

Learning objectives

Neurosciences-2 module

TOTAL WEEKS-5

Central Curriculum Committee, Khyber Medical University

List of themes

	Themes	Duration in weeks
1	Facial palsy (face, 5 th and 7 th cranial nerves)	1
2	Neck swelling (thyroid, larynx, neck, muscles etc.)	1
3	Anosmia	1
4	Diplopia	7 days
5	Deafness (ear / 8 th nerve)	3 days

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
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specific learning objectives

Theme-1 (Facial palsy)

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

			Name the boundaries of infratemporal fossa
			Enlist the contents of fossa
			Describe the relations of Infratemporal fossa
			Name the layers of scalp
	Scalp and muscles of facial expression		Describe the muscles of scalp
			Name the neurovascular supply of scalp
			Describe the lymphatic drainage of scalp
			Name the fascial muscles along with attachments, nerve supply and actions
	Muscles of mastication		Enumerate the muscles of mastication along with their attachments, nerve supply and actions
	Blood supply and lymphatic drainage of face		Describe the blood supply and lymphatic drainage of face portion
	Temporomandibular joint (TMJ)		Name the type of TMJ
			Name the ligaments related with TMJ
			Describe the relations of TMJ
			Name the muscles causing movements of TMJ
			Name the neurovascular supply of TMJ

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

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

Medicine	Bell`s palsy		Describe the clinical features and management of Bell`s palsy
Skills and affective domain			
Histology	Submandibular and Sublingual Salivary Gland		Identify the slide of submandibular and sublingual salivary glands under the microscope
Physiology	Examination of Cranial nerves, V, VII		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		Describe the bony features of typical cervical vertebrae
			Name the joints formed by typical vertebrae
			Describe the attachments
	Atypical cervical vertebra		Describe the bony features of atypical cervical vertebrae
			Name the joints formed by atypical vertebrae
			Describe the attachments
	Hyoid bone		Describe the bony features of hyoid bone
			Describe the attachments of muscles and ligaments with hyoid bone
	Pterygopalatine fossa		Name the boundaries of pterygopalatine fossa
			Enumerate the contents of pterygopalatine fossa
			Describe the relations of pterygopalatine fossa
	Deep fascia of neck		Enumerate the layers of deep cervical fascia
			Draw and labelled diagram of transverse section of neck showing deep cervical fascia

			Describe the layers of deep cervical fascia along with its clinical importance
	Larynx		Name the paired and unpaired cartilages of larynx
			Enumerate the ligaments and membrane of larynx
			Describe the sensory and blood supply of larynx
			Enumerate the intrinsic and extrinsic muscle of larynx along with its actions and nerve supply
			Describe the pyriform fossa
	Ant. triangle of neck		Enlist the subdivisions of anterior triangle of neck
			Describe the boundaries and contents of submental triangle
			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		Enlist the subdivisions of posterior triangle of neck
			Describe the boundaries and contents of occipital triangle
			Describe the boundaries and contents of supraclavicular triangle
	Arteries of neck		Describe the course, Distribution and branches of main arteries of neck
	veins of neck		Describe the course, Draining and tributaries of main veins of neck

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

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

Theme-3 (Anosmia)

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

		Define threshold for smell
		Describe transmission of smell signals into the central nervous system
		Describe primitive and newer olfactory pathways into the central nervous system
		Describe centrifugal control of activity in the olfactory bulb by the central nervous system.
ENT	Sinusitis	Describe the causes and clinical features of acute and chronic sinusitis
Gross anatomy	Tongue	Describe the mucosa and muscles of tongue along with its attachments, nerve supply and actions
	Salivary glands	Name the salivary glands
		Describe the location of each gland
		Describe the relations of each gland
		Name the nerve supply
		Describe the drainage of salivary glands along with its importance
	Palate	Name the bones forming the hard palate
		Describe the soft palate along with its muscles, attachments and nerve supply
		Describe the relations of palate
		Name the neurovascular supply of palate
	Pharynx	Enumerate the division of pharynx
		Describe the nasopharynx with its clinical significance
		Describe the oropharynx with its clinical significance
		Describe the laryngopharynx with its clinical significance

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

			Discuss different pathological conditions of the gland
	Sublingual glands		Identify the variety of gland according to its nature of acinus
			Differentiate between the stroma and parenchyma of sublingual gland
			Describe the ductal system of the gland and its lining epithelium
			Describe the detailed structure of its acinus
			Discuss the opening of Bartholin ducts
			Discuss different pathological conditions of the gland
Physiology	Sense of Taste		Discuss primary sensations of taste
			Explain threshold for taste
			Describe the taste bud and its function
			Describe mechanism of stimulation of taste buds
			Describe transmission of taste signals into the central nervous system
Pediatric surgery	Cleft palate		Describe the pathogenesis, clinical features and management of a patient with cleft palate
Skills and affective domain			
Histology	Tongue		Identify the slide of tongue under the microscope
Physiology	Examination of Cranial nerves I, IX, X		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		Name the bones forming the bony orbit
			Identify the foramina, fissures, and fossae associated with the orbit and what are the structures transmitted through these openings.
			Name the contents of orbit
	Eye ball		Name the layers of eyeball
			Describe the fibrous layer of eyeball
			Describe the pigmented layers of eyeball
			Describe the inner nervous layer of eyeball
			Describe the chambers and of eyeball
			Describe the secretion and drainage of aqueous humor and vitrous humor
			Describe the neurovascular supply of eye
			Describe the intra and extraoccular muscles with their attachment, actions and nerve supply

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

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

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

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

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

Theme-5 (Deafness)

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

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

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

Physiology	Audiometry		Examine a standardized patient for functions of inner ear
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