VISWASS SCHOOL & COLLEGE OF NURSING

GNM 1ST YEAR

ANATOMY AND PHYSIOLOGY

UNIT-11

THE NERVOUS SYSTEM

SHORT QUESTIONS AND ANSWERS

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1)Enlist the cranial nerves.(5)

Cranial nerves:

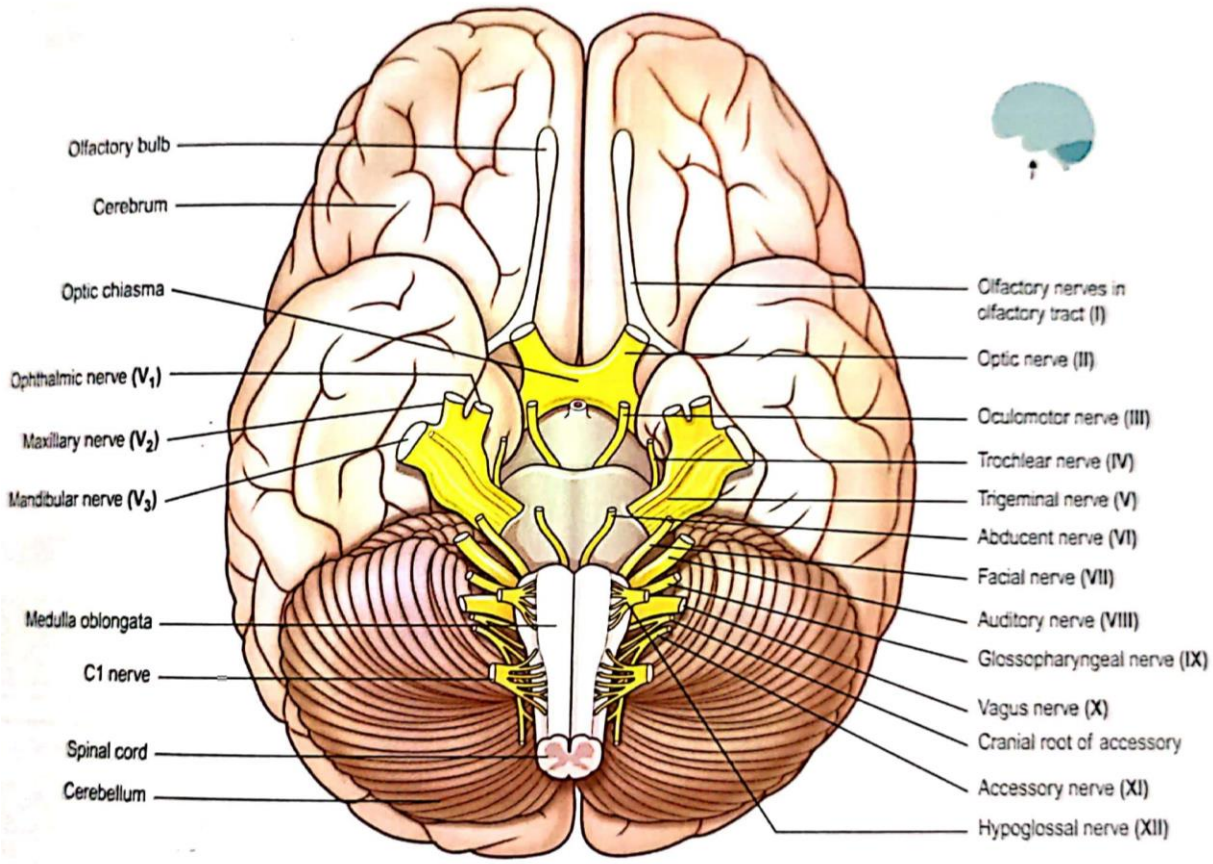
- **Cranial nerves** are the nerves that emerge directly from the brain (including the brainstem), of which there are conventionally considered twelve pairs. Cranial nerves relay information between the brain and parts of the body, primarily to and from regions of the head and neck, including the special senses of vision, taste, smell, and hearing.
- The cranial nerves emerge from the central nervous system above the level of the first vertebrae of the vertebral column. Each cranial nerve is paired and is present on both sides. There are conventionally twelve pairs of cranial nerves, which are described with Roman numerals I–XII.
- According to the order in which they connect to the brains, they are:

I. olfactory nerve
II. optic nerve
III. oculomotor nerve
IV. trochlear nerve
V. trigeminal nerve
VI. abducent nerve
VII. facial nerve
VIII. vestibulocochlear nerve
IX. glossopharyngeal nerve

X. vagus nerve

XI. accessory nerve

XII. hypoglossal nerve



✓ <u>Olfactory nerves:</u>

- The **olfactory nerve** is typically considered the first cranial nerve, or simply **CN I**, that contains sensory nerve fibers relating to the sense of smell.
- The afferent nerve fibers of the olfactory receptor neurons transmit nerve impulses about odors to the central nervous system, where they are perceived as odors. We refer to this sense as (olfaction). Derived from the embryonic nasal placode, the olfactory nerve is somewhat unusual among cranial nerves because it is capable of some regeneration if damaged.

- The olfactory nerve is sensory in nature and originates on the olfactory mucosa in the upper part of the nasal cavity.

✓ Optic nerves:

- The **optic nerve**, also known as **cranial nerve II**, or simply as **CN II**, is a paired cranial nerve that transmits visual information from the retina to the brain.
- In humans, the optic nerve is derived from optic stalks during the seventh week of development and is composed of retinal ganglion cell axons and glial cells

✓ Oculomotor nerves:

- The oculomotor nerve is the third cranial nerve (CN III). It enters the orbit via the superior orbital fissure and innervates extrinsic eye muscles that enable most movements of the eye and that raise the eyelid.
- The nerve also contains fibers that innervate the intrinsic eye muscles that enable pupillary constriction and accommodation (ability to focus on near objects as in reading).
- The oculomotor nerve is derived from the basal plate of the embryonic midbrain. Cranial nerves IV and VI also participate in control of eye movement.

✓ Trochlear nerves:

- The trochlear nerve, also called the **fourth cranial nerve** or **CN IV**, is a motor nerve (a somatic efferent nerve) that innervates only a single muscle: the superior oblique muscle of the eye, which operates through the pulley-like trochlea.

✓ Trigeminal nerves:

- The **trigeminal nerve** (the **fifth cranial nerve**, or simply **CN V**) is a nerve responsible for sensation in the face and motor functions such as biting and chewing; it is the most complex of the cranial nerves.
- Its name ("trigeminal" = *tri-*, or three, and - *geminus*, or twin: thrice-twinned) derives from the fact that each of the two nerves (one on each side of the pons) has three major branches: the ophthalmic nerve (V_1), the maxillary nerve (V_2), and the mandibular nerve (V_3).

- The ophthalmic and maxillary nerves are purely sensory, whereas the mandibular nerve supplies motor as well as sensory (or "cutaneous") functions.
- Adding to the complexity of this nerve is the fact that autonomic nerve fibers as well as special sensory fibers (taste) are contained within it.
- The motor division of the trigeminal nerve derives from the basal plate of the embryonic pons, and the sensory division originates in the cranial neural crest. Sensory information from the face and body is processed by parallel pathways in the central nervous system.

✓ Abducent nerves:

- The **abducens nerve** (or **abducent nerve**) is the sixth cranial nerve (CNVI), in humans, that controls the movement of the lateral rectus muscle, responsible for outward gaze. It is a somatic efferent nerve.

✓ Facial nerves:

- The **facial nerve** is the seventh cranial nerve, or simply **CN VII**. It emerges from the pons of the brainstem, controls the muscles of facial expression, and functions in the conveyance of taste sensations from the anterior two-thirds of the tongue.
- The nerves typically travels from the pons through the facial canal in the temporal bone and exits the skull at the stylomastoid foramen.
- It arises from the brainstem from an area posterior to the cranial nerve VI (abducent nerve) and anterior to cranial nerve VIII (vestibulocochlear nerve).

✓ Vestibulocochlear nerves:

- The vestibulocochlear nerve (auditory vestibular nerve), known as the eighth cranial nerve, transmits sound and equilibrium (balance) information from the inner ear to the brain.
- The vestibulocochlear nerve consists mostly of bipolar neurons and splits into two large divisions: the cochlear nerve and the vestibular nerve.

- Cranial nerve 8, the vestibulocochlear nerve, goes to the middle portion of the brainstem called the pons, (which then is largely composed of fibers going to the cerebellum).

- The 8th cranial nerve runs between the base of the pons (the middle portion of the brainstem) and medulla oblongata (the lower portion of the brainstem). This junction between the pons, medulla, and cerebellum that contains the 8th nerve is called the cerebellopontine angle.

✓ Glossopharyngeal nerves:

- The **glossopharyngeal nerve**, known as the ninth cranial nerve (**CN IX**), is a mixed nerve that carries afferent sensory and efferent motor information.
- It exits the brainstem out from the sides of the upper medulla, just anterior (closer to the nose) to the vagus nerve. The motor division of the glossopharyngeal nerve is derived from the basal plate of the embryonic medulla oblongata, while the sensory division originates from the cranial neural crest.

✓ Vegus nerves:

- The **vagus nerve**, historically cited as the **pneumogastric nerve**, is the tenth cranial nerve or **CN X**, and interfaces with the parasympathetic control of the heart, lungs, and digestive tract.
- The vagus nerves are normally referred to in the singular. It is the longest nerve of the autonomic nervous system in the human body. The ending part of the vagus nerve is known as the nucleus ambiguus

✓ Accessory nerves:

- The **accessory nerve** is a cranial nerve that supplies the sternocleidomastoid and trapezius muscles.
- It is considered as the eleventh of twelve pairs of cranial nerves, or simply **cranial nerve XI**, as part of it was formerly believed to originate in the brain.

- The sternocleidomastoid muscle tilts and rotates the head, while the trapezius muscle, connecting to the scapula, acts to shrug the shoulder.

✓ Hypoglossal nerves:

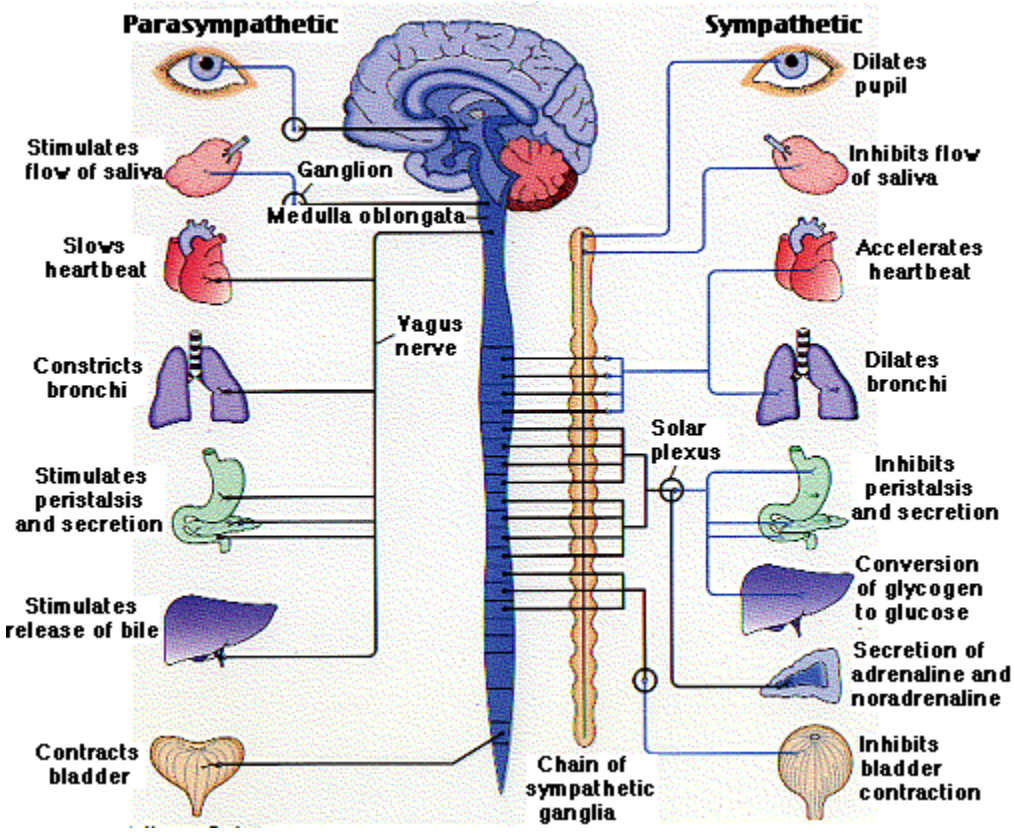
- The **hypoglossal nerve** is the twelfth cranial nerve, and innervates all the extrinsic and intrinsic muscles of the tongue, except for the palatoglossus which is innervated by the vagus nerve.
- It is a nerve with a solely motor function. The nerve arises from the hypoglossal nucleus in the medulla as a number of small rootlets, passes through the hypoglossal canal and down through the neck, and eventually passes up again over the tongue muscles it supplies into the tongue.
- The nerve is involved in controlling tongue movements required for speech and swallowing, including sticking out the tongue and moving it from side to side.

2)Write down the structure & functions of autonomous nervous system.(5)

Autonomous nervous system:

- The autonomic nervous system is the part of the nervous system that supplies the internal organs, including the blood vessels, stomach, intestine, liver, kidneys, bladder, genitals, lungs, pupils, heart, and sweat, salivary, and digestive glands.
- The autonomic nervous system regulates certain body processes, such as blood pressure and the rate of breathing. This system works automatically (autonomously), without a person's conscious effort.
- Within the brain, the autonomic nervous system is regulated by the hypothalamus
- Although the ANS is also known as the visceral nervous system, the ANS is only connected with the motor side. Most autonomous functions are involuntary but they can often work in conjunction with the somatic nervous system which provides voluntary control.

- The autonomic nervous system has two main divisions:
    - Sympathetic
    - Parasympathetic
- After the autonomic nervous system receives information about the body and external environment, it responds by stimulating body processes, usually through the sympathetic division, or inhibiting them, usually through the parasympathetic division.
- An autonomic nerve pathway involves two nerve cells. One cell is located in the brain stem or spinal cord.
- It is connected by nerve fibers to the other cell, which is located in a cluster of nerve cells (called an autonomic ganglion). Nerve fibers from these ganglia connect with internal organs.
- Most of the ganglia for the sympathetic division are located just outside the spinal cord on both sides of it. The ganglia for the parasympathetic division are located near or in the organs they connect with.



Structure:

- The autonomic nervous system is divided into the sympathetic nervous system and parasympathetic nervous system.
- The sympathetic division emerges from the spinal cord in the thoracic and lumbar areas, terminating around L2-3.
- The parasympathetic division has craniosacral "outflow", meaning that the neurons begin at the cranial nerves (specifically the oculomotor nerve, facial nerve, glossopharyngeal nerve and vagus nerve) and sacral (S2-S4) spinal cord.
- The efferent (motor) nerves of the autonomic nervous system arise from the brain and emerge at various levels between the mid brain and the sacral region of the spinal cord.
- Many of them travel within the same nerve sheath as peripheral nerves to reach the organs they innervate.
- Each division has two efferent neurons between the CNS and effector organs. These are:
    - the preganglionic neurone
    - the postganglionic neurone
- The cell body of the preganglionic neurone is located in the brain or spinal cord.
- Its axon terminals synapse with the cell body of the postganglionic neurone in an autonomic ganglion outside the CNS.

Function:

- The autonomic nervous system controls internal body processes such as:
    - Blood pressure
    - Heart and breathing rates
    - Body temperature
    - Digestion
    - Metabolism (thus affecting body weight)

- The balance of water and electrolytes (such as sodium and calcium)
- The production of body fluids (saliva, sweat, and tears)
- Urination
- Defecation
- Sexual response

3)Explain about Meninges.(5)

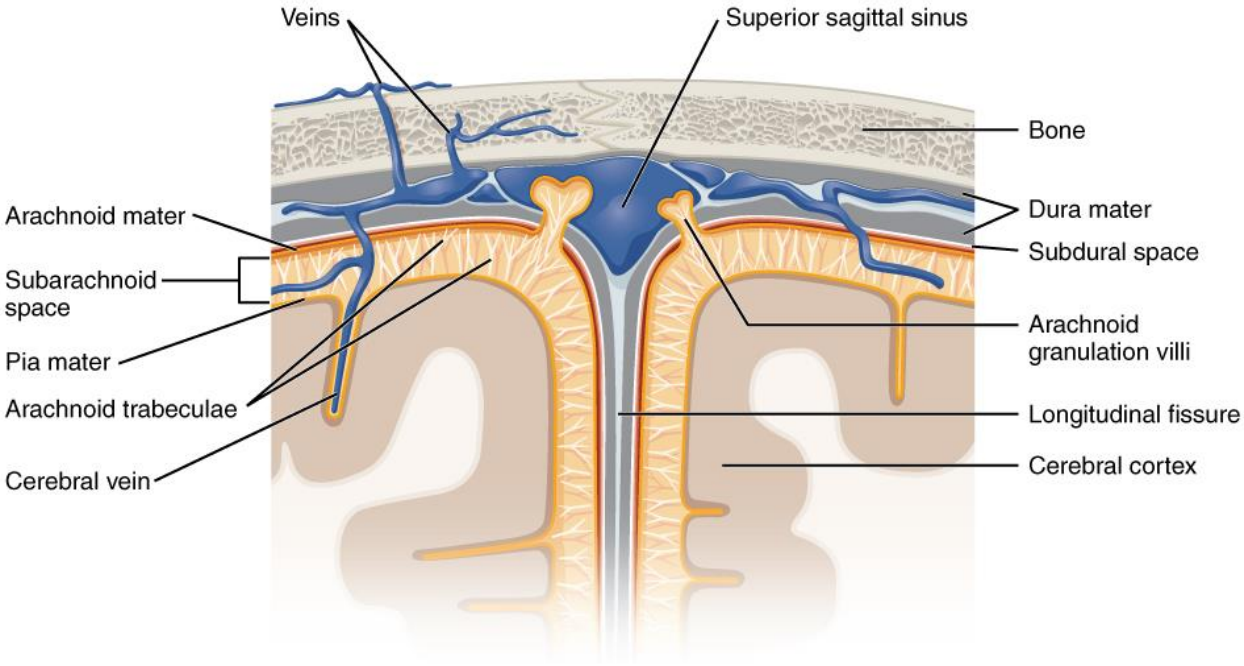
Meninges:

- The central nervous system consist of the brain and spinal cord. These essential structures are both well protected from damage and injury: the brain is enclosed within the skull and the spinal cord by the vertebrae that form the spinal column.
- Membranous covering called meninges provide further protection.
- The brain and spinal cord are completely surrounded by three layers of tissue, the meninges, lying between the skull and the brain, and between the vertebral foramina and the spinal cord.
- Named from out side inwards, they are the:
    - Dura mater
    - Arachnoid mater
    - Pia mater

In the brain, two spaces are associate with the meninges:

- The subdural space- this is a potential space that lies between the dural and arachnoid maters, and contains a very small amount of serous fluid.
- The subarachnoid space- this separates the arachnoid and pia maters, and contain cerebrospinal fluid.

These continue into the spinal canal, which contains an additional space, the epidural space.



Dura mater:

- The dura mater is a thick, durable membrane, closest to the skull and vertebrae.
- The dura mater, the outermost part, is a loosely arranged, fibroelastic layer of cells, characterized by multiple interdigitating cell processes, no extracellular collagen [source?], and significant extracellular spaces..
- The middle region is a mostly fibrous portion. It consists of two layers: the endosteal layer, which lies closest to the skull, and the inner meningeal layer, which lies closer to the brain.
- It contains larger blood vessels that split into the capillaries in the pia mater. It is composed of dense fibrous tissue, and its inner surface is covered by flattened cells like those present on the surfaces of the pia mater and arachnoid mater.
- The dura mater is a sac that envelops the arachnoid mater and surrounds and supports the large dural sinuses carrying blood from the brain toward the heart.

The dura has divides areas of infolding:

- Falx cerebri, the largest, sickle-shaped; separates the cerebral hemispheres. Starts from the frontal crest of frontal bone and the crista galli running to the internal occipital protuberance.

- Tentorium cerebelli, the second largest, crescent-shaped; separates the occipital lobes from cerebellum. The falx cerebri attaches to it giving a tentlike appearance.
- Falx cerebelli, vertical infolding; lies inferior to the tentorium cerebelli, separating the cerebellar hemispheres.

Arachnoid mater:

- The middle element of the meninges is the arachnoid mater, so named because of its spider web-like appearance. It cushions the central nervous system.
- This thin, transparent membrane is composed of fibrous tissue and, like the pia mater, is covered by flat cells also thought to be impermeable to fluid.
- The shape of the arachnoid does not follow the convolutions of the surface of the brain and so looks like a loosely fitting sac. In particular, in the region of the brain a large number of fine filaments called arachnoid trabeculae pass from the arachnoid through the subarachnoid space to blend with the tissue of the pia mater.
- The arachnoid is composed of an outermost portion (arachnoid barrier cell layer) with tightly packed cells and no extracellular collagen; that is why it is considered to represent an effective morphological and physiological meningeal barrier between the cerebrospinal fluid and subarachnoid space and the blood circulation in the dura.
- The arachnoid barrier layer is characterized by a distinct continuous basal lamina on its inner surface toward the innermost collagenous portion of the arachnoid reticular layer.

Pia mater:

- The pia mater is a very delicate membrane. It is the meningeal envelope that firmly adheres to the surface of the brain and spinal cord, following all of the brain's contours.
- It is a very thin membrane composed of fibrous tissue covered on its outer surface by a sheet of flat cells thought to be impermeable to fluid.
- The pia mater is pierced by blood vessels to the brain and spinal cord, and its capillaries nourish the brain.