COURSE PLAN

FIRST: BASIC INFORMATION

College	
College	: College of Medicine
Department	: Basic Medical Sciences
Course	
Course Title	: Nervous System and Special Senses
Course Code	: 31500311
Credit Hours	: 7 Credit Hours / 8 Weeks of Teaching
Prerequisite	: N/A
Instructor	
Name	: Multi-disciplinary staff members; Dr. Ezidin Kaddumi (course Coordinator)
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Office Hours	: Provided by each staff member

Class Times

Building	Day	Start Time	End Time	Room No.
Lecture halls complex	S M T W T	9:00	12:00	Auditorium 2
College of Science laboratories	S M T W T	12:00	4:00	- Anatomy lab - Histology & Pathology lab

Text Book

Anatomy:

- Clinical Neuroanatomy for Medical Students By R.S Snell. Latest Edition.
- Clinical Anatomy for Medical Students. By R. S. Snell, Latest Edition.
- Any Atlas of neuroanatomy, Latest Edition.
- Basic Histology. By L. Carlos Junqueira, Latest Edition.
- Before we are born. By K. L. Morre and T. V. N. Persaud, Latest Edition.

Physiology:

- Textbook of Medical Physiology. By Guyton and Hall, Latest Edition.
- Concise Text of Neuroscience, by R. E. Kingsley, Latest Edition.

Biochemistry:

- Harper's Biochemistry. By Robert K. Murray and Co. Latest Edition.
- Supplementary Departmental Handouts.

Pharmacology:

- Lippincott's Illustrated Reviews Pharmacology, Latest edition.
- Basic and Clinical Pharmacology. By Katzung, Latest Edition.
- Goodman and Gilman's: The pharmacological basis of therapeutics, Latest edition
- Clinical Pharmacology. D.R. Laurence, P.N. Bennet, and M.J. Brown. Churchill Livingstone, Latest edition.
- Supplementary handouts.

Pathology:

- Basic Pathology. By Kumar, Cotran and Robbins, Latest Edition.
- Essential of Pathology Rubin, Latest Edition.
- Supplementary handouts.

Microbiology:

- Medical Microbiology. An Introduction to Infectious Diseases. By Sherris, Latest Edition.

References

Provided for each discipline by staff members.

SECOND: PROFESSIONAL INFORMATION

COURSE DESCRIPTION

This course covers nervous system and special senses from the stand points of anatomy, histology and organization of the central and peripheral nervous system including the brain, spinal cord, and nerves including their motor and sensory functions in addition to the study of vision, hearing and chemical sense, cerebral cortex and intellectual functions, neurotransmission including its chemistry, receptors and neurotransmitters, and chemistry of vision. It also covers diseases of the central nervous system and organs of special senses including bacterial, viral, fungal and parasitic infections, brain edema, hydrocephalus, vascular disturbances, trauma, congenital malformations, tumors, degenerative and immune-mediated disorders and the drugs used for the treatment of these diseases. The course is concluded by covering the clinical aspects of disease that affect the central and peripheral nervous system as well as special senses.

COURSE OBJECTIVES

Upon completion of this course students should be able to:

1. Describe the anatomical and histological structures of different parts of the nervous system and understand their functions.
2. Explain the biochemical basis of different disorders affecting nervous system.
3. Distinguish the pathological conditions affecting the nervous system.
4. Select the appropriate diagnostic tests and treatments for certain NS disorders.

COURSE LEARNING OUTCOMES

1. Outline the general organization of the nervous system (NS).
2. Describe the gross features of the human central nervous system(CNS) (brain and spinal cord).
3. Describe brain coverings, cerebrospinal fluid (CSF), and blood supply of the central nervous system.
4. Define the structural basis, physiological, and pharmacological properties of the pathways that transmit sensory and motor information in the CNS.
5. Describe the anatomical and physiological basis for higher-order cortical functions.
6. Describe pathogens that infect the CNS and the specific diseases related to the infection process.
7. Describe the pathological changes in central nervous system tissue that underlies various neurological diseases.

8. Describe the principles that guide our understanding of human behavior and the biochemical basis of various behavioral disorders.
9. Describe the pharmacology of drugs employed in the management of various mental and neurological disorders.
10. Explain the mechanisms of sensing the various environmental stimuli.
11. Analyze the structures conveying information to and from the central nervous system.
12. Explain how drugs modify the functions of the peripheral nervous system.
13. Describe common infections affecting the nervous system.
14. Explain symptoms, signs, investigations and forms of treatments of nervous system's anomalies.
15. Correlate lesion sites at specific levels of the central nervous system with neurological and pathological findings of various neurological disorders.
16. Demonstrate the various possibilities where things can go wrong in different parts of the peripheral nervous system.

COURSE SYLLABUS

#	LECTURE TITLE	LECTURE OBJECTIVES
	Week 1	
1	Introductory lecture **(Coordinator)**	1. Understand the general outline of the Neuroscience module. 2. Be familiar with the modalities of teaching throughout the course. 3. Acknowledge the important relation between normal and abnormal structure and function. 4. Appreciate the importance of basic neurosciences in clinical application and neurology.
2	Introduction and basic structural organization of the NS **(Anatomy 1)**	1. Describe the organization of the NS. 2. Overview of the main parts of the CNS. 3. Identify the main parts of the brain in CT scan and MRI. 4. Describe the surface anatomy of the brain. 5. Briefly describe the brain ventricles and meninges. 6. Explain the concept of nuclei, fasciculi, lemnisci, tracts, laminae, white and gray matter inputs (afferent) and outputs (efferent).
3	Microscopic structure of the NS **(Anatomy 2)**	1. Classify the types of neurons. 2. Describe the structure of the different parts of neurons. 3. Describe the process of myelination of myelinated axons. 4. Describe the types of glia cells and their functions. 5. Describe the structure of peripheral nerves. 6. Describe the structure of ganglia (sensory and autonomic).
4	Gross morphology of the brain **(Anatomy 3)**	1. Demarcate the major lobes, gyri and sulci of the cerebral hemisphere. 2. Describe the organization of the cerebral hemisphere into cerebral cortex, white matter and nuclei. 3. Describe the types of fibers in the white matter of the cerebral hemisphere: projection (internal capsule), commissural and association fibers. 4. Identify the basal nuclei. 5. Identify main parts of the diencephalons and name the main functions of each part. 6. Define parts of the brainstem and briefly describe its internal structure. 7. Identify the superficial attachments of the cranial nerves.

5	Metabolism of neurotransmitters **(Biochemistry 1)**	1. Discuss the synthesis and degradation of gamma-amino-butyric acid (GABA). 2. Discuss the synthesis and degradation of dopamine, epinephrine and nor-epinephrine. 3. Discuss the formation and catabolism of serotonin. 4. Discuss the glutamate metabolism. 5. Understand the brain peptides as neurotransmitters.
6	Cerebral cortex (**Anatomy 4**)	1. Describe the organization of the cerebral cortex. 2. Locate the motor, sensory and other cortical areas. 3. Describe the cortical areas related to the written and spoken language. 4. Identify the components of the medial temporal lobe and the hippocampal formation. 5. Identify the structures in coronal, sagittal and horizontal sections of brain.
7	Gross morphology of spinal cord (**Anatomy 5)**	1. Describe the gross anatomical features of the spinal cord. 2. Describe the formation and components of spinal nerves. 3. Describe the level of the different spinal segments compared to the level of their respective vertebrae. 4. Identify important gross features of spinal cord, nerve roots, and spinal ganglia. 5. Describe the internal features of spinal cord (gray matter and white matter) in the different regions. 6. Summarize the location, origin, course and termination of the important ascending and descending tracts of spinal cord.
8	Characteristic features of CNS pathology **(Pathology 1)**	1. To know the selectivity of disease and vulnerability of certain areas to specific disease processes. 2. To know the types and functions of the various elements in the CNS & their response to injury. 3. To know the types of cerebral herniations, their anatomical locations & complications. 4. To know the pathology of cerebral edema. 5. To know the types, causes & effects of hydrocephalus. 6. List the malformations and developmental diseases including neural tube defects with or without hydrocephalus.
9	Brain meninges, ventricles and CSF **(Anatomy 6)**	1. Describe the arrangement of the meninges and their relationship to brain and spinal cord. 2. Explain the occurrence of epidural, subdural and subarachnoid spaces. 3. Locate the principal subarachnoid cisterns, and arachnoid granulations. 4. Describe the ventricles of brain and importance of their choroids plexus. 5. Summarize the pathway of cerebrospinal fluid (CSF) circulation. 6. Locate the safe sites for the lumbar puncture. 7. Identify brain ventricles in CT scan, MRI and ventriculograms.
10	Blood supply of the CNS **(Anatomy 7)**	1. Describe the four arteries supplying the CNS. 2. Follow up each artery to its destination. 3. Describe the circle of Willis and its branches. 4. Discuss the principle of end artery type of circulation. 5. Describe venous drainage and circulation of the brain.
11	Physiology of the brain circulation and CSF Formation	1. Explain types of Blood–brain barrier. 2. Discuss functions of the blood-brain barrier. 3. Discuss regulation of cerebral blood flow. 4. Discuss cerebral microcirculation.

	(Physiology 1)	5. Explain brain Metabolism. 6. Explain function of cerebro-spinal fluid (CSF). 7. Discuss composition of CSF comparing to plasma.
12	Bacterial meningitis **(Microbiology 1)**	- Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, prevention of meningitis caused by *Neisseria meningitidis*, group B Streptococci, S. Pneumoniae, Hemophilus influenzae, and *Listeria monocytogenesis*.
13	Language and memory (I) **(Physiology 2)**	1. Functions of specific cortical areas. 2. Discuss cortical association areas. 3. Discuss Complementary specialization of the hemispheres versus "cerebral dominance". 4. Explain language mechanism. 5. Explain dyslexia & aphasias. 6. Discuss memory. 7. Discuss neuronal basis of memory. 8. Explain multi-store model memory: A. Sensory memory B. Short-term memory
14	Language and memory (II) **(Physiology 3)**	1. Discuss Working memory: C. Discuss Intermediate long-term memories. D. Discuss Long-term memory. 2. Explain consolidation of memory. 3. Explain number of neurons and their connectivity often change significantly during learning. 4. Explain structural changes occur in synapses during development of long-term memory. 5. Discuss synaptic plasticity. 6. Discuss role of different areas in brain in relation to memory. 7. Discuss emotion relation to memory.
15	Vascular diseases of the CNS **(Pathology 2)**	1. Define stroke, transient ischemic attack, and the areas & cells in the brain, which are most susceptible to ischemia & hypoxia. 2. Describe global/ ischemic encephalopathy, laminar necrosis, Border-Zone (Watershed) infarcts. 3. Understand regional infarction and describe their pathology. 4. Know the types of intracranial hemorrhage & their pathological features. 5. Know the effects of hypertension on the brain.
		Week 2
16	The biochemical basis of selective neurological disorders **(Biochemistry 2)**	1. Discuss the sphingolipids metabolism and their disorders (sphingolipidoses). 2. Understand the biochemical bases of Huntington disease. 3. Understand the biochemical bases of Alzheimer disease. 4. Understand the role of biochemical mechanisms in brain damage due to stroke.
17	Vascular disease and trauma of the CNS	1. List the types of aneurysms in the brain, their pathology, and outcome of their rupture. 2. Define berry aneurysms in the circle of Willis and describe their clinical and pathological manifestations. 3. Describe the types, morphology, pathology and complications of open and closed injury to the brain.

	(Pathology 3)	4. Describe the pathology of diffuse axonal injury. 5. List the complications of trauma to the brain and spinal cord. 6. List the types of perinatal brain injury.
18	Histology of the CNS **(Anatomy 10)**	1. Describe the histology of the cerebral cortex layers. 2. Describe the histological features of the cerebellum; layers and cells of cerebellar cortex. 3. Describe the elements of the blood-brain barrier and the blood-CSF barrier. 4. Describe the structure of the choroid plexus and the meninges.
19 & 20	Development of CNS **(Anatomy 8 & 9)**	1. Describe the formation of neural tube and neural crest. 2. Describe the development of brain and spinal cord. 3. Describe the positional changes of spinal cord. 4. Describe the development of the spinal nerves and their spinal ganglia. 5. Describe the development of meninges. 6. Describe the development of brain vesicles from the neural tube. 7. Describe the development of the different parts of brain. 8. Describe the development of brain ventricles and choroid plexuses. 9. Describe the development of the cranial nerves and their ganglia. 10. Describe the congenital anomalies of brain and spinal cord.
21	Viral and fungal meningitis **(Microbiology 2)**	1. Describe the morphology, physical properties, pathogenesis, laboratory diagnosis of, Enteroviruses: Polio viruses, basic structural, morphological and physical properties, epidemiology, pathogenesis, clinical presentation, laboratory diagnosis, and prevention. 2. Describe Cryptococcus neoformans, its morphology, cultural characteristics, pathogenesis, laboratory diagnosis, its importance.
22 & 23	Infections of CNS **(Pathology 4 & 5)**	1. Compare & contrast the clinical and pathological findings in bacterial and viral meningitis. 2. Know the pathology of tuberculous meningitis and tuberculoma. 3. List the types of syphilitic & fungal diseases in the brain. 4. Describe viral encephalitis and the main morphological features in the commoner types. 5. Know about prion diseases in the CNS.
24 & 25	Brainstem & Diencephalon **(Anatomy 11 & 12)**	1. Identify the gross features of the brainstem. 2. Briefly describe the internal structure of the brainstem (ascending and descending pathways, sensory and motor cranial nuclei, substantia nigra, red nucleus, olivary nucleus and reticular formation). 3. Describe the main connections of the sensory cranial nuclei. 4. Describe the main connections of the motor cranial nuclei. 5. Review the blood supply of the brainstem. 6. Describe lesions in the brainstem such as medial medullary syndrome and lateral medullary syndrome. 7. Describe the main connections of the substantia nigra and the red nucleus. 8. Describe the main connections of RF and correlate these connections with its main functions. 9. Describe the anatomical features of the diencephalon; components, location and relations.
26 & 27	The Limbic System and the Hypothalamus (I & II)	1. Discuss Reticular formation: - Ascending reticular formation. - Descending reticular formation.

	(Physiology 4 & 5)	2. Discuss ascending activating-driving systems of the brain. 3. Explain (1) Neuronal system control of cerebral activity. 4. Explain (2) Neuro-hormonal systems. 5. Explain hypothalamus: hypothalamic input, hypothalamic output. 6. Discuss hypothalamic functions: - Control of pituitary gland (anterior and posterior lobe). - Control of autonomic functions. - Relation to cyclic phenomena & sleep. - Relation to hunger. - Relation to Thirst (Neural Mechanisms of Thirst). - Relation to thermal regulation (Hypothalamic role in controlling body temperature), Fever (hyperthermia), Hypothermia. 7. Discuss limbic system. 8. Discuss main components of the limbic system. 9. Discuss reward and punishment function of limbic system: a. Reward center or pleasure center, b. Punishment Centers. 10. Discuss effects of stimulating the amygdala. 11. Explain effects of bilateral ablation of the amygdala (The Klüver-Bucy Syndrome).
28	Drugs used in schizophrenia and psychotic disorders **(Pharmacology 1)**	1. Describe the dopamine hypothesis of schizophrenia. 1. List the major receptors blocked by antipsychotic drugs. 2. Describe the classifications of antipsychotic drugs. 3. Describe the pharmacodynamics of antipsychotic drugs and correlate these pharmacodynamic to their clinical uses. 4. List the adverse effects and the behavior effects of the major antipsychotic drugs. 5. Describe the pharmacokinetics and pharmacodynamic of lithium.
29	Antidepressants **(Pharmacology 2)**	1. Describe the monoamine theory of depression. 2. Describe the classification of antidepressants. 3. Describe the probable mechanisms and the major pharmacodynamic properties of tricyclic antidepressants. 4. List the toxic effects that occur during chronic therapy and after an overdose of tricyclic antidepressants. 5. Describe the therapeutic use and toxic effects of MAO inhibitors. 6. Identify the second and third generation antidepressants and their distinctive properties. 7. Identify the prototype selective serotonin reuptake inhibitor and list its major characteristics. 8. Identify the major drug interactions associated with the use of antidepressant drugs.
30	Electroencephalogram (EEG) & Sleep **(Physiology 6)**	1. Explain electroencephalogram; Alpha wave, Beta wave, Gamma wave, Theta wave &, Delta wave. Sleep 2. Explain sleep patterns: a. Rapid eye movement (REM) sleep (Paradoxical or Desynchronized sleep), b. Non-rapid eye movement (NREM) or slow-wave sleep. 3. Explain physiological function of sleep. 4. Explain basic theories of sleep. 5. Explain sleep stages.
Week 3		

31	Sedative-hypnotics **(Pharmacology 3)**	1. Identify the major chemical classes of sedative-hypnotics. 2. Describe the sequence of CNS effects of a typical sedative-hypnotic over the entire dose range. 3. Describe the pharmacodynamics of benzodiazepines, including interactions with neuronal membrane receptors. 4. Compare the pharmacokinetics of commonly used benzodiazepines and barbiturates and discuss how differences among them affect clinical use. 5. Describe the clinical uses of sedative-hypnotics. 6. Describe the common adverse effects and drug interaction of sedative-hypnotics. 7. Understand tolerance and dependence induced by sedative-hypnotics. 8. Understand the therapeutic indications and adverse effects of benzodiazepines antagonists.
32	Drugs used in epilepsy **(Pharmacology 4)**	1. Describe the major drugs for partial seizures, generalized tonic-clonic, absence, myoclonic seizures, and status epilepticus. 2. List the mechanism of action, adverse effects and drug-drug interaction of each drug. 3. Understand the importance of Therapeutic drug monitoring in the follow -up of patients taking antiepileptic drugs. 4. Describe the pharmacokinetic factors that must be considered in designing a dosage regimen for antiepileptic drugs. 5. List the new antiepileptic drugs and describe their advantages, major indications and adverse effects.
33 & 34	Motor pathways **(Anatomy 13 & 14)**	1. Define the terms upper and lower motor neurons with examples. 2. Describe the corticospinal (pyramidal) tract and the direct motor pathways from the cortex to the trunk and limbs. 3. Briefly describe the indirect motor pathways from the cortex to the trunk and limbs through extrapyramidal tracts such as rubrospinal and reticulospinal tracts. 4. Describe motor pathways to the face muscles. 5. Compare the signs and symptoms of the upper and lower motor neuron lesions. 6. Identify the centers that make the basal ganglia. 7. Identify the different parts, regions and nuclei of the cerebellum. 8. Summaraize the motor system circuitry.
35	Higher motor control **(Physiology 7)**	1. Discuss primary motor cortex (M I: Brodmann's area 4): Function; characteristics of vertical columns. 2. Discuss supplementary motor area (M-II). 3. Discuss pre-motor cortex (M III). 4. Discuss specialized area of motor control found in human motor cortex. 5. Explain simplified linear sequence of events of Voluntary movements. 6. Explain transmission of signals from the motor cortex to the muscle.
36	Basal ganglia **(Physiology 8)**	1. Explain anatomical structure of basal ganglia. 2. Explain the functions of the basal ganglia. 3. Explain neuronal circuitry of the Basal Ganglia: • First: executive loop: A. The putamen circuit (a. Direct Pathway (Excitatory), b. Indirect Pathway, c. hyper-direct' pathway), the cortico-subthalamo-pallidal (inhibitory), B. The nigrostriatal pathway. • Second: cognitive loop (The caudate circuit).

		• Third: Limbic loop. • Fourth: Occulo-motor loop. 4. Explain Abnormal Function in the Putamen Circuit, Disorders of the Basal Ganglia.
37	Antiparkinsonism drugs **(Pharmacology 5)**	1. Describe the neurochemical imbalance underlying the symptoms of Parkinson's disease. 2. Identify the mechanisms by which drugs can alleviate parkinsonism. 3. Describe the therapeutic and toxic effects of the major antiparkinsonism drugs. 4. Identify the compounds that inhibit DOPA decarboxylase and COMT and describe their use in parkinsonism. 5. Identify the chemical agents and drugs that cause Parkinson symptom.
38	Cerebellum **(Physiology 9)**	1. Explain Functions of cerebellum. 2. Explain Neuronal Circuit of the Cerebellum: Afferent Pathways from other parts of the brain; Afferent Pathways from the Periphery. 3. Explain the three major layers of the cerebellar cortex. 4. Explain Functional Unit of the Cerebellar Cortex (canonical circuit): cerebellar cortex neuronal cells: a. The Purkinje cells, b. the granule cells; Basket cells, Stellate cells, Golgi cells 5. Discuss afferent pathway to cerebellar cortex circulatory neurons: a. the climbing fibers; b. the mossy fibers. 6. Discuss efferent pathway to cerebellar cortex circulatory neurons. 7. Discuss Turn-On/Turn-Off (agonist muscle) and Turn-Off/Turn-On (antagonist muscle) Output Signals from the cerebellum. 8. Discuss Function of the cerebellum in overall motor control: 1. the vestibule-cerebellum (or flocculo-nodular lobe), 2. The spino-cerebellum, 3. The cerebro-cerebellum. 9. Discuss clinical abnormalities of the cerebellum.
Week 4		
Midterm Exam		
39	General sensory pathways of the trunk and limbs **(Anatomy 15)**	1. Describe gracile and cuneate tracts and pathways for conscious proprioception, touch, pressure and vibration from the limbs and trunk. 2. Describe dorsal and ventral spinocerebellar tracts and pathways for unconscious proprioception from the limbs and trunk. 3. Describe lateral spinothalamic tract and pathways for pain and temperature from the limbs and trunk. 4. Describe ventral spinothalamic tract and pathways for simple touch from the limbs and trunk.
40	General sensory pathways of the face area, Taste pathways and Hearing pathways **(Anatomy 16)**	1. Describe pathways for general sensations (pain, temperature, touch and proprioception) from the face area. 2. Describe taste pathways. 3. Describe hearing pathways.
41	Sensory system (I) **(Physiology 10)**	1. Discuss the thermal receptors and their excitation. 2. Explain warmth receptors mechanism of function. 3. Explain cold receptors mechanism of function. 4. Discuss stimulation of thermal receptors (sensations of cold, cool, indifferent, warm, and hot). 5. Discuss adaptation of thermal receptors. 6. Explain mechanism of stimulation of thermal receptors.

		7. Discuss spatial summation of thermal sensations. 8. Discuss pain receptors and sensation characteristics. 9. Explain causes of pain. 10. Explain pathophysiological types of Pain.
42	Opioids and opioid antagonists **(Pharmacology 6)**	1. List the receptors affected by opioid analgesics and the endogenous opioid peptides. 2. List of major opioid agonists and rank them in analgesic efficacy. 4. Describe the main pharmacodynamic and pharmacokinetic properties of agonist opioid analgesics and list their clinical uses. 5. List the main adverse effects of acute and chronic use of opioid analgesics. 6. Identify opioid receptor antagonists and mixed agonist-antagonist.
43	Sensory system (II) **(Physiology 11)**	1. Discuss referred pain; Visceral Pain (Visceral Receptors). 2. Discuss pain modulation. 3. Discuss the endogenous opiate system. 4. Discuss structure of cerebral cortex. 5. Explain somatosensory Areas I and its functions & somatosensory association area. 6. Explain Function of the thalamus in somatic sensation.
44	The orbit, orbital contents and cranial nerves III, IV and VI **(Anatomy 17)**	1. Describe the location of the orbit. 2. Make a list of structures making the orbit starting from orbital margin. 3. Define each component. 4. Describe openings into orbital cavity. 5. Define the orbital fascia. 6. Describe muscles of the orbit, their cone arrangement, origin, insertion, nerve supply and their function. 7. Describe the nerves of the orbit, their courses, important relations and their targets 8. Describe blood supply and lymph drainage of the orbit.
45	The Eye and optic nerve **(Anatomy 18)**	1. Make a list of structures making the eyeball. 2. Describe the contents and layers of the eyeball. 3. Describe the sensory, sympathetic and parasympathetic nerve supply. 4. Define the optic nerve. 5. Follow the optic nerve from the eyeball to its point of entry to the brain and its central connections. 6. Explain the effect of optic nerve fibers' injuries on the visual field. 7. List the related structures to the eye; eyelids and lacrimal system.
46	Trigeminal nerve **(Anatomy 19)**	1. Discuss briefly how the face is developed. 2. Follow up the course of trigeminal nerve from its point of central connections, exit and down to its target areas. 3. Describe briefly important cranial reflexes involving the face and trigeminal nerve.
47	Mycobacterium Leprae. Clostridium tetani & Clostridium Botulism **(Microbiology 3)**	1. Understand the characteristics, laboratory diagnosis and management of Mycobacterium leprae. 2. Understand the bacteriological aspects, laboratory diagnosis, management and prevention of Clostridium Tetani and Botulism.
48	CNS stimulants and drugs of abuse	1. Describe the clinical uses of the opioid receptor antagonists. 2. Describe methods of treatment of opioids dependency. 3. Describe the pharmacological types of drug dependence.

	(Pharmacology 7)	4. Describe the major pharmacological actions of drugs that are commonly abused. 5. Describe the major signs and symptoms of withdrawal of drugs that are commonly abused. 6. Identify the most likely causes of fatalities from commonly abused agents. 7. Describe methods of treatment of drugs abuse.
49	Vision (I) **(Physiology 12)**	1. Discuss Principles of optics& Retinal Image & the near response 2. Accommodation & Miosis& Convergence. 3. Discuss Common Errors of refraction 4. Explain Morphology of the retina, Pigment epithelium, Photoreceptors: main differences between rods and cones. 5. Discuss rhodopsin-retinal visual cycle and excitation of the rode. 6. Explain Color vision and color blindness. 7. Discuss rod receptor potential is hyperpolarizing, not depolarizing. 8. Discuss dark and light adaptation.
50	Vision (II) **(Physiology 13)**	1. Discuss retinal electrophysiology; On-center, Off-center retinal ganglion cell &What is the benefit of on-center off-center? 2. Discuss Central Neurophysiology of Vision: - Lateral geniculate body functions, organization and function of visual cortex, the layers of primary visual cortex. - Discuss columnar architecture of primary visual cortex. a. Ocular dominance columns, b. Orientation columns. 3. Discuss cortical Modules (primary visual cortex): a. Simple cells, b. Complex cells, c. Hyper-complex cell (end-stopped cell). 4. Discuss other cortical areas concerned with vision. 5. Discuss fixation movements of eyes: Saccadic Movement of the Eyes, Pursuit Movement. 6. Discuss mechanism of involuntary locking fixation (role of the superior colliculi in turning the eyes and head toward a visual disturbance). 7. Explain neural mechanism of stereopsis for judging distances of visual objects.
		Week 5
51	General anesthetics **(Pharmacology 8)**	1. Describe stages of anesthesia. 2. Describe drugs used as pre-anesthetics and the rationale of their use. 3. Identify the main inhalation anesthetic agents and describe their pharmacodynamic and pharmacokinetics properties. 4. Understand the mechanism and toxicities of inhalation anesthetics. 5. Describe the relationship between the blood: gas partition coefficient of an inhalation anesthetic and the induction and recovery of anesthesia. 6. Describe how changes in pulmonary ventilation and blood flow can influence the induction and the recovery of inhalation anesthesia. 7. Describe the pharmacodynamic and pharmacokinetics properties of the commonly used intravenous anesthetics. 8. Describe the toxicity of the intravenous anesthetics.
52	The external and middle ear & carinal nerve VII	1. Make a list of structures making the external and middle ear. 2. Discuss the features of the external auditory meatus and tympanic membrane. 3. Describe the shape, position, boundaries and content of the middle ear. 4. Describe the auditory tube, its openings and structure. 5. Describe the mastoid air cells and their connection to the middle ear.

	(Anatomy 20)	6. Follow up the course of facial nerve from its point of central connections, exit and down to its target areas. 7. Follow up the central connections of the facial nerve. 8. Discuss the various modalities of its fibers. 9. Review your knowledge of its target organs.
53	Inner ear & cranial nerve VIII **(Anatomy 21)**	1. Make a list of parts making the internal ear. 2. Note how structures fit each other. 3. Describe the bony labyrinth. 4. Explain how the membranous labyrinth fits the bony one. 5. Describe the hearing and balance receptors. 6. Follow the course of the VIII nerve down to its point of entry to the brain. 7. Follow up the central connections of the VIII nerve.
54	Hearing & equilibrium (I) **(Physiology 14)**	1. Explain sound wave. 2. Explain characteristics of sound waves. 3. Explain sound transmission. 4. Revise Middle ear (ossicular system). 5. Discuss tympanic reflex (attenuation reflex) and its functions. 6. Revise structure of inner ear. 7. Discuss the characteristics of basilar membrane. 8. Explain transmission of sound waves in the cochlea (the traveling wave).
55	Hearing & equilibrium (II) **(Physiology 15)**	1. Revise structure of Organ of Corti. 2. Explain the functions of inner hair cells. 3. Explain the depolarization of hair cell. 4. Explain the function of cerebral cortex in hearing. 5. Discuss sound frequency perception in the primary auditory cortex. 6. Discuss discrimination of sound “Patterns” by the auditory cortex. 7. Discuss determination of the direction from which sound come. Equilibrium: 8. Explain sensory organ of utricle and saccule. 9. Explain spatial orientation. 10. Explain rotational movement & Semicircular canal. 11. Explain responses to rotational acceleration.
56	Prions **(Microbiology 4)**	- Indicate the historical background of prions and discuss its basic structure, classification of diseases involved, epidemiology, pathogenesis and pathology, laboratory diagnosis, and prevention.
57	Local anesthetics **(Pharmacology 9)**	1. Describe the classification of the local anesthetic. 2. Indicate the pharmacological characteristics of their chemical structures. 3. Describe the mechanism of blockade of the impulse by local anesthetics. 4. Discuss the relation between pH, pK_a, and the speed of onset of local anesthesia. 5. List the factors that determine the susceptibility of nerve fibers to blockade by local anesthetics. 6. List the major toxic effects of the local anesthetics. 7. Explain use-of dependent blockade by local anesthetics.

58	Cranial nerves IX, X, XI, XII **(Anatomy 22)**	1. Follow up the course of glossopharyngeal, vagus, accessory, and hypoglossal nerves from its central connections, exit from the brain and down to its target organs. 2. Make a list of types of nerve modalities conveyed by these nerves. 3. Review your knowledge of its target organs. 4. Make note of plexuses X nerve creates in the thorax and abdomen.
59	Chemical senses; taste & smell **(Physiology 16)**	Smell 1. Explain olfactory epithelium. 2. Explain olfactory bulbs. 3. Explain olfactory cortex. 4. Explain signal transduction in an odorant receptor. 5. Discuss sniffing. 6. Discuss role of pain fibers in the nose. 7. Discuss abnormalities in Odor Detection. Taste 8. Revise taste buds structure. 9. List the types of taste buds. 10. Explain taste pathway. 11. Discuss taste receptors and transduction.
60	Face and scalp, cervical plexus & nerves of the head and neck **(Anatomy 23)**	1. Review the general anatomical features of the face and scalp. 2. Describe blood supply, innervation, and lymphatic drainage of the face and scalp. 3. Make a list of contributing roots to cervical plexus. 4. Discuss the general arrangement. 5. Describe the location of this plexus. 6. Make a list of the outcoming nerves. 7. Follow the branches to their target organs. 8. Make a list of the cutaneous nerves. 9. Follow the cutaneous branches to their destinations.
61	The neck **(Anatomy 24)**	1. Define the boundaries of the neck. 2. Describe the fasciae of the neck. 3. Summarize the main arteries, veins, nerves and lymph nodes of the neck. 4. List the muscles of the neck. 5. Describe the neck triangles. 6. Describe the key muscles creating the triangles, mainly, sternomastoid, omohyoid and digastric. 7. Study the boundaries and content of each triangle.
62	Ticks **(Microbiology 5)**	- Study the following tick born diseases: 1. **Lyme disease** (understand the epidemiology of Lyme disease, Microbiology, Clinical manifestations, Immunopathogenesis, Diagnosis, and prevention). 2. **Tick- borne encephalitis viruses including:** - Far-Eastern tick-borne encephalitis virus. - Siberian tick-borne encephalitis virus. - European or Western tick-borne encephalitis virus. - Study the methods for transmission, vectors, clinical manifestation, laboratory diagnosis, prevention and control.

63	Drugs for neurodegenerative diseases **(Pharmacology 10)**	1. Drugs used in Alzheimer's disease: - Discuss acetylcholinesterase inhibitors. - Discuss NMDA receptor antagonist. 2. Drugs used in multiple sclerosis: - List the disease-modifying therapies. - Describe the disease-modifying therapies mechanisms of action. - Describe the Symptomatic treatment of multiple sclerosis. - Discuss drugs used in amyotrophic lateral sclerosis.
64	Demyelinating diseases **(Pathology 6)**	1. Know the various causes and types of peripheral neuropathies. 2. Know about various axonal degeneration and injures. 3. Know the general features of demyelinating diseases, with special emphasis on Multiple Sclerosis and Guillain-Barré syndrome. 4. Know the general features of Neuromuscular Junction Disorders (myasthenia gravis and Lambert-Eaton syndrome).
65	Neurodegenerative diseases **(Pathology 7)**	1. Know the general features of degenerative diseases & dementias, with special emphasis on Alzheimer's disease, its clinical & morphological findings. 2. Know briefly about Parkinson's Disease, Huntington's disease and amyotrophic lateral sclerosis.
	Week 6	
66	Directly acting cholinergic agonists & Indirectly acting cholinergic agonists **(Pharmacology 11)**	1. Review the steps involved in the synthesis, storage, release and the termination of action of acetylcholine. 2. Mention examples on inhibitors of acetylcholine synthesis, storage, and release. 3. List the locations and types of acetylcholine receptors in various organ systems. 4. Describe the effects of acetylcholine on major organ systems. 5. Correlate the pharmacokinetic properties of various choline esters and cholinomimetic alkaloids with their chemical properties. 6. List the major clinical indications and adverse effects of cholinomimetic agonists. 7. Describe the distribution and function of cholinesterase. 8. Provide a classification and examples on drugs that inhibit cholinesterase. 9. Describe the pharmacodynamic differences between direct and indirect-acting cholinomimetic agents. 10. List the major signs and symptoms of organophosphate insecticide poisoning. 11. Describe the treatment modalities of organophosphate poisoning.
67	Tumors of the Nervous system **(Pathology 8)**	1. Classify tumors and describe the general features of primary brain tumors in comparison to other tumors in the body. 2. Know the pathology and prognosis of the various types of brain tumors. 3. Describe tumors of the peripheral nerves. 4. Know the common types of metastatic tumors and their pathologic characteristics.
68	Brachial plexus & Nerves of the upper limb	1. Make a list of contributing spinal nerves. 2. Discuss the general arrangement of this plexus. 3. Locate the plexus in the axilla and note important relations to blood vessels. 4. Make a list of local branches with short notes on its target organs. 5. Make a list of the terminal main branches of brachial plexus.

	(Anatomy 25)	6. Follow up each branch down to its target organs (myotomes and Dermatomes).
69	Rabies and, arboviruses **(Microbiology 6)**	- Discuss Rabies and Arboviruses: classification, basic structural, morphological and physical properties, epidemiology, pathogenesis, clinical presentation, laboratory diagnosis, and prevention.
70	Lumbosacral plexus & nerves of the lower limb **(Anatomy 26)**	1. Make a list of contributing spinal nerves to the lumbar plexus. 2. Discuss the arrangement of the plexus. 3. Describe the location of this plexus and its relation to the psoas muscle. 4. List the terminal branches and follow up each branch to its final destination. 5. Make a list of contributing spinal nerves to the sacral plexus. 6. Discuss the arrangement of this plexus. 7. Describe the location of this plexus. 8. List its terminal branches and follow up each branch to its target organs. 9. Make a list of nerves of the lower limb including the Gluteal region. 10. Follow up each nerve down to its target joints, myotomes, and dermatomes.
71	Sympathetic nervous system **(Anatomy 27)**	1. Review the subdivisions of the nervous system. 2. Review the general arrangement and compare the sympathetic and parasympathetic parts. 3. Describe the following plans: - Para vertebral ganglia. - Prevertebral ganglia. - Parasympathetic ganglia. - Splanchnic nerves. - Autonomic plexuses. 4. Map out the various plexuses in head and neck, thorax, abdomen and pelvis. 5. Make a list of the components of the system. 6. Review the basic structure of sympathetic trunk. 7. Describe the source of sympathetic system in the neck and make a list of target organs. 8. Describe the Para vertebral sympathetic ganglia in the abdomen; their locations and target organs. 9. Discuss the relation of this system to the adrenal medulla. 10. Discuss the sympathetic innervation of blood vessels.
72	Cholinergic antagonists **(Pharmacology 12)**	1. Describe the effects of cholinergic antagonists on various organ systems. 2. List the major clinical indications of muscarinic antagonists. 3. List the major adverse effects of antimuscarinic agents. 4. Describe the signs, symptoms and treatment of atropine poising.
73	Adrenergic agonists **(Pharmacology 13)**	A. 1. Review the steps involved in the synthesis, storage, release and the termination of action of epinephrine and nor epinephrine. 2. List examples on the inhibitors of norepinephrine synthesis, storage, release and re-uptake. 3. List tissues that contain significant numbers α_1 or α_2 adrenergic receptors. 4. Describe the major systemic effects of a pure alpha agonist.

		5. Indicate the major clinical applications and major adverse effect of α-receptor agonists. B. 1. List tissues that contain significant numbers of β_1 or β_2 receptors. 2. Describe the major organ system effects of a pure beta agonist, and a mixed alpha and beta agonist. 3. List the major clinical applications and adverse effect of β-receptor agonists. 4. Indicate the pharmacodynamic differences between direct and indirect acting sympathomimetic amines.
74	Parasympathetic nervous system **(Anatomy 28)**	1. Make a list of the components of the system. 2. Make a list of cranial nerves having parasympathetic activity. 3. Describe the parasympathetic ganglia in the head and neck, their locations and target organs. 4. Describe the sacral parasympathetic outflow. 5. Make a list of its target organs.
75	Enteroviruses **(Microbiology 7)**	- Discuss Coxsackie viruses, Echo viruses: basic structural, morphological and physical properties, epidemiology, pathogenesis, clinical presentation, laboratory diagnosis, and prevention.
76	Adrenergic antagonists **(Pharmacology 14)**	1. Indicate the differences between selective and nonselective α -receptor antagonists. 2. List the main indications and the major adverse effects of α-receptors antagonists. 3. Provide a classification for α -receptor antagonists. 4. Compare the pharmacokinetics of various b- receptor antagonists. 5. Describe the main indications and major adverse effects of b receptors antagonists. 6. Describe the main drug-drug interactions of a and b receptors antagonists.
77	Epidemiology and prevention of Poliomyelitis and Meningitis **(Community Medicine 1)**	1. Describe the public health importance of polio and meningitis as serious infectious diseases. 2. Describe Epidemiological pattern of polio and meningitis diseases; Globally and locally. 3. Identify and understand the rote of transmission and risk factors of Polio and meningitis. 4. Understand the importance and different types of polio and meningitis prevention.
Week 7		
Case discussion		Case 1 Case 2
Feedback session		
Revision sessions		
Week 8		
Practical & Final Exams		

#	PRACTICAL TITLE	OBJECTIVES
1	Neuroanatomy I **(Anatomy 1)**	- Gross morphology of brain. 1. Identify major components of brain. 2. Know major lobes, major gyri and sulci. 3. Identify major components of brain stem, important landmarks and the main arteries of the brain including the circle of Willis.
2	Neuroanatomy II **(Anatomy 2)**	1. Study and identify the major components of brain in coronal, transverse and sagittal sections including: Thalamus, hypothalamus, Basal ganglia, ventricular system, cerebellum, and brainstem. 2. Brain ventricular system included capsule, basal ganglia etc. 3. Use dissected brains, CT scan & MRI.
3	Neuroanatomy III **(Anatomy 3)**	1. Study major parts of the brainstem, origin of the cranial nerves. 2. Identify the main nuclei (including the cranial nuclei) and the main ascending and descending pathways in the brainstem. 3. Identify the gross morphology of the spinal cord. 4. Identify the main nuclei, laminae, and tracts in the spinal cord.
4	**Pathology 1**	- Study Images of medical CNS lesions
5	**Pathology 2**	- Study images of tumors of CNS, peripheral nerves and eye.
6	Neurophysiology **(Physiology 1)**	1. Cutaneous sensations - Determine tactile sensibility by determining two-point discrimination. 2. Reflexes: - Demonstrate deep tendon reflexes and explain their clinical significance. The following reflexes will be studied: knee jerk, ankle jerk, biceps, and triceps reflex. - Demonstrate and elicit the following superficial reflexes and explain their physiological significance. The following reflexes will be studied: corneal reflex, palatal reflex, abdominal reflex, and Babinski's sign. 3. Muscle tone. 4. Body temperature examination
7	**Microbiology 1**	1. Describe the method of specimen collection including the process of lumbar puncture, transportation of specimen, and storage. 2. Describe the laboratory method used for the specimen processing, including media used, incubation environment, colonial morphology and bacterial identification. 3. Prepare a sample culturing resembling CSF specimen and Identify the organisms involved. 4. Write the laboratory findings in the hospital laboratory format.
8	Orbit, Eye and Ear **(Anatomy 4)**	1. Recognize individual structures related to orbit, eye & ear. 2. Observe the organization and relations of these structures. 3. Compare between your understanding, your atlas and the specimens you see in the lab.
9	Face, Scalp & Neck **(Anatomy 5)**	1. Recognize individual structures related to face, scalp & neck. 2. Observe the organization and relations of these structures. 3. Compare between your understanding, your atlas and the specimens you see in the lab.

10	Brachial plexus and Nerves of the upper limb. Lumbo-sacral plexus and nerves of the lower limb. **(Anatomy 6)**	1. Recognize individual structures related to brachial & lumbosacral plexuses. 2. Observe the organization and relations of these structures. 3. Compare between your understanding, your atlas and the specimens you see in the lab. - Identify the major histological features of the nervous system.
11	**Physiology 2**	1. Students are expected to do experiments demonstrating the following tests: - Visual acuity test, Snellen, Charts. - Color vision test using Ishihara charts. - Confrontational perimetry and mapping of blind spot. - Use of ophthalmoscope and examination of the retina. 2. Students are expected to perform auditory tests, including Rinne's and Webber's tests. Demonstrating physiology of balance and equilibrium using Barny chair.

COURSE LEARNING RESOURCES

- Lectures
- Practical Sessions
- Group Discussion
- Reviews

ONLINE RESOURCES

Anatomy

- http://famona.sezampro.rs/medifiles/anatomy/jsplamli/index.htm
- http://library.med.utah.edu/WebPath/HISTHTML/NEURANAT/NEURANCA.html#5
- http://www.bellarmine.edu/faculty/mwiegand/atlas/cover.html

ASSESSMENT TOOLS

ASSESSMENT TOOLS		**%**
Midterm Exam		30
Practical and discussion exam		20
Final Exam		50
TOTAL MARKS		100

THIRD: COURSE RULES

ATTENDANCE RULES

Attendance and participation are extremely important, and the usual University & college rules will apply. Attendance will be recorded for each session. Absence of 15% (up to 20% for student having some excuses that are approved by the dean) will result in that the student will not be permitted to attend the final examination and he/she will be granted zero mark in that exam.

GRADING SYSTEM

A	**4**	**C**	**2**
A-	**3.75**	**C-**	**1.75**
B+	**3.5**	**D+**	**1.5**
B	**3**	**D**	**1**
B-	**2.75**	**D-**	**0.75**
C+	**2.5**	**F**	**0.5**

REMARKS

Exam remarks:

- Exam time depends on number of questions (~ I minute/question)
- Number of questions depends on the covered material

Attendance remarks:

- Attendance will be taken at the first ten minutes of the session (lecture or lab).
- Attendance for lectures will be taken according to seating numbers.
- Attendance for labs will be taken according to the group list.

COURSE COORDINATOR

Course Coordinator: Dr. Ezidin Kaddumi	**Department Head: Dr. Nabil Amer**
Signature:	**Signature:**
Date:	**Date:**