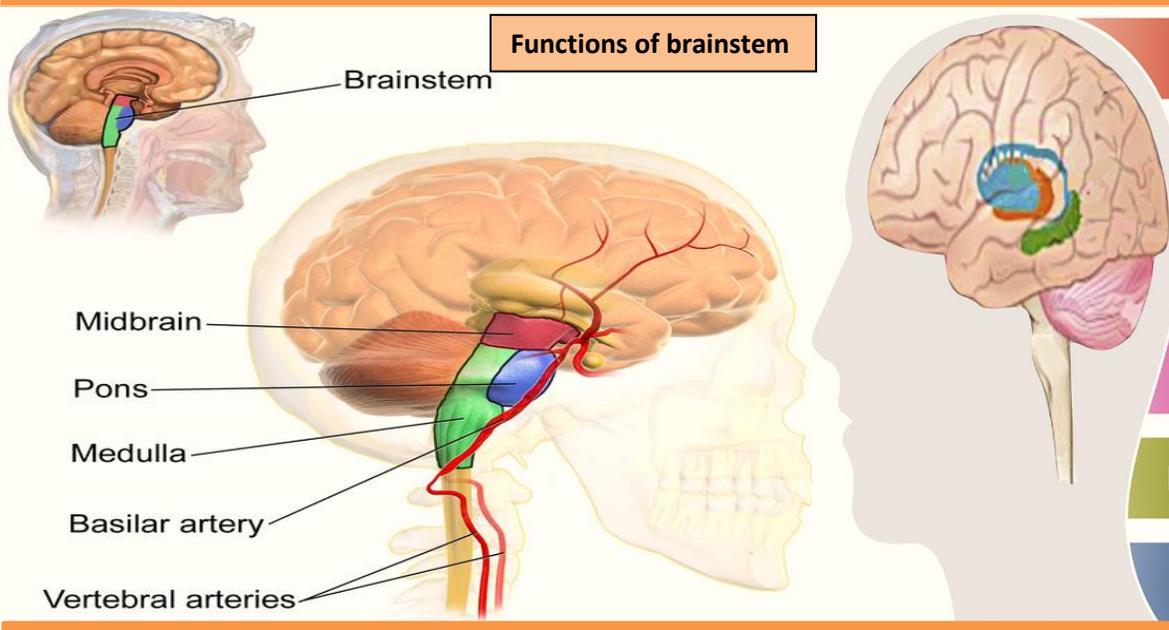
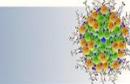


# Study Guide- Second Year MBBS

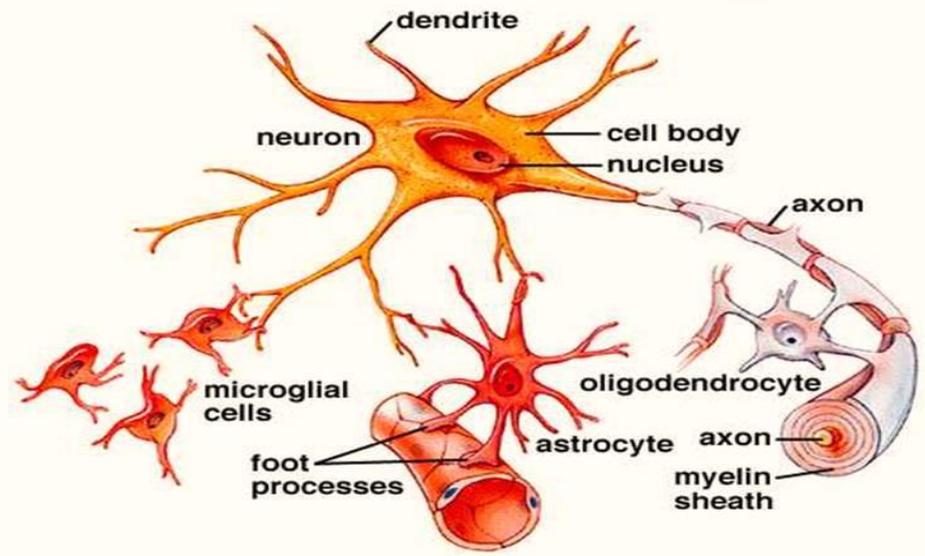
- 4<sup>th</sup> April- 26<sup>th</sup> May 2022
- Duration: 7 Weeks

## NEUROSCIENCES MODULE I



- Polymeric Biomaterials 
- Implanted Scaffold 
- Insulin-like Growth Factors 
- Tissue Engineered Scaffolds 
- Induced Pluripotent Stem Cells 
- Nano-particles 

### Nervous tissue Neurons and neuroglia



**STUDY GUIDE FOR NEUROSCIENCES MODULE-I**

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Module name: *Neurosciences -I*Year: *Two*Duration: *7 weeks (April – May 2022)*

*Timetable hours: Interactive Lectures, Case-Based Learning (CBL), Practical, Skills, Self-Directed Learning*

### MODULE INTEGRATED COMMITTEE

<b>MODULE COORDINATOR:</b>	<ul style="list-style-type: none"> <li>• Dr. Ahsan Ashfaq (<i>Physiology</i>)</li> </ul>
<b>CO-COORDINATORS:</b>	<ul style="list-style-type: none"> <li>• Dr. Fizzah Ali (<i>Pharmacology</i>)</li> <li>• Dr Faiza Kamran (<i>Biochemistry</i>)</li> </ul>

### DEPARTMENTS' & RESOURCE PERSONS' FACILITATING LEARNING

<b>BASIC HEALTH SCIENCES</b>		
<b><i>ANATOMY</i></b> Professor Zia-ul-Islam		
<b><i>BIOCHEMISTRY</i></b> Professor Kashif Nisar		
<b><i>PHYSIOLOGY</i></b> Professor Syed Hafeezul Hassan		
<b><i>DEPARTMENT OF HEALTH PROFESSIONS EDUCATION</i></b>		
<ul style="list-style-type: none"> <li>• Professor Nighat Huda</li> <li>• Dr. Sana Shah</li> </ul>	<ul style="list-style-type: none"> <li>• Professor Sobia Ali</li> </ul>	<ul style="list-style-type: none"> <li>• Dr. Afifa Tabassum</li> </ul>
<b><i>LNH&amp;MC MANAGEMENT</i></b>		
<ul style="list-style-type: none"> <li>• Professor KU Makki, Principal LNH&amp;MC</li> <li>• Dr. Shaheena Akbani, Director A.A &amp; R.T LNH&amp;MC</li> </ul>		
<b><i>STUDY GUIDE COMPILED BY: Department of Health Professions Education</i></b>		

## **INTRODUCTION**

### **WHAT IS A STUDY GUIDE?**

It is an aid to:

- Inform students how student learning program of the module has been organized
- Help students organize and manage their studies throughout the module
- Guide students on assessment methods, rules and regulations

### **THE STUDY GUIDE:**

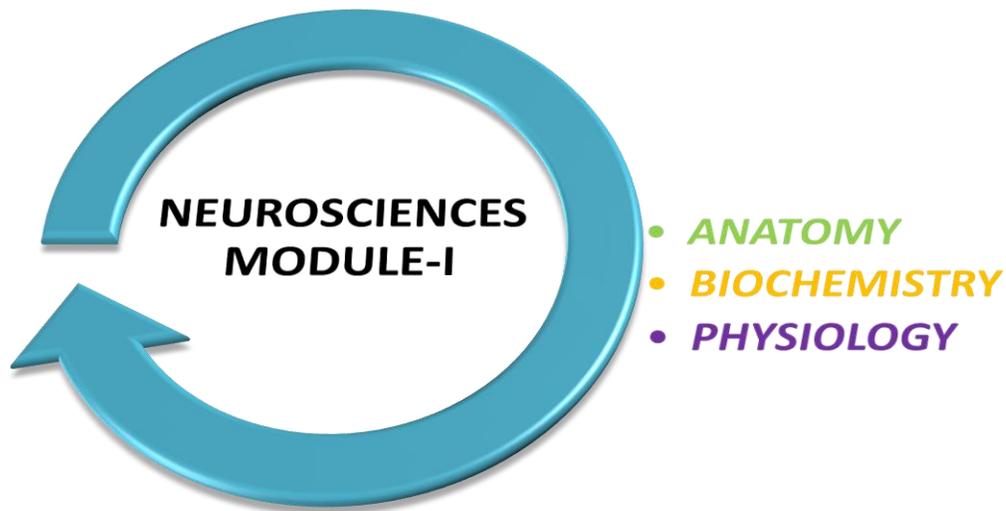
- Communicates information on organization and management of the module. This will help the student to contact the right person in case of any difficulty.
- Defines the objectives which are expected to be achieved at the end of the module.
- Identifies the learning strategies such as lectures, small group teachings, clinical skills, demonstration, tutorial and case based learning that will be implemented to achieve the module objectives.
- Provides a list of learning resources such as books, computer assisted learning programs, web-links and journals for students to consult in order to maximize their learning.
- Highlights information on the contribution of continuous and examinations on the student's overall performance.
- Includes information on the assessment methods that will be held to determine every student's achievement of objectives.
- Focuses on information pertaining to examination policy, rules and regulations.

### **CURRICULUM FRAMEWORK**

Students will experience integrated curriculum similar to previous modules.

**INTEGRATED CURRICULUM** comprises of system-based modules such as Head and Neck, Nervous system Endocrinology, Reproductive and Renal which links basic science knowledge to clinical problems. Integrated teaching means that subjects are presented as a meaningful whole. Students will be able to have better understanding of basic sciences when they repeatedly learn in relation to clinical examples. Case-based discussions, computer-based assignments, early exposure to clinics, wards, and skills acquisition in skills lab are characteristics of integrated teaching program.

## INTEGRATING DISCIPLINES OF NEUROSCIENCES MODULE-I



### LEARNING METHODOLOGIES

The following teaching / learning methods are used to promote better understanding:

- Interactive Lectures
- Small Group Discussion
- Case- Based Learning
- Practicals
- Skills session
- Self-Directed Learning

### INTERACTIVE LECTURES

In large group, the lecturer introduces a topic or common clinical conditions and explains the underlying phenomena through questions, pictures, videos of patients' interviews, exercises, etc. Students are actively involved in the learning process.

**SMALL GROUP DISCUSSION:** This format helps students to clarify concepts acquire skills or attitudes. Sessions are structured with the help of specific exercises such as patient case, interviews or discussion topics. Students exchange opinions and apply knowledge gained from lectures, tutorials and self study. The facilitator role is to ask probing questions, summarize, or rephrase to help clarify concepts.

**CASE- BASED LEARNING:** A small group discussion format where learning is focused around a series of questions based on a clinical scenario. Students' discuss and answer the questions applying relevant knowledge gained in clinical and basic health sciences during the module.

**PRACTICAL:** Basic science practicals related to anatomy, biochemistry, pathology, pharmacology and physiology are scheduled for student learning.

**SKILLS SESSION:** Skills relevant to respective module are observed and practiced where applicable in skills laboratory or Department of Physiotherapy.

**SELF DIRECTED LEARNING:** Students' assume responsibilities of their own learning through individual study, sharing and discussing with peers, seeking information from Learning Resource Center, teachers and resource persons within and outside the college. Students can utilize the time within the college scheduled hours of self-directed learning.

## MODULE 2: NEUROSCIENCES -I

### INTRODUCTION

Neuroscience is the study of the nervous system. It is a cross-disciplinary field that engages in investigating how the nervous system develops and functions on a cellular level as well as the mechanisms that underlie neurological disease. This module combines breadth of exposure to the field as a whole with the opportunity for depth of experience in one of three central domains of neuroscience: Cellular and Systems, Functional and Integration and Clinical Neurosciences.

When someone in the neighborhood develops stroke and the family wants to know what more can be done to improve the patient's lifestyle, or what are the chances his /her children will have stroke, it is our primary responsibility as future doctors to know not just the treatment but also preventive strategies for a healthy living.

Through this module you will develop an integrated, scientific knowledge that you can put into practice in a clinical setting, plus creative and problem-solving skills. These key skills will prepare you for a career helping to progress scientific discovery into clinical and medical practice, ultimately to improve human health.



**COURSE OBJECTIVES AND STRATEGIES**

At the end of the module the students will be able to:

**ANATOMY**

TOPICS & OBJECTIVES	LEARNING STRATEGIES	
<b>1. General organization of Nervous system, different types of nerve tissue cells (Neurons &amp; Neuroglia)</b> <ul style="list-style-type: none"> <li>• Explain the general components of nervous system</li> <li>• Discuss the division of nervous system into CNS, ANS &amp; PNS</li> <li>• Discuss the structural/ cellular organization of nervous system</li> <li>• Describe the structure of neuron &amp; neuroglia</li> <li>• List the types of neuron &amp; neuroglia</li> <li>• List the functions of neuron &amp; neuroglia</li> <li>• Discuss the formation of blood brain barrier</li> <li>• Identify the histological sections of neuron &amp; neuroglia under light microscope</li> </ul>	Interactive Lecture/ Tutorial/Prac tical	
<b>2. Development of Brain and Spinal cord &amp; anomalies (Embryology)</b> <ul style="list-style-type: none"> <li>• Describe the formation of primary &amp; secondary vesicles and flexures</li> <li>• Relate the components of ventricular system with the cavities of secondary vesicles.</li> <li>• Describe the differentiation of the layers from neuro-epithelium in primitive spinal cord.</li> <li>• Describe derivation of alar &amp; basal plates, neuron and neuroglia cells</li> <li>• Discuss positioning of spinal cord</li> <li>• Describe the congenital anomalies of spinal cord viz. Spina bifida occulta, spinal bifida cystica, Myeloschisis</li> </ul>		
<b>3. Gross External features of spinal cord</b> <ul style="list-style-type: none"> <li>• Discuss the extent (starting &amp; terminating point) of spinal cord</li> <li>• Describe the gross features of spinal cord and its blood supply</li> <li>• Discuss the regional enlargements of spinal cord</li> </ul>		
<b>4. Histology of spinal cord</b> <ul style="list-style-type: none"> <li>• Describe the distribution and components of gray and white matter in spinal cord.</li> <li>• Compare the sections at different segmental levels (cervical ,thoracic)</li> </ul>		
<b>5. Internal features of spinal cord I- (Ascending tracts)</b> <ul style="list-style-type: none"> <li>• Discuss the internal features of spinal cord, gray (groups) &amp; white (columns) matter.</li> <li>• Discuss 1<sup>st</sup>, 2<sup>nd</sup> &amp; 3<sup>rd</sup> order neurons of sensory pathway.</li> <li>• Discuss in detail the ascending (sensory) tracts of the spinal cord and their lesions</li> </ul>		Interactive Lecture/ Tutorial/ Self-directed learning
<b>6. Internal features of spinal cord II- (Descending tracts)</b> <ul style="list-style-type: none"> <li>• Discuss in detail the descending (motor) tracts of the spinal cord and their lesions</li> </ul>		
<b>7. Development of forebrain (Embryology)</b> <ul style="list-style-type: none"> <li>• Discuss the process of development of forebrain and its anomalies</li> </ul>		Interactive Lecture
<b>8. Development of midbrain &amp; hindbrain (Embryology)</b> <ul style="list-style-type: none"> <li>• Discuss the process of development of midbrain &amp; hindbrain and their anomalies</li> </ul>		

<b>9. Blood supply (arterial supply &amp; venous drainage) of spinal cord and clinical manifestations of ischemia</b>	
<ul style="list-style-type: none"> <li>Describe the Vertebral Systems of arteries</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the area of spinal cord supplied by different branches.</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the role of radicular and feeder arteries.</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the venous drainage of spinal cord</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the clinical consequences of ischemia of spinal cord</li> </ul>	
<b>10. Gross anatomy of Cerebellum</b>	
<ul style="list-style-type: none"> <li>Describe the gross anatomy of the cerebellum location, structural &amp; functional division(lobes )and its blood supply</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the folia, tracts and nuclei of cerebellum</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the clinical conditions associated with cerebellar dysfunction</li> </ul>	
<b>11. Histology of Cerebellum</b>	
<ul style="list-style-type: none"> <li>Describe the layers of cerebellar cortex.</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the cellular organization in each layer.</li> </ul>	
<b>12. Diencephalon I- Thalamus</b>	
<ul style="list-style-type: none"> <li>Describe the gross features, boundaries and division of diencephalon and its blood supply</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the gross features and relations of Thalamus.</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the nuclei, connections and functions of thalamus</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the clinical conditions associated with thalamus</li> </ul>	
<b>13. Diencephalon II- Sub thalamus, Hypothalamus &amp; Epithalamus</b>	
<ul style="list-style-type: none"> <li>Describe the location, relations, components and structure of subthalamus, hypothalamus &amp; epithalamus.</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss their nuclei, connections and functions.</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the lesions of sub thalamus, hypothalamus &amp; Epithalamus</li> </ul>	
<b>14. Limbic system &amp; Reticular formation</b>	
<ul style="list-style-type: none"> <li>Describe the various parts of limbic system</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the hippocampal formation</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the disorders of limbic system</li> </ul>	
<b>15. Basal ganglia &amp; its nuclei</b>	
<ul style="list-style-type: none"> <li>Describe the location and components of basal ganglia and their blood supply</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss their connections and functions</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the lesions of basal ganglia</li> </ul>	
<b>16. Histology of cerebrum</b>	
<ul style="list-style-type: none"> <li>Describe the layers of cerebral cortex.</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the variation of layers in different cortical regions.</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the types of neurons and fibers distributed in different layers</li> </ul>	
<b>17. White matter of cerebrum -I (Projection fibers and Internal capsule)</b>	
<ul style="list-style-type: none"> <li>Discuss the basic concepts of white matter of cerebrum.</li> </ul>	
<ul style="list-style-type: none"> <li>Describe the location, parts, connections and relations of internal capsule and its blood supply</li> </ul>	
<ul style="list-style-type: none"> <li>Discuss the common lesion associated with the internal capsule</li> </ul>	
Interactive Lecture/ Small Group Discussion	
Interactive Lecture	
Interactive Lecture/ Tutorial/ Practical	

<b>18. White matter of cerebrum- II (Commissural &amp; Association fibers)</b>	
• Discuss the commissural fibers and their connections	
• Describe corpus callosum and its parts	
• Explain the association fibers and their connections	
• Discuss the common lesions associated with commissural and association fibers	
<b>19. Blood supply of brain</b>	
• Discuss the carotid and vertebral systems of vessels	
• List the branches arising from them	
• Describe the formation of circle of Willis.	
• Discuss the area of supply of the 3 cerebral arteries.	
• Tabulate the veins of brain and their area of drainage.	
• Discuss the clinical manifestations of ischemia of brain	
• Discuss its branches	
<b>20. Meninges of brain &amp; spinal cord</b>	
• List the meninges of brain & spinal cord	
• Describe the Dural layers, folds, extensions and spaces (subdural etc.)	
• Discuss pia mater and its modifications (ligamentum denticulatum, tela choroidea).	
• Describe the arachnoid mater, subarachnoid space and cisterns.	
• Describe the blood and nerve supply of meninges.	
<b>21. Dural venous sinuses</b>	
• Describe the location, relations, and drainage of Dural venous sinuses of brain.	
• Describe the contents of cavernous sinus and extra cranial communication.	
• Discuss the clinical importance of different sinuses.	
<b>22. Autonomic nervous system</b>	
• Describe the divisions of ANS (sympathetic & parasympathetic)	
• Describe the components of sympathetic nervous system (thoracolumbar outflow: lateral gray horn, paravertebral sympathetic chain, prevertebral ganglia and plexuses)	
• Describe the varied fate of preganglionic and post ganglionic fibers.	
• Discuss the components of parasympathetic part of nervous system (craniosacral outflow: cranial nerve nuclei and sacral spinal segments)	
• List the parasympathetic ganglia	
• Describe the pathways of pre and postganglionic parasympathetic fibers.	
• Differentiate the 2 system on the basis of structure and function	
<b>23. Skull as whole, vault of skull and Anterior cranial fossa</b>	
• Describe the gross anatomy of skull	
• Discuss the sutures of skull	
• Discuss different views (normal) of skull	
• Discuss the division of the cranial cavity	
• Describe the boundaries, bony prominences and foramina of the anterior cranial fossa	
<b>24. Middle &amp; Posterior cranial fossa</b>	
• Describe the boundaries, bony prominences and foramina of the middle & posterior cranial fossa	
	Interactive Lecture
	Interactive Lecture/ Tutorial

<b>25. Spinal cord lesions, transection &amp; spinal shock</b>	
• Discuss the lesions of anterior & posterior nerve roots	
• Elaborate the lesions of ascending & descending tracts	
• Discuss the mechanism & consequences of tabes dorsalis, spinal shock syndrome, Brown Sequard syndrome, poliomyelitis, syringomyelia	
<b>26. Brainstem I- Medulla Oblongata</b>	
• Discuss the formation and parts of brainstem.	
• Describe the gross anatomical features of Medulla Oblongata and its blood supply	
• Discuss in detail the internal features of Medulla Oblongata.	
• Discuss the cranial nerves emerging from Medulla Oblongata.	
• Discuss the clinical importance of Medulla Oblongata	
<b>27. Brainstem II-Pons</b>	
• Describe the location of Pons	
• Discuss the external & internal features of Pons and its blood supply	
• Discuss the relation of Pons with 4th ventricle	
• Discuss the cranial nerves emerging from Pons	
• Discuss the clinical conditions associated with Pons	
<b>28. Brainstem III -Midbrain</b>	
• Describe the location of midbrain	
• Discuss the external & internal features of midbrain with its supply	
• Discuss the relation of Pons with cerebral aqueduct	
• Describes the cranial nerves emerging from midbrain	
• Discuss the clinical conditions associated with midbrain	
<b>29. Gross anatomy of Cerebrum (external features, surfaces, gyri &amp; sulci)</b>	
• Discuss the gross anatomical features of cerebrum (surfaces, borders, poles, lobes, sulci & gyri)	
• Describe the blood supply of cerebrum	
<b>30. Functional cortical areas of cerebrum &amp; their lesions</b>	
• Describe different functional areas of cerebral cortex (motor, sensory, auditory, visual)	
• Discuss the lesions of the functional cortical areas of cerebral cortex	
<b>31. Ventricular system I- Lateral ventricle</b>	
• Describe the ventricles of brain	
• Discuss the location, boundaries and relations of lateral ventricles and its blood supply	
• Discuss the clinical conditions associated with lateral ventricles	
<b>32. Ventricular system II- 3rd &amp; 4th ventricles and CSF circulation</b>	
• Describe the structure and location of 3rd and 4th ventricles, and cerebral aqueduct	
• Discuss briefly the normal CSF secretion, circulation & blood brain barrier	
• Discuss the applied anatomy of ventricles of brain and CSF flow	
<b>33. Cranial nerves (I to VI)</b>	
• Mention the names of all the cranial nerves in sequence	
• List the locations of the cranial nerve nuclei (I to VI)	
• Discuss their distribution	
• Describe the main effects of lesions of cranial nerves	
	Interactive Lecture/ Tutorial
	Interactive Lecture

<b>34. Cranial nerves (VII to XII)</b>	
• List the location of the cranial nerve nuclei (VII to XII)	
• Discuss their distribution	
• Describe the main effects of lesions of VII to XII cranial nerves	
<b>35. Functional cortical areas of cerebellum</b>	
• Discuss the location and lesions of the functional cortical areas of cerebellar cortex	
<b>36. Ventricular system and CSF circulation</b>	
• Discuss the ventricular system included lateral, 3rd and 4th ventricles with CSF circulation	
<b>37. Spinal cord and its cut sections (Demonstration on Sectra)</b>	
• Discuss the various cut sections of spinal cord and associated lesion	
<b>38. Spinal cord, spinal nerve &amp; ganglia</b>	
• Discuss the histological features of spinal cord, spinal nerve & ganglia	
• Identify the histological features of spinal cord, spinal nerve & ganglia under light microscope	
<b>39. Microscopic anatomy of cerebellar cortex</b>	Practical
• Discuss the histological features of cerebellum; its layers, cells & nuclei	
• Identify the histological features of cerebellar cortex under light microscope	
<b>40. Microscopic anatomy of cerebral cortex</b>	
• Discuss the histological features of cerebrum; its layers, cells & nuclei	
• Identify the histological features of cerebral cortex under light microscope	

## **BIOCHEMISTRY**

TOPICS & OBJECTIVES	LEARNING STRATEGIES
<b>1. Lipids of the nervous system: Chemistry of Brain Lipids</b>	Interactive Lecture/ Small Group Discussion
• Classify brain lipids with examples	
• Explain the chemistry of brain lipids	
• Describe the chemical composition and functions of myelin	
• Discuss the clinical significance of lipid storage diseases	
<b>2. Blood Brain Barrier</b>	Interactive Lecture
• Define and give the biochemical composition of the Blood Brain Barrier	
• Explain the functions of the Blood Brain Barrier	
• Explain the impact of Blood Brain Barrier disruption	
• Discuss the clinical disorders associated with Blood Brain Barrier disruption	
<b>3. Cerebrospinal fluid</b>	Interactive Lecture/ Practical
• Describe the chemical composition of CSF	
• Discuss the biochemical functions of CSF	
• Explain the mechanism of production, route of flow and re-absorption of CSF	
• Explain the procedure of lumbar puncture	
• Interpret the laboratory investigations of CSF in different diseases	
• Discuss the clinical importance of Cerebrospinal fluid	

• Interpret clinical conditions correlated with their laboratory investigations		
• Identify the chemical tests and bio-techniques to detect analytes in CSF		
• Identify the parts of LP needle		
• Interpret the laboratory report in different CNS diseases		
• Interpret clinical conditions correlated with their laboratory investigations		
<b>4. Introduction of Neurotransmitters</b>	Interactive Lecture/ Small Group Discussion/ Practical	
• Define Neurotransmitters		
• Classify Neurotransmitters with examples		
• Describe the mechanism of action and functions of Neurotransmitters		
• Classify receptors of Neurotransmitters		
• Explain the synthesis and degradation pathways of Neurotransmitters		
• Discuss the disorders associated with Neurotransmitter		
<b>5. Acetylcholine &amp; Dopamine</b>		
• Describe the chemical structure of Acetylcholine and Dopamine		
• Describe the metabolism of Acetylcholine and Dopamine		
• Explain the mechanism of action and functions of Acetylcholine & Dopamine		
• Discuss the receptors of Acetylcholine and Dopamine		
• Explain the clinical disorders associated with Acetylcholine and Dopamine		
• Discuss the clinical importance of Acetylcholine & Dopamine		
• Interpret clinical conditions correlated with their laboratory investigations		
<b>6. Serotonin &amp; GABA</b>	Interactive Lecture/ Small Group Discussion/ Practical	
• Describe the chemical structure of Serotonin and GABA		
• Describe the metabolism of Serotonin and GABA		
• Explain the mechanism of action and functions of Serotonin and GABA		
• Discuss the receptors of Serotonin and GABA		
• Explain the clinical disorders associated with Serotonin and GABA		
• Discuss the clinical importance of Serotonin & GABA		
• Interpret clinical conditions correlated with their laboratory investigations		
<b>7. Neurodegenerative diseases of CNS</b>		Interactive Lecture/ Tutorial
• List the common Neurodegenerative diseases		
• Discuss the common mediators of Neurodegenerative diseases		
• Discuss the biochemical changes in Neurodegenerative diseases		
• Describe the biochemical phenomenon of ageing		
• Discuss the clinical importance of neurodegenerative diseases		
• Interpret clinical conditions correlated with their laboratory investigations		
<b>8. Role of free radicals &amp; Vitamins in CNS disorders</b>		
• Explain the role of free radicals in Neurodegenerative diseases		
• List the free radicals causing degenerative diseases		
• List the sources of free radicals		
• Explain the mechanism of free radical injury		
• Describe the role of free radicals in diseases		
• Classify the antioxidants with examples		

• Discuss the process of oxidative stress response	Practical
• Discuss the biochemical importance of vitamins in neurological disorders	
• Discuss the sources, biochemical role and daily requirements of vitamins B1, B6, B9, B12 and folic acid	
• Explain the deficiency diseases related to these vitamins	
<b>9. CSF Glucose Estimation</b>	
• Identify the procedure & bio-technique to detect glucose in CSF	
• Estimate glucose in CSF	
• Interpret the laboratory report of glucose in CSF	
• Interpret clinical conditions correlated with their laboratory investigations	
<b>10. CSF Protein Estimation</b>	
• Identify the procedure & bio-technique to detect proteins in CSF	
• Estimate proteins in CSF	
• Interpret the laboratory report of proteins in CSF	
• Interpret clinical conditions correlated with their laboratory investigations	
<b>11. CSF Chloride Estimation</b>	
• Identify the procedure & bio-technique to detect chloride in CSF	
• Estimate chloride in CSF	
• Interpret the laboratory report of chloride in CSF	
• Interpret clinical conditions correlated with their laboratory investigations	

## PHYSIOLOGY

TOPICS & OBJECTIVES	LEARNING STRATEGIES
<b>1. Neurons membrane, generation &amp; propagation of nerve impulse</b>	Interactive Lecture/ Small Group Discussion
• Elaborate the structure and functions of a neuron	
• Discuss the classification & functions of nerve fibers	
• Describe the threshold & initiation of action potential in neuronal cells	
• Describe the propagation of nerve impulse/ saltatory conduction	
<b>2. Synapsis, properties of synapses</b>	
• Describe the properties of chemical and electrical synapses	
<b>3. Sensory receptors and neuronal circuits</b>	
• Discuss the classification of sensory receptors	
• Describe the functions & properties of different types of receptors	
• Explain the properties of different types of neuronal circuit	
<b>4. Somatic sensations</b>	
• Explain the general organization of somatic sensation: tactile and position senses	
• Discuss the dorsal-column medial lemniscal pathway	
• Discuss the anterolateral pathway	
• Describe the mechanism of thermal receptors & their excitation	
<b>5. Physiology of pain – I &amp; headache</b>	
• Discuss the types of pain (slow & fast) and their characteristics	
• Explain the mechanism of stimulation of pain receptors	
• Discuss the clinical abnormalities of pain: hyperalgesia, headache & its causes	

<b>6. Physiology of pain II- Brain analgesic system</b>
• Explain the analgesic system of brain
• Discuss the opiate system of brain
• Describe visceral & referred pains
<b>7. Spinal cord and reflexes</b>
• Describe the motor function of spinal cord
• Discuss the mechanism of flexor reflex, crossed extensor reflex, scratch reflex, postural & locomotive reflexes
• Discuss spinal cord transection & spinal shock (Brown Sequard syndrome)
<b>8. Muscles proprioceptors (muscle spinal &amp; Golgi tendon organ)</b>
• Explain the structure & function of muscle spindle
• Discuss the muscle, stretch reflex & its clinical applications
• Explain the mechanism of Golgi tendon reflex& its significance in controlling motor activities
<b>9. Somatosensory cortex</b>
• Discuss the orientation of various areas of cortex and their associated function
• Describe the layers of somatic sensory cortex and their functions
<b>10. Function of brain stem</b>
• Explain the role of brain stem nuclei in controlling motor functions
• Discuss the vital and non- vital functions of brain stem (respiratory, cardiac, vasomotor centers & coughing, sneezing & vomiting reflexes)
<b>11. Cerebellum and its functions</b>
• Explain the functions of cerebellum & its associated disorders
• Discuss the afferent and efferent pathways of cerebellum
<b>12. Vestibular system and maintenance of equilibrium</b>
• State the names of the parts of vestibular system
• Explain the functions of the vestibular system
• Discuss the role of utricle & saccule in static equilibrium
• Discuss the role of semicircular ducts in angular acceleration
<b>13. Functions of diencephalon</b>
• Discuss the function of thalamus and its nuclei
<b>14. Limbic system</b>
• Describe the functions of limbic system
• Discuss the role of hypothalamus in limbic system
• Discuss the importance of reward and punishment centers
• Elaborate the role of hippocampus and amygdala
• Discuss the effects of Kluver-Bucy syndrome
<b>15. Basal ganglia and its nuclei</b>
• Explain the functions of caudate & putamen pathways
• List the functions of specific neurotransmitters of basal ganglial system
• Explain the disorders associated with basal ganglia (hypokinetic and hyperkinetic)
<b>16. Motor cortex, pyramidal tract, Upper and lower Motor Neurons</b>
• Explain the functions of pyramidal tract
• List the functions of specific cortical areas
• Differentiate between upper & lower motor neuron lesions (UMN & LMN)

<b>17. Physiology of sleep &amp; sleep disorders</b>	
• Explain the physiology of slow wave sleep & rapid eye movement (REM) sleep	
• Explain the basic theories of sleep & origin of brain waves	
<b>18. Learning and memory</b>	
• Determine the role of cerebral cortex in higher intellectual functions	
• Classify the different types of memories	
<b>19. CSF: formation, circulation &amp; function</b>	
• Describe the mechanism of CSF formation, its circulation & functions	
<b>20. Autonomic Nervous System</b>	
• Describe the functions of sympathetic & parasympathetic nervous system	
<b>21. Speech &amp; its disorders</b>	
• Explain the physiology of speech and associated disorders	
<b>22. Examination of Superficial reflexes</b>	
• Elicit superficial reflexes viz. Corneal reflexes, Abdominal reflexes & Plantar reflexes	
• Describe their significance in different neurological disorders	
<b>23. Examination of Deep reflexes</b>	
• Perform deep reflexes	
• Describe their significance	
<b>24. Cerebellar function tests</b>	
• Perform cerebellar function tests	
• Identify disorders of cerebellar function	
<b>25. Body temperature</b>	
• Determine the body temperature by using oral mercury thermometer	
<b>26. EEG</b>	
• Interpret brain waves with the help of power lab	
<b>27. Examination of Cranial Nerves (V, VII, IX, X)</b>	
• Perform different tests for examination of the cranial nerves	Practical

**LEARNING RESOURCES**

<b>SUBJECT</b>	<b>RESOURCES</b>
<b>ANATOMY</b>	<p><b>A. <u>GROSS ANATOMY</u></b></p> <ol style="list-style-type: none"> <li>1. K.L. Moore, Clinically Oriented Anatomy</li> <li>2. Neuro Anatomy by Richard Snell</li> </ol> <p><b>B. <u>HISTOLOGY</u></b></p> <ol style="list-style-type: none"> <li>1. B. Young J. W. Health Wheather’s Functional Histology</li> </ol> <p><b>C. <u>EMBRYOLOGY</u></b></p> <ol style="list-style-type: none"> <li>1. Keith L. Moore. The Developing Human</li> <li>2. Langman’s Medical Embryology</li> </ol>
<b>BIOCHEMISTRY</b>	<p><b>A. <u>TEXTBOOKS</u></b></p> <ol style="list-style-type: none"> <li>1. Harper’s Illustrated Biochemistry</li> <li>2. Lehninger Principle of Biochemistry</li> <li>3. Biochemistry by Devlin</li> </ol>
<b>PHYSIOLOGY</b>	<p><b>A. <u>TEXTBOOKS</u></b></p> <ol style="list-style-type: none"> <li>1. Textbook Of Medical Physiology by Guyton And Hall</li> <li>2. Ganong ‘ S Review of Medical Physiology</li> <li>3. Human Physiology by Lauralee Sherwood</li> <li>4. Berne &amp; Levy Physiology</li> <li>5. Best &amp; Taylor Physiological Basis of Medical Practice</li> </ol> <p><b>B. <u>REFERENCE BOOKS</u></b></p> <ol style="list-style-type: none"> <li>1. Guyton &amp; Hall Physiological Review</li> <li>2. Essentials Of Medical Physiology by Jaypee</li> <li>3. Textbook Of Medical Physiology by InduKhurana</li> <li>4. Short Textbook Of Physiology by Mrthur</li> <li>5. NMS Physiology</li> </ol>



**OTHER LEARNING RESOURCES**

<b><u>Weblink</u></b>	<a href="http://www.who.int/mental_health/neurology/neurological_disorders_report_web.pdf">http://www.who.int/mental_health/neurology/neurological_disorders_report_web.pdf</a>
<b><u>Hands-on Activities/ Practical</u></b>	Students will be involved in Practical sessions and hands-on activities that link with the Nervous system I module to enhance the learning.
<b><u>Labs</u></b>	<ul style="list-style-type: none"> <li>Utilize the lab to relate the knowledge to the specimens and models available.</li> </ul>
<b><u>Skill Labs</u></b>	<ul style="list-style-type: none"> <li>A skills lab provides the simulators to learn the basic skills and procedures. This helps build the confidence to approach the patients.</li> </ul>
<b><u>Videos</u></b>	Video familiarize the student with the procedures and protocols to assist patients.
<b><u>Computer Lab/CDs/DVDs/Internet Resources:</u></b>	To increase the knowledge students should utilize the available internet resources and CDs/DVDs. This will be an additional advantage to increase learning.
<b><u>Self Study</u></b>	Self Study which generally means studying without direct supervision. During this session one learns by himself/herself to search for information to solve cases, read through different resources and discuss among the peers and with the faculty to clarify the concepts.

**ASSESSMENT METHODS:**

- **Best Choice Questions(BCQs)** also known as MCQs (Multiple Choice Questions)
- **Objective Structured Practical/Clinical Examination (OSPE or OSCE)**

**Internal Evaluation**

- Students will be assessed comprehensively through multiple methods.
- 20% marks of internal evaluation will be added to JSMU final exam. That 20% may include class tests, assignment, practicals and the internal exam which will all have specific marks allocation.

**Formative Assessment**

Individual department may hold quiz or short answer questions to help students assess their own learning. The marks obtained are not included in the internal evaluation

**For JSMU Examination Policy, please consult JSMU website!**

**More than 75% attendance is needed to sit for the internal and final examination**



**LNH&MC EXAMINATION RULES & REGULATIONS**

- Student must report to examination hall/venue, 30 minutes before the exam.
- **Exam will begin sharp at the given time.**
- No student will be allowed to enter the examination hall after 15 minutes of scheduled examination time.
- Students must sit according to their roll numbers mentioned on the seats.
- **Cell phones are strictly not allowed in examination hall.**
- If any student is found with cell phone in any mode (silent, switched off or on) he/she will be not be allowed to continue their exam.
- No students will be allowed to sit in exam without University Admit Card, LNMC College ID Card and Lab Coat
- Student must bring the following stationary items for the exam: Pen, Pencil, Eraser, and Sharpener.
- Indiscipline in the exam hall/venue is not acceptable. Students must not possess any written material or communicate with their fellow students.

**SCHEDULE:**

WEEKS	2nd YEAR	MONTH
WEEK 1	GIT & LIVER MODULE-I	28 <sup>th</sup> February 2022
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		31 <sup>st</sup> March 2022
WEEK 1	NEUROSCIENCE MODULE-I	4 <sup>th</sup> April 2022
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		
WEEK 6		
WEEK 7		26 <sup>th</sup> May 2022
WEEK 1	HEAD & NECK MODULE	May 2022*
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		
WEEK 6		
WEEK 7		August 2022*
<b>Mid Term Examination*</b>		

\*Final dates will be announced later.

