Learning objectives

Neurosciences-1B module

TOTAL WEEKS-5

Central Curriculum Committee, Khyber Medical University

List of themes

Sr. No	Themes	Duration in weeks
1	Facial palsy (face, 5th and 7th cranial nerves)	1
2	Neck swelling (thyroid, larynx, neck, muscles etc.)	1
3 & 4	Cleft palate (palate, tongue, pharynx) Anosmia	1
5	Diplopia / blindness (2nd, 3rd, 4th, 6th cranial nerve / eye ball / orbit)	1
6	Deafness (ear / 8th nerve)	1

General learning outcomes

At the end of this module, the 2nd year students will be able to:

1) Describe the structure of vertebrae, skull bones palate, pharynx, larynx, facial bones and base of the skull
2) Describe the contents walls and boundaries of anterior and posterior triangles of the neck
3) Describe the structure, relation, blood supply and venous drainage of thyroid
4) Describe the arteries, veins and nerves of the neck including cervical plexuses
5) Describe the nuclei, course, relations, and structures supplies by all cranial nerves
6) Describe the origin, course, relations and structures supplies by the arteries, veins and lymphatics of head and neck
7) Describe the anatomy of all the muscles of facial expression and head and neck
8) Describe the structure and functions of eye, ears, nose and paranasal sinuses
9) Describe the development of different structures of organs of the head and neck
10) Identify the microscopic structure of salivary glands and tongue
11) Examine a standardized patient`s cranial nerves
12) Demonstrate Perimetry and Audiometry

specific learning objectives

Theme-1 (Facial palsy)

Subject	Topic	S. No	Learning objectives
Gross anatomy	Osteology of mandible	1	Describe the gross features of adult mandible.
		2	Describe the bony features of mandible
		3	Name the joints formed by mandible
		4	Name the attachment of muscles and ligaments on mandible
	Norma frontalis	5	Describe the bony features of frontal view of skull
	Norma basalis	6	Name the bones forming the base of skull
		7	Name the bony features
		8	Identify the different foramina and name the structures passing through these foramina
		9	Describe the attachment and relation of base of skull
		10	Describe the clinical importance
	Norma lateralis	11	Name the boundaries of temporal fossa
		12	Enumerate the contents of temporal fossa
		13	Describe the relations of temporal fossa

		14	Name the boundaries of infratemporal fossa
		15	Enlist the contents of fossa
		16	Describe the relations of Infratemporal fossa
		17	Name the layers of scalp
	Scalp and muscles of facial expression	18	Describe the muscles of scalp
		19	Name the neurovascular supply of scalp
		20	Describe the lymphatic drainage of scalp
		21	Name the fascial muscles along with attachments, nerve supply and actions
	Muscles of mastication	22	Enumerate the muscles od mastication along with their attachments, nerve supply and actions
	Blood supply and lymphatic drainage of face	23	Describe the blood supply and lymphatic drainage of face portion
	Temporomandibular joint (TMJ)	24	Name the type of TMJ
		25	Name the ligaments related with TMJ
		26	Describe the relations of TMJ
		27	Name the muscles causing movements of TMJ
		28	Name the neurovascular supply of TMJ

	Extra cranial course of CN VII	29	Describe the extra cranial course of CN VII along with its clinical importance
Embryology	Face development	30	Discuss the five facial primordia
		31	Describe the inter-maxillary segment
		32	Describe the embryological defects of face
Histology	Parotid glands	33	Identify the variety of gland according to nature of its acinus
		34	Discuss the capsular structure and its extensions in the gland
		35	Differentiate between the stroma and parenchyma of parotid gland
		36	Describe the ductal system of the gland and its lining epithelium
		37	Differentiate between the intercalated and striated ducts in intralobular parts of gland
		38	Describe the detailed structure of serous acinus
		39	Discuss the location of stenson,s duct and its structure
		40	Discuss clinical conditions related with parotid gland
Biochemistry	Biotechnology	41	Describe the indications and procedure of Polymerase Chain Reaction (PCR), Cloning and Restriction fragment length polymorphism (RFLP)

	Purine Nucleotide synthesis and degradation	42	Describe the process of nucleotide synthesis and degradation
	Hyperuricemia-Gout	43	Describe the normal levels of serum Uric acid in the blood
		44	Describe the mechanism of synthesis of Uric acid from Purines
		45	Describe the etiology, pathogenesis and clinical features of Gout
	Pyrimidine Nucleotide synthesis and degradation	46	Describe the mechanisms of Pyrimidines synthesis and degradation
	Salvage pathway of nucleotide synthesis	47	Explain the salvage pathway of Nucleotide synthesis
	The structural basis of cellular information	48	Explain the structural basis of cellular information
	DNA, chromosomes, discovery and organization in genome	49	Explain the structure, organization and functions of Chromosomes, DNA and genes
	DNA replication	50	Describe the process of DNA replication
	Transcription	51	Describe the mechanism of transcription
	Protein synthesis	52	Explain the mechanisms of protein synthesis
	Mutation	53	Define mutation
	DNA, damage and repairs	54	Explain the mechanisms of DNA damage and repair

Medicine	Bell`s palsy	55	Describe the clinical features and management of Bell`s palsy
Skills and affective domain			
Histology	Submandibular and Sublingual Salivary Gland	56	Identify the slide of submandibular and sublingual salivary glands under the microscope
Physiology	Examination of Cranial nerves, V, VII	57	Examine the cranial nerves V & VII on a standardized patient

Theme-2 (neck swelling)

Subject	Topic	S. No	Learning objectives
Gross Anatomy	Typical cervical vertebra	58	Describe the bony features of typical cervical vertebrae
		59	Name the joints formed by typical vertebrae
		60	Describe the attachments
	Atypical cervical vertebra	61	Describe the bony features of atypical cervical vertebrae
		62	Name the joints formed by atypical vertebrae
		63	Describe the attachments
	Hyoid bone	64	Describe the bony features of hyoid bone
		65	Describe the attachments of muscles and ligaments with hyoid bone
	Pterygopalatine fossa	66	Name the boundaries of pterygopalatine fossa
		67	Enumerate the contents of pterygopalatine fossa
		68	Describe the relations of pterygopalatine fossa
	Deep fascia of neck	69	Enumerate the layers of deep cervical fascia
		70	Draw and labelled diagram of transverse section of neck showing deep cervical fascia

		71	Describe the layers of deep cervical fascia along with its clinical importance
	Larynx	72	Name the paired and unpaired cartilages of larynx
		73	Enumerate the ligaments and membrane of larynx
		74	Describe the sensory and blood supply of larynx
		75	Enumerate the intrinsic and extrinsic muscle of larynx along with its actions and nerve supply
		76	Describe the pyriform fossa
	Ant. triangle of neck	77	Enlist the subdivisions of anterior triangle of neck
		78	Describe the boundaries and contents of submental triangle
		79	Describe the boundaries and contents of carotid triangle Describe the boundaries and contents of digastric triangle Describe the boundaries and contents of muscular triangle
	Post triangle of neck	80	Enlist the subdivisions of posterior triangle of neck
		81	Describe the boundaries and contents of occipital triangle
		82	Describe the boundaries and contents of supraclavicular triangle
	Arteries of neck	83	Describe the course, Distribution and branches of main arteries of neck
	veins of neck	84	Describe the course, Draining and tributaries of main veins of neck

	cervical plexus and nerves of neck	85	Describe the cervical plexus along with its branches and distribution
Embryology	Pharyngeal apparatus	86	Describe the components of pharyngeal apparatus.
		87	Describe the development of pharyngeal apparatus
		88	Enlist the derivatives of the first pharyngeal arch
		89	Define the terms pharyngeal arch, pouch, cleft and membrane
		90	Enumerate the derivatives of the second pharyngeal arch
		91	Enumerate the derivatives of the 3rd pharyngeal arch
		92	Enumerate the derivatives of the 4th pharyngeal arch
		93	Enlist the derivatives of 1st ,2nd, 3rd and 4th pharyngeal pouches
		94	Describe the derivatives of pharyngeal, grooves, and membranes
		95	Discuss the arterial supply and innervation of the pharyngeal arches
		96	Describe the pharyngeal membranes
		97	Discuss the branchial cyst, sinuses, and fistula
		98	Describe the 1st arch developmental defects
Histology	Thyroid gland	99	Discuss the structural unit of thyroid gland
		100	Identify the lining epithelium of follicular cells

		101	Discuss the formation and storage of colloid in the lumen of follicular cells
		102	Describe the location and structure of parafollicular cells
		103	Discuss the interfollicular connective tissue
ENT	Lump in neck	104	Approach to a patient with lump in the neck
Skills and affective domain			
Histology	Thyroid gland	105	Identify the slide of thyroid gland under the microscope
Physiology	Examination of Cranial nerves XI, XII	106	Examine a standardized patient for Cranial nerves XI, XII

Theme-3 (Anosmia)

Subject	Topic	S. No	Learning objectives
Anatomy	Nose and paranasal sinuses	107	Describe the external features of nose
		108	Describe the relations of nose with other structures
		109	Describe the nasal septum
		110	Describe the lateral wall of nose
		111	Name the neurovascular supply of nose
		112	Describe the olfactory nerve
		113	Describe the paranasal sinuses along with its clinical importance
Embryology	Development of nose	114	Describe the development of nasal cavities and paranasal air sinuses.
		115	Describe the development of nasolacrimal groove, duct, and sac
		116	Enlist developmental defects of nose
Physiology	Sense of Smell	117	Describe olfactory membrane
		118	Explain mechanism of excitation of the olfactory cells.
		119	Discuss Rapid Adaptation of Olfactory Sensations.

		120	Define threshold for smell
		121	Describe transmission of smell signals into the central nervous system
		122	Describe primitive and newer olfactory pathways into the central nervous system
		123	Describe centrifugal control of activity in the olfactory bulb by the central nervous system.
ENT	Sinusitis	124	Describe the causes and clinical features of acute and chronic sinusitis
Gross anatomy	Tongue	125	Describe the mucosa and muscles of tongue along with its attachments, nerve supply and actions
	Salivary glands	126	Name the salivary glands
		127	Describe the location of each gland
		128	Describe the relations of each gland
		129	Name the nerve supply
		130	Describe the drainage of salivary glands along with its importance
	Palate	131	Name the bones forming the hard palate
		132	Describe the soft palate along with its muscles, attachments and nerve supply
		133	Describe the relations of palate
		134	Name the neurovascular supply of palate
	Pharynx	135	Enumerate the division of pharynx
		136	Describe the nasopharynx with its clinical significance
		137	Describe the oropharynx with its clinical significance
		138	Describe the laryngopharynx with its clinical significance

		139	Enlist the muscles of pharynx with its nerve supply and actions
	Extra-cranial course of CN IX, XXi, XII	140	Describe the extra cranial course of CN IX, X, XI and XII
Embryology	Tongue	141	Describe the development of anterior 2/3 of the tongue
		142	Discuss the role of the third pharyngeal arch in tongue development.
		143	Discuss the innervation, blood vessels, and muscles of tongue.
		144	Describe the development of papillae, taste buds and salivary glands.
		145	Describe the developmental anomalies of tongue.
	Palate	146	Describe the development of primary and secondary palate.
		147	Discuss the developmental defects of lip and primary, secondary palate
Histology	Submandibular glands	148	Identify the variety of gland according to nature of its acinus.
		149	Discuss the capsular structure and its extensions in the gland
		150	Differentiate between the stroma and parenchyma of submandibular gland
		151	Describe the ductal system of the gland and its differences with parotid gland
		152	Describe the detailed structure of serous and mucous acinus
		153	Discuss the formation of serous demilune
		154	Discuss the opening of Wharton,s duct

		155	Discuss different pathological conditions of the gland
	Sublingual glands	156	Identify the variety of gland according to its nature of acinus
		157	Differentiate between the stroma and parenchyma of sublingual gland
		158	Describe the ductal system of the gland and its lining epithelium
		159	Describe the detailed structure of its acinus
		160	Discuss the opening of Bartholin ducts
		161	Discuss different pathological conditions of the gland
Physiology	Sense of Taste	162	Discuss primary sensations of taste
		163	Explain threshold for taste
		164	Describe the taste bud and its function
		165	Describe mechanism of stimulation of taste buds
		166	Describe transmission of taste signals into the central nervous system
Pediatric surgery	Cleft palate	167	Describe the pathogenesis, clinical features and management of a patient with cleft palate
Skills and affective domain			
Histology	Tongue	168	Identify the slide of tongue under the microscope
Physiology	Examination of Cranial nerves I, IX, X	169	Examine a standardized patient for cranial nerve I, IX, X examination (sense of smell, taste, gag reflex)

Theme-4 (Diplopia)

Subject	Topic	S. No	Learning objectives
Gross anatomy	Bony orbit	170	Name the bones forming the bony orbit
		171	Identify the foramina, fissures, and fossae associated with the orbit and what are the structures transmitted through these openings.
		172	Name the contents of orbit
	Eye ball	173	Name the layers of eyeball
		174	Describe the fibrous layer of eyeball
		175	Describe the pigmented layers of eyeball
		176	Describe the inner nervous layer of eyeball
		177	Describe the chambers and of eyeball
		178	Describe the secretion and drainage of aqueous humor and vitrous humor
		179	Describe the neurovascular supply of eye
		180	Describe the intra and extraoccualr muscles with their attachment, actions and nerve supply

	Extra cranial course of CN III, IV, VI	181	Describe the course of optic, oculomotor, trochlear and abducent nerve with clinical importance
Embryology	Development of eye	182	Define lens placode and formation of retina.
		183	Describe the development of ciliary body, iris, lens and choroid.
		184	Discuss the formation of sclera, cornea, sphincter and dilator pupillae
		185	Discuss the development of virtreous body and optic nerve
		186	Describe developmental anomalies of eye
Histology	Eye	187	Enlist different histological layers of the eye
		188	Discuss retinal pigment epithelium(RPE) in detail
		189	Describe the structural details of rods
		190	and cones and the supporting cells
		191	Discuss structure of macula densa
		192	Describe the histological layers of cornea and retina
Physiology	Physical Principles of Optics	193	Describe refraction at interface between two media.
		194	Describe the physical principles of optics.
		195	Apply refractive principles to lenses
		196	Describe Focal Length of a Lens
		197	Explain formation of image by convex lenses
		198	Explain how to measure refractive power of a lens
	Optics of The Eye	199	Explain lens system of the eye.

		200	Describe the concept of “Reduced” Eye.
		201	Explain accommodation reflex.
		202	Explain presbyopia
		203	Describe that “depth of focus” of the lens system increases with decreasing pupillary diameter
		204	Define visual acuity.
		205	Explain the determination of distance of an object from the eye- —“DEPTH PERCEPTION”
		206	Describe errors of refraction
	Fluid System of The Eye—Intraocular Fluid	207	Describe the formation of aqueous humor by the ciliary body
		208	Describe the outflow of aqueous humor from the eye
		209	Describe Regulation of Intraocular Pressure and Glaucoma
	Anatomy and Function of The Structural Elements of The Retina	210	Describe foveal region of the retina and its importance in acute vision.
		211	Discuss the functional parts of the Rods and Cones.
		212	Describe blood supply of the retina—the central retinal artery and the choroid
	Photochemistry of Vision	213	Explain rhodopsin-retinal visual cycle and excitation of the rods
		214	Explain the role of vitamin A for formation of rhodopsin.

		215	Describe excitation of the rod when rhodopsin is activated by light
		216	Describe receptor potential, and logarithmic relation of the receptor potential to light intensity
		217	Describe mechanism by which rhodopsin decomposition decreases membrane sodium conductance—the excitation "cascade."
		218	Explain dark and light adaptation.
	Color Vision	219	Describe photochemistry of color vision by the cones
		220	Explain tricolor mechanism of color detection
		221	Explain Young-Helmholtz theory of color vision.
		222	Explain color blindness.
	Neural Function of The Retina	223	Describe different neuronal cell types and their functions
		224	Describe the visual pathway from the cones to the ganglion cells
		225	Discuss the retinal neurotransmitters.
		226	Discuss retinal ganglion cells and their respective fields
		227	Describe lateral inhibition.
		228	Explain excitation of ganglion cells.
		229	Discuss on and off response of ganglion cells.
	Visual Pathways	230	Discuss the function of the dorsal lateral geniculate nucleus of the thalamus.

		231	Describe organization and function of the visual cortex
		232	Describe primary visual cortex.
		233	Describe secondary visual areas of the cortex.
		234	Describe two major pathways for analysis of visual information: (1) the fast “position” and “motion” pathway and (2) the accurate color pathway
		235	Describe neuronal patterns of stimulation during analysis of the visual image
		236	Discuss detection of color
	Eye Movements and Their Control	237	Describe muscular control of eye movements.
		238	Describe neural pathways for control of eye movements.
		239	Describe fixation movements of the eyes
		240	Explain mechanism of involuntary locking fixation—role of the superior colliculi.
		241	Explain “Fusion” of the visual images from the two eyes
		242	Describe neural mechanism of stereopsis for judging distances of visual objects
	Autonomic control of Accommodation and pupillary aperture	243	Describe autonomic nerves to the eyes
		244	Describe control of accommodation
		245	Describe control of pupillary diameter
		246	Discuss Pupillary reflexes or reactions in central nervous system disease.

Community medicine	Prevention of blindness	247	Describe the causative agents and prevention of community blindness
Medicine	Ocular nerves palsies	248	Describe the clinical features and etiology of 3, 4 and 6th nerve palsies
Ophthalmology	blindness	249	Approach a patient with unilateral and bilateral blindness
Skills and affective domain			
Histology	Parotid Gland	250	Identify the histological layers of parotid gland under the microscope
Physiology	Visual Acuity	251	Examine a standardized patient for visual acuity and errors of refraction
	Perimetry	252	Examine a standardized patient for visual field function

Theme-6 (Deafness)

Subject	Topic	S. No	Learning objectives
Gross anatomy	External and middle ear	253	Describe the auricle
		254	Describe the external auditory meatus with clinical importance
		255	Name the neurovascular supply of external ear
		256	Name the boundaries of middle ear
		257	Describe the contents of middle ear
		258	Describe the auditory tube along with its clinical importance
	Inner ear	259	Describe the bony labyrinth
		260	Describe the membranous labyrinth
		261	Describe the course of CN VIII along with its clinical importance
Embryology	Development of ears	262	Describe the development of external and middle ear
		263	Explain the origin of internal ear along the relationship of saccule, utricle, semi-circular canals
		264	Describe the development of cochlear duct and organ of corti
		265	Enlist the developmental anomalies of external middle and internal ear

Physiology	Tympanic Membrane and The Ossicular system	266	Explain conduction of sound from the tympanic membrane to the cochlea.
		267	Describe “Impedance Matching” by the Ossicular System.
		268	Describe attenuation of sound by contraction of the tensor tympani and stapedius muscles.
		269	Describe transmission of sound through bone.
	Cochlea	270	Describe functional anatomy of the cochlea
		271	Describe basilar membrane and resonance in the cochlea.
		272	Describe transmission of sound waves in the cochlea—“traveling wave”
		273	Describe pattern of vibration of the basilar membrane for different sound frequencies.
		274	Describe amplitude pattern of vibration of the basilar membrane.
		275	Describe function of the organ of corti
		276	Describe Excitation of the Hair Cells
		277	Discuss the “place” principle
		278	Describe detection of changes in loudness—the power law.
		279	Describe threshold for hearing sound at different frequencies.
	Auditory Nervous Pathways	280	Describe auditory pathway.

		281	Explain the function of the cerebral cortex in hearing.
		282	Describe how to determine the direction from which sounds come.
		283	Describe transmission of centrifugal signals from CNS to lower auditory centres
		284	Describe different types of deafness.
	Vestibular Sensations and Maintenance of Equilibrium	285	Describe the physiologic anatomy of vestibular apparatus
		286	Describe function of the utricle and saccule in the maintenance of static equilibrium
		287	Describe function of semi-circular ducts
		288	Describe Neuronal Connections of the Vestibular Apparatus
		289	Describe Vestibular mechanism for stabilizing the eyes
ENT	Hearing loss	290	Describe different clinical tests for hearing loss
		291	Describe the etiology and management of conduction and sensorineural hearing loss
Skills and affective domain			
Physiology	Examination of Cranial Nerves III, IV and VI	292	Examine a standardized patient for oculomotor, Abducens and Trochlear nerves with an ophthalmoscope
Physiology	Tuning fork test	293	Examine a standardized patient for hearing loss with tuning fork (Weber and Rinne`s test)

Physiology	Audiometry	293	Examine a standardized patient for functions of inner ear