spine-AP and lateral view (4) plain X-ray of paranasal sinuses	—	—	—	02
255	AN 43.8	Describe the anatomical route used for carotid angiogram and vertebral angiogram	—	—	—	02
256	AN 43.9	Identify anatomical structures in carotid angiogram and vertebral angiogram	—	—	—	02
		ABDOMEN				
		44. Anterior Abdominal Wall				
257	AN 44.1	Describe and demonstrate the planes (transpyloric, transtubercular, subcostal, lateral vertical, linea alba, linea semilunaris), regions and quadrants of abdomen	—	04	03	02
258	AN 44.2	Describe and identify the fascia, nerves abdominal wall	—	—	04	02
259	AN 44.3	Describe the formation of rectus sheath and its contents	01	02	—	02
260	AN 44.4	Describe and demonstrate extent, boundaries, contents of inguinal canal including Hesselbach's triangle	01	01	02	02
261	AN 44.5	Explain the anatomical basis of inguinal hernia	—	01	—	02
262	AN 44.6	Describe and demonstrate attachments of muscles of anterior abdominal wall	—	05	02	02
263	AN 44.7	Enumerate common abdominal incisions	—	01	—	02
		45. Posterior Abdominal Wall				
264	AN 45.1	Describe thoracolumbar fascia	—	01	01	02
265	AN 45.2	Describe and demonstrate lumbar plexus for its root value, formation and branches	—	05	—	02
266	AN 47.12	Describe important nerve plexuses of posterior abdominal wall				02
267	AN 45.3	Mention the major subgroups of back muscles, nerve supply and action	—	02	—	02
		46. Male External Genitalia				
268	AN 46.1	Describe and demonstrate coverings, internal structure, side determination, blood supply, nerve supply, lymphatic drainage and descent of testis with its applied anatomy	01	03	02	02
269	AN 46.2	Describe the parts of epididymis	—	01	—	02
270	AN 46.3	Describe penis under following headings: Parts, components, blood supply and lymphatic drainage	—	02	02	02
271	AN 46.5	Explain the anatomical basis of phimosis and circumcision				02
272	AN 46.4	Explain the anatomical basis of varicocoele	—	01	—	02

S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
		47. Abdominal Cavity				
273	AN 47.1	Describe and identify boundaries and recesses of lesser and greater sac				02
274	AN 47.2	Name and identify various peritoneal folds and pouches with its explanation	01	06	04	02
275	AN 47.3	Explain anatomical basis of ascites and peritonitis				02
276	AN 47.4	Explain anatomical basis of subphrenic abscess				01
277	AN 47.5	Describe and demonstrate major viscera of abdomen under following headings: Anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects				02
278	AN 47.6	Explain the anatomical basis of splenic notch, accessory spleens, Kehr's sign, different types of vagotomy, liver biopsy (site of needle puncture), referred pain in cholecystitis, obstructive jaundice, referred pain around umbilicus, radiating pain of kidney to groin and lymphatic spread in carcinoma stomach	09	31	33	02
279	AN 47.7	Mention the clinical importance of Calot's triangle	—	01	—	02
280	AN 47.8	Describe and identify the formation, course, relations and tributaries of portal vein, inferior vena cava and renal vein				02
281	AN 47.10	Enumerate the sites of portosystemic anastomosis	01	03	02	0
282	AN 47.11	Explain the anatomic basis of hematemesis and caput medusae in portal hypertension				02
283	AN 47.9	Describe and identify the origin, course, important relations and branches of abdominal aorta, coeliac trunk, superior mesenteric, inferior mesenteric and common iliac artery	—	06	05	02
284	AN 47.13	Describe and demonstrate the attachments, openings, nerve supply and action of the thoracoabdominal diaphragm	—	03	02	02
285	AN 47.14	Describe the abnormal openings of thoracoabdominal diaphragm and diaphragmatic hernia				02
		48. Pelvic Wall and Viscera				
286	AN 48.1	Describe and identify the muscles of pelvic diaphragm	01	02	02	02
287	AN 48.2	Describe and demonstrate the (position, features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and clinical aspects of) important male and female pelvic viscera	06	17	12	02
288	AN 48.3	Describe and demonstrate the origin, course, important relations and branches of internal iliac artery	—	01	03	02
289	AN 48.4	Describe the branches of sacral plexus	—	01	01	02
290	AN 48.5	Explain the anatomical basis of suprapubic cystostomy, urinary obstruction in benign prostatic hypertrophy, retroverted uterus, prolapse uterus, internal and external haemorrhoids, anal fistula, vasectomy, tubal pregnancy and tubal ligation	—	—	05	02
291	AN 48.6	Describe the neurological basis of automatic bladder	—	01	—	02
292	AN 48.7	Mention the lobes involved in benign prostatic hypertrophy and prostatic cancer	—	—	01	02
293	AN 48.8	Mention the structures palpable during vaginal and rectal examination	—	—	02	02
		49. Perineum				
294	AN 49.1	Describe and demonstrate the superficial and deep perineal pouch (boundaries and contents)	—	06	02	02
295	AN 49.2	Describe and identify perineal body	—	01	—	02
296	AN 49.3	Describe and demonstrate perineal membrane in male and female	—	01	—	02
297	AN 49.4	Describe and demonstrate boundaries, contents and applied anatomy of ischiorectal fossa	01	02	01	02
298	AN 49.5	Explain the anatomical basis of perineal tear, abscess and anal fissure	—	—	03	02
		50. Vertebral Column				
299	AN 50.1	Describe the curvatures of the vertebral column				02
300	AN 50.4	Explain the anatomical basis of scoliosis, lordosis, prolapsed disc, spondylosis and spina bifida	—	01	06	02
301	AN 50.2	Describe and demonstrate the type, articular ends, ligaments and movements of intervertebral joints, sacroiliac joints and pubic symphysis	—	02	02	02
302	AN 50.3	Describe lumbar puncture (site, direction of the needle, structures pierced during the lumbar puncture)	—	01	—	02
		51. Sectional Anatomy				
303	AN 51.1	Describe and identify the cross-section at the level of T8, T10, and L1 (transpyloric plane)	—	03	—	02
304	AN 51.2	Describe and identify the midsagittal section of male and female pelvis	—	—	01	01
		52. Histology and Embryology				
305	AN 52.1	Describe and identify the microanatomical features of gastrointestinal system: Esophagus, fundus of stomach, pylorus of stomach, duodenum, jejunum, ileum, large intestine, appendix, liver, gallbladder, pancreas and suprarenal gland	—	11	10	02
306	AN 52.2	Describe and identify the microanatomical features of urinary system: Kidney, ureter and urinary bladder; male reproductive system: Testis, epididymis, prostate and penis; female reproductive system: Ovary, uterus, uterine tube, cervix, placenta and umbilical cord	—	09	12	02
307	AN 52.3	Describe and identify the microanatomical features of esophageal junction and corpus luteum	—	02	01	02
308	AN 52.4	Describe the development of anterior abdominal wall	—	01	—	02

S. No.	Competency No.	Competency details	Long essays	Short essays	Short answers	MCQs
345	AN 62.4	Enumerate parts and major connections of basal ganglia and limbic lobe	—	04	01	01
346	AN 62.5	Describe boundaries, parts, gross relations, major nuclei and connections of dorsal thalamus, hypothalamus, epithalamus, metathalamus and subthalamus	02	02	—	02
347	AN 62.6	Describe and identify formation, branches and major areas of distribution of circle of Willis	—	03	02	02
		63. Ventricular System				
348	AN 63.1	Describe and demonstrate parts, boundaries and features of IIIrd, IVth and lateral ventricle	—	—	04	02
349	AN 63.2	Describe anatomical basis of congenital hydrocephalus	—	—	02	02
		64. Histology and Embryology				
350	AN 64.1	Describe and identify the microanatomical features of spinal cord, cerebellum and cerebrum	—	03	—	02
351	AN 64.2	Describe the development of neural tube, spinal cord, medulla oblongata, pons, midbrain, cerebral hemisphere and cerebellum	—	03	—	02
352	AN 64.3	Describe various types of open neural tube defects with its embryological basis	—	01	02	02
		GENERAL HISTOLOGY				
		65. Epithelium Histology				
353	AN 65.1	Identify epithelium under the microscope and describe the various types that correlate to its function	—	03	05	02
354	AN 65.2	Describe the ultrastructure of epithelium	—	02	02	02
		66. Connective Tissue Histology				
355	AN 66.1	Describe and identify various types of connective tissue with functional correlation	—	01	01	02
356	AN 66.2	Describe the ultrastructure of connective tissue	—	02	05	02
		67. Muscle Histology				
357	AN 67.1	Describe and identify various types of muscle under the microscope				02
358	AN 67.2	Classify muscle and describe the structure–function correlation of the same	—	05	02	02
359	AN 67.3	Describe the ultrastructure of muscular tissue				02
		68. Nervous Tissue Histology				
360	AN 68.1	Describe and identify multipolar and unipolar neuron, ganglia, peripheral nerve				02
361	AN 68.2	Describe the structure–function correlation of neuron	—	06	02	02
362	AN 68.3	Describe the ultrastructure of nervous tissue				02
		70. Glands and Lymphoid Tissue				
363	AN 70.1	Identify exocrine gland under the microscope and distinguish between serous, mucous and mixed acini				02
364	AN 70.2	Identify the lymphoid tissue under the microscope and describe microanatomy of lymph node, spleen, thymus, tonsil and correlate the structure with function	—	04	04	02
		71. Bone and Cartilage				
365	AN 71.1	Identify bone under the microscope; classify various types and describe the structure–function correlation of the same	—	03	03	02
366	AN 71.2	Identify cartilage under the microscope and describe various types and structure–function correlation of the same	—	02	01	02
		72. Integumentary System				
367	AN 72.1	Identify the skin and its appendages under the microscope and correlate the structure with function	—	02	01	02
		GENETICS				
		73. Chromosomes				
368	AN 73.1	Describe the structure of chromosomes with classification				02
369	AN 73.2	Describe technique of karyotyping with its applications	—	05	03	02
370	AN 73.3	Describe the Lyon's hypothesis				02
		74. Patterns of Inheritance				
371	AN 74.1	Describe the various modes of inheritance with examples				02
372	AN 74.2	Draw pedigree charts for the various types of inheritance and give examples of diseases of each mode of inheritance				02
373	AN 74.3	Describe multifactorial inheritance with examples	—	05	03	02
374	AN 74.4	Describe the genetic basis and clinical features of achondroplasia, cystic fibrosis, vitamin D resistant rickets, haemophilia, Duchene's muscular dystrophy and sickle cell anemia				02
		75. Principle of Genetics, Chromosomal Aberrations and Clinical Genetics				
375	AN 75.1	Describe the structural and numerical chromosomal aberrations				02
376	AN 75.2	Explain the terms mosaics and chimeras with example	—	10	04	02

Chapter

1

Anatomical Terminology

1.1 DEMONSTRATE NORMAL ANATOMICAL POSITION, VARIOUS PLANES, RELATION, COMPARISON, LATERALITY AND MOVEMENT IN OUR BODY

SHORT ESSAYS

1. Describe the terms of relationship and comparison in human body.

Term	*Meaning*
Superior	Nearer to the vertex of the skull
Inferior	Nearer to the sole of the foot
Cranial	Nearer to the skull
Caudal	Nearer to the tail/feet
Anterior	Nearer to the front of the body
Posterior	Nearer to the back of the body
Ventral	Nearer to the belly/front
Dorsal	Nearer to the back
Rostral	Nearer to the front (particularly used for describing structures in brain)
Medial	Nearer to midline of the body
Lateral	Farther from the midline of the body
Superficial	Nearer to the skin
Intermediate	In between superficial and deep
Deep	Farther from the skin
External	Outside of an organ/part of the body
Internal	Inside of an organ/part of the body
Proximal	Nearer to the root of a structure or a limb
Distal	Farther to the root of a structure or a limb

2. Describe the terms of movement.

Term	*Meaning*
Flexion	Movement that decreases in the angle between the anterior surface of two bones or bending
Extension	Movement that increases in the angle between the anterior surface of two bones or straightening
Right/left lateral flexion	Movement that causes bending towards right or left side of the body (possible only with neck and trunk)
Adduction	Moving towards the median plane
Abduction	Moving away from the median plane
Circumduction	A sequential movement involving flexion, abduction, extension, and adduction so that distal part of the structure moves in a circle
Rotation	Revolving of a part of the body around its own axis
Elevation	Raises a part upwards/superiorly
Depression	Lowers a part downwards/inferiorly
Medial rotation	Movement that brings the anterior surface of a limb closer to the midline
Lateral rotation	Movement that takes the anterior surface of the limb away from midline
Protrusion	Forward movement (as in scapula and mandible)

Term	*Meaning*
Retrusion/ retraction	Forward movement (as in scapula and mandible)
Pronation	*Occurs exclusively in forearm:* Movement that causes palm to face posteriorly and dorsum of the hand to face anteriorly
Supination	*Occurs exclusively in forearm:* Movement that causes palm to face anteriorly and dorsum of the hand to face posteriorly
Opposition	Movement that allows the tip of the thumb to touch tips of other fingers across the palm
Reposition	Movement that brings the tip of the thumb from opposition to normal position
Inversion	*Occurs exclusively in foot:* Movement that causes medial border of the sole to face upwards
Eversion	*Occurs exclusively in forearm:* Movement that causes lateral border of the sole to face upwards

SHORT ANSWERS

1. Describe the anatomical position of the human body.

In the anatomical position, the human body is:

- Standing straight with looking straightforward (Figs 1.1.1 and 1.1.2)

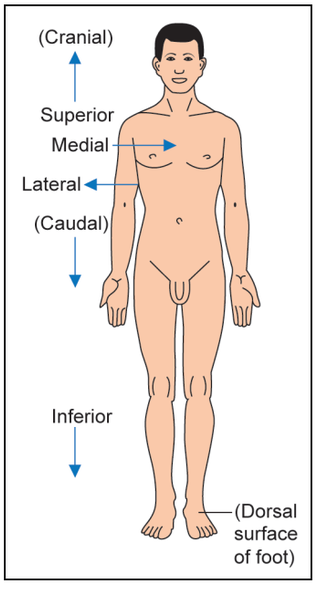

Fig. 1.1.1: Anatomical position of the human body

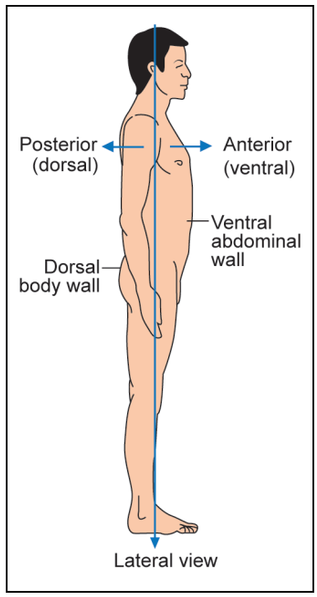

Fig. 1.1.2: Anatomical position of the human body

- Both the upper limbs by the bodyside with palms forward-facing
- Feet approximated together with the toes pointing forwards

2. An Intern enters the casualty department, where a Consultant is looking at a CT scan of the head. The Consultant asks the Intern to describe the meaning of coronal, median, sagittal and transverse planes. Define all the above mentioned anatomical planes.

Anatomical Planes (Fig. 1.1.3)

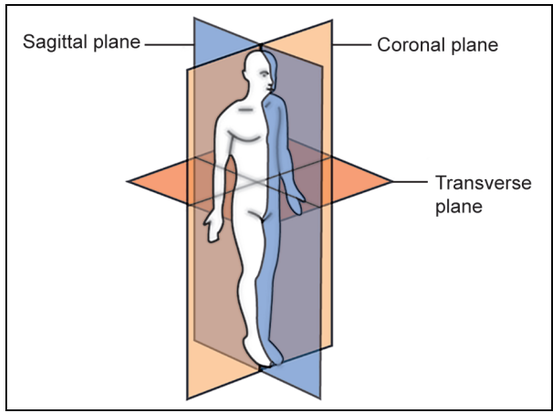

Fig. 1.1.3: Anatomical planes of the human body

1. **Midsagittal plane or median plane**
   - Passes through the center of the body
   - The body is divided into two equal halves—right and left
2. **Sagittal plane:** Any longitudinal plane which is parallel to the midsagittal plane
3. **Coronal plane**
   - This plane is perpendicular to the sagittal plane
   - The body is divided into two halves—anterior and posterior
4. **Transverse plane**
   - Perpendicular plane to the sagittal and coronal planes
   - The body is divided into two parts—upper and lower

3. Describe the use of anatomical planes in practice of medicine.

Anatomical planes are used to describe sections:

1. **Transverse/cross section:** In this section, the slices of the body are cut in a plane perpendicular to the longitudinal axis of the body or parts of the body (as in a CT scan)
2. **Longitudinal section:** This section passes parallel to the longitudinal axis of the body or parts of the body
3. **Oblique section:** Refers to section of the body cut in planes/direction excluding the transverse and longitudinal sections
4. **Describe the terms of laterality.**

Term	*Meaning*
Unilateral	Structures present on one side of the body only (E.g.: spleen, liver)
Bilateral	Structures present on both sides of the body (E.g.: kidneys, lungs)
Ipsilateral	Structures present on same side of the body (E.g.: right thumb and right toe)
Contralateral	Structures present on different sides of the body (E.g.: right thumb and left thumb)

1.2 DESCRIBE COMPOSITION OF BONE AND BONE MARROW

SHORT ESSAY

1. Describe the composition of bone.

Bone is a highly vascularised, mineralized, living and specialized connective tissue made of cells embedded in an extracellular matrix.

Composition of Bone

A. Cells

B. Extracellular matrix
   - Ground substance
   - Fibers

A. Cells: Five Types

1. **Osteoprogenitor cells**
   - These are the stem cells which can give rise to other types of cells
   - They are derived from mesenchymal stem cells
   - These are present on the external and internal surfaces of the bone
2. **Osteoblasts**
   - These are cells which produce the bone matrix
   - Arise from the osteoprogenitor cells
   - These give rise to the osteocytes (only 10–20% of osteoblasts give rise to osteocytes)
   - Produces an unmineralized matrix known as osteoid
   - Produces osteocalcin, alkaline phosphatase, and matrix vesicles, which assist in mineralization of the osteoid
3. **Osteocytes**
   - Formed when an osteoblast is surrounded by matrix
   - Flattened cells with cytoplasmic processes which communicate with each other by gap junctions
   - Located in space called lacunae and canaliculi
   - The nutritive material diffuses through the canaliculi radiating from lacuna
   - Apart from maintaining bone, these also play a role in mechanotransduction (increased and decreased mechanical stimuli will lead to bone formation and bone loss, respectively)

4. **Osteoclasts**
   - Derived from the fusion of uncommitted cells of red bone marrow
   - Large cells with many nuclei
   - Vital role in bone remodeling by resorbing the bone
   - Present in Howship's lacunae—which are shallow depressions of the bone
5. **Bone lining cells**
   - Two types—periosteal and endosteal cells
   - Derived from the osteoblasts
   - Provide nutrition to osteocytes

B. Extracellular Matrix

Ground substance

- Proteoglycans—chondroitin sulfate, keratan sulfate
- Glycoproteins—osteonectin, osteocalcin
- Mineral component—hydroxyapatite, citrate ions, bicarbonate ions
- Water—7%

Fibers

- Type I collagen fibers
- Gives tensile strength

SHORT ANSWERS

1. Enumerate the bone cells and mention at least one function of each cell.

Bone cells	*Functions*
Osteoprogenitor cells	• Give rise to osteoblasts and other bone cells
Osteoblasts	• Produce osteoid—unmineralized matrix, made of proteoglycans, glycoproteins, type I collagen fibers • Produce osteocalcin, alkaline phosphatase cause the release of calcium and phosphate • Produce matrix vesicles—concentrate calcium and phosphate—vital for mineralization
Osteocytes	• Have balanced osteogenic and osteoclastic activity—maintain the bone • Alkaline phosphatase secreted—maintain calcification
Osteoclasts	• Vital role in bone remodeling by resorbing the bone
Bone lining cells	• Provide nutritional support to the osteocytes

2. Compare and contrast the features of compact/dense and cancellous/spongy bone.

- The classification into compact and spongy bone depends on the amount of solid bony tissue present and the size and number of spaces present within bony tissue
- Compact bone has more solid bony tissue, less and smaller spaces within and vice versa in case of cancellous bone

Feature	*Compact bone*	*Cancellous bone*
Density	Dense	Porous
Location	Outer part of the bone	Inner part of the bone
Lamellae	Regular	Irregular
Haversian system	Present	Absent
Bone marrow	Absent	Present
Percentage in the body by weight	75%	25%