Section 1

General Functional Organization of the Nervous System

1) The central nervous system includes all the following components, except :-
   a- spinal cord
   b- medulla oblongata
   c- autonomic ganglia
   d- diencephalon

2) The central nervous system is connected with the peripheral nervous system by all the following types of nerve fibers, except :-
   a- postganglionic autonomic fibers
   b- preganglionic autonomic fibers
   c- somatic motor fibers
   d- autonomic sensory fibers

3) The sensory system is involved in all the following, except :-
   a- initiation of reflex movements
   b- initiation of voluntary movements
   c- learning processes
   d- initiation of emotional responses
Section 2

Sensory System and Sensory Receptors

1) The two-element sensory receptors differ from other types of receptors in being:
   a- more numerous
   b- more widely spread in the body
   c- more sensitive
   d- composed of specialized cells at the sensory nerve terminals

2) Sensory receptors are classified functionally according to the following criteria, except:
   a- their location in the body
   b- the nature of tissues in which they are found
   c- the nature of stimuli acting on them
   d- their connection with cerebral coretx

3) Most sensory receptors:
   a- are stimulated by different types of stimuli
   b- are stimulated only by specific stimuli
   c- posses a high threshold for their specific stimuli
   d- only ‘b’ and ‘c’ are correct

4) A specific stimulus produces a receptor potential by:
   a- inhibiting Na+ influx into receptor
   b- inhibiting K+ efflux from receptor
   c- enhancing Na+ influx into receptor
   d- enhancing K+ efflux from receptor

5) Receptor potential initiated by an adequate stimulus:
   a- develops always at it full magnitudes
   b- undergoes temporal summation only
   c- undergoes spatial summation only
   d- could initiate an action potential

6) Once initiated, the receptor potential:
   a- spreads to a long distance along the sensory nerve fiber
   b- amplitude is not related to the strength of the stimulus
   c- always generates an action potential from the receptor
   d- stays for a variable period depending on the type of the receptor
7) Receptor potential generates :-
   a- an electrotonic current which is transmitted along sensory fibers to the CNS
   b- a nerve impulse at the receptive region of the receptor
   c- a state of hyperpolarization of the receptor membrane
   d- a nerve impulse at the spike initiating region of the receptor

8) When stimulated by effective steady stimuli, sensory receptors :-
   a- continuously discharge impulses
   b- stop discharging after a short time
   c- produce an initial high rate of impulse discharge followed by decline of this rate
   d- differ in their response; some types discharge continuously, while other types do not respond at all

9) Slowly adapting receptors include all the following types, except :-
   a- Golgi tendon organs
   b- warmth receptors
   c- free nerve endings
   d- Meissner corpuscles

10) Slowly adapting receptors differ from rapidly adapting receptors in :-
    a- stopping to discharge after a relatively longer period of constant stimulation
    b- detecting the dynamic properties of stimuli
    c- detecting velocity of stimuli
    d- generating receptor potentials as long as stimulus is applied.

11) Rapidly adapting receptors are involved in :-
    a- static reflex responses
    b- detection of joint movements
    c- regulation of heart rate
    d- only ‘a’ and ‘b’ are correct

12) Receptors detect stimulus intensity by :-
    a- lowering the threshold for receptor stimulation
    b- by generating receptor potentials having higher magnitudes
    c- by generating nerve impulses that are transmitted along sensory fibers at higher velocities
    d- by enhancing the central effects of sensory impulses
1) General sensations:-
   a- originate from all sensory receptors of the body
   b- are mediated by somatic sensory fibers only
   c- include the sense of movement
   d- include the sense of equilibrium

2) Detection of the stimulus modality depends upon :-
   a- the location of the receptors in the body
   b- the magnitude of the stimulus
   c- the anatomical connections between the receptors and specific sensory areas in the cerebral cortex
   d- the magnitude of the receptor potential

3) Receptors detect stimulus intensity by :-
   a- lowering the threshold for stimulating receptors
   b- raising the threshold for stimulating receptors
   c- decreasing the magnitude of receptor potential
   d- raising the magnitude of receptor potential

4) The ability to localize the site of stimuli depends upon :-
   a- the type of the stimulated receptor
   b- connections between the receptor and the sensory cortex
   c- the rate of adaptation of the stimulated receptors
   d- the nature of the stimulus
Section 4

Mechanoreceptive Sensations

1) Touch receptors :-
   a- are found only in the skin
   b- are all encapsulated receptors
   c- include two-element receptors
   d- are stimulated by vibration

2) Tactile receptors include all the following receptors, except :-
   a- free nerve endings
   b- hair follicle receptors
   c- hair cell receptors
   d- Ruffini nerve endings

3) Rapidly adapting tactile receptors include all the following types, except :-
   a- Merkel discs
   b- Meissner corpuscles
   c- Pacinian corpuscles
   d- hair end organs

4) Fine touch :-
   a- is detected by slowly adapting touch receptors
   b- is transmitted by the spinothalamic tract
   c- is characterized by it emotional affect
   d- is not involved in feeling the texture of touched objects

5) Crude touch is more effective than fine touch in evoking an emotional response because :-
   a- its provoking stimuli are stronger
   b- its central pathway connects with the limbic system
   c- it is stimulated during emotional excitement
   d- the provoking stimuli have an emotional nature

6) A more developed two-point tactile discrimination :-
   a- indicates a greater threshold distance for feeling of two points of touch applied simultaneously
   b- is seen in the proximal regions of the body compared with the distal regions
   c- is inversely related to the size of the receptive fields of the stimulated sensory units
   d- depends upon the type of the involved touch receptor
7) Proprioceptive sensations include all the following, except :-
   a- position sense
   b- equilibrium sense
   c- movement sense
   d- kinesthetic sense

8) Proprioceptors include all the following types of receptors, except :-
   a- muscle spindles
   b- pressure receptors
   c- vestibular receptors
   d- joint receptors

9) Proprioceptive sensations are transmitted by all the following pathways, except :-
   a- spinothalamic tracts
   b- spinocerebellar tract
   c- gracile tract
   d- cuneocerebellar tract

10) Astereognosis :-
    a- indicates inability to localize the site of touch on the body surface
    b- results from lesions of the secondary somatic sensory area
    c- associates parietal lobe neglect
    d- results from loss of crude touch sensation

11) Parietal lobe neglect :-
    a- is characterized by inability to use skeletal muscles on the opposite side of the body
    b- is characterized by inability to use skeletal muscles on the same side of the body
    c- results from damage of primary sensory cortex.
    d- causes loss of sensations on the same side of the body
Section 5

Pain Sensation

1) Pain sensation :-
   a- is evoked by strong stimulation of specific receptors
   b- produces reactions that block transmission of pain impulses
   c- arises from small encapsulated receptors
   d- occurs when the stimulus causes damage of the sensory receptors

2) Reaction to pain includes all the following, except :-
   a- increased heart rate
   b- depression
   c- withdrawal reflexes
   d- stoppage of impulse discharge from nociceptors in chronic painful conditions

3) Pain receptors :-
   a- become more sensitive with prolonged stimulation
   b- are stimulated by prostaglandins
   c- are more numerous in viscera than other tissues
   d- include different morphological types

4) Pain threshold :-
   a- is the highest intensity of stimulus that causes pain
   b- is the lowest intensity of stimulus that causes pain
   c- differs markedly among different individuals
   d- is elevated by substance P

5) Fast pain differs from slow pain in :-
   a- being transmitted in the dorsal column pathway
   b- evoking a depressor autonomic reaction
   c- having a sharp quality
   d- arising from encapsulated pain receptors

6) Double pain sensation that is occasionally felt following painful stimulation of the skin is due to :-
   a- repetition of the painful stimulus
   b- presence of dual pain pathways
   c- perception of pain at two different higher centers
   d- application of two painful stimuli simultaneously at two different sites
7) Cutaneous pain :-
   a- is always sharp in character
   b- is transmitted by Aδ sensory fibers
   c- is always followed by hyperalgesia
   d- evokes spasm of nearby muscles

8) Primary cutaneous hyperalgesia :-
   a- develops in the normal skin region around the area of flare
   b- is an abnormal condition in the skin in which painful stimuli become more severe
   c- is due to changes in threshold of pain receptors
   d- is associated with throbbing type of pain

9) Deep pain shows the following characteristics, except :-
   a- dull aching
   b- throbbing
   c- evokes flexor reflexes
   d- diffuse

10) Intermittent Claudications evoke :-
    a- visceral pain
    b- deep pain
    c- cutaneous hyperalgesia
    d- colicky pain

11) Pain produced by muscle spasm results from :-
    a- mechanical stimulation of pain receptor by muscle spasm
    b- decreased release of lactic acid from the spastic muscle fibers
    c- release of compounds from the spastic muscle which increase the threshold for stimulation of pain receptors
    d- decreased oxygen supply to the muscle

12) Visceral pain :-
    a- is more common than the other types of pain
    b- arises only from wall of the visceral organs
    c- is often well localized
    d- evokes depressor autonomic reactions

13) Stimuli which evoke true visceral pain include all the following, except :-
    a- sharp cutting
    b- stretching
    c- spasm
    d- chemical irritation
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14) Visceral pain is usually felt :-
   a- deeply in the diseased viscera
   b- in deep tissues close to the diseased viscera
   c- in skin areas that just overlie the diseased viscera
   d- in skin areas remote from the diseased viscera

15) Intracranial headache could result from painful stimuli applied on :-
   a- the dura lining the inner surface of the bones of cranial vault
   b- the brain tissue
   c- wall of big intracranial veins
   d- arachnoid mater

16) Intracranial headache may result from all the following clinical causes, except :-
   a- decreased CSF pressure
   b- spasm of scalp muscles
   c- distension of big venous sinuses
   d- pressure upon tentorium cerebelli

17) Transmitters in pain control system include all the following, except :-
   a- serotonin
   b- acetylcholine
   c- enkephalin
   d- norepinephrine

18) Enkephalin binds best with :-
   a- delta ‘δ’ opiate receptors
   b- mu ‘μ’ opiate receptors
   c- kappa ‘κ’ opiate receptors
   d- all opiate receptors with equal affinity

19) Pain control system :-
   a- is activated whenever a painful stimulus is applied to body tissues
   b- is never activated naturally
   c- is activated only by administration of opiate drugs
   d- is activated naturally under conditions associated with strong emotional excitement
20) Enkephalin blocks pain transmission by :-
   a- blocking the response of pain receptors to painful stimuli
   b- slowing down transmission of pain impulses through synapses in the pain pathway
   c- inhibiting the response of the cerebral cortical somatic sensory area to pain signals
   d- blocking Ca ++ channels in the central terminals of pain sensory fibers

21) The spinal pain gate is :-
   a- Ligand controlled
   b- voltage controlled
   c- opened by enkephalin
   d- closed by substance P
Section 6
Thermal Sensations

1) Thermal sensations :-
   a- are evoked by all changes in environmental temperatures
   b- are evoked by stimulation of thermo-sensitive pain receptors
   c- are involved in regulation of metabolic activity
   d- are transmitted by Aβ sensory fibers

2) Thermal receptors are :-
   a- slowly adapting receptors
   b- rapidly adapting receptors
   c- biphasic receptors
   d- all encapsulated receptors
Section 7

Synapses of the Central Nervous System

1) Connexons of gap junctions in electric synapses:-
   a- are Ligand-gated
   b- are voltage-gated
   c- allow transmission of potential changes in both directions between the pre- and post- synaptic neurons
   d- close whenever the presynaptic neuron becomes hyperpolarized

2) Chemical synapses in the nervous system :-
   a- allow diffusion of chemical substances form the presynaptic neuron into the postsynaptic neuron
   b- allow transmission of potential changes in one direction only; from the presynaptic to the postsynaptic neurons
   c- have potential-gated ionic channels
   d- are more numerous in the peripheral nervous system than the central nervous system

3) Synaptic cleft :-
   a- is the space between two synapses on the surface of neurons
   b- allow diffusion of transmitters between neurons
   c- is filled with intracellular fluid
   d- ranges between 20 – 30 μm in width

4) Synaptic knobs :-
   a- synthesize different types of neurotransmitters
   b- release neurotransmitters by diffusion across their membranes
   c- have ligand-gated Ca ++
   d- are located at the terminal end of dendrites

5) Synaptic transmission depends upon :-
   a-direct transmission of impulses from the presynaptic neuron to the postsynaptic neuron
   b- diffusion of neurotransmitters from synaptic knobs into the soma and dendrites of postsynaptic neurons
   c- presence of voltage-gated Ca ++ channels in membrane of synaptic knobs
   d- presence of voltage-gated Ca ++ channels in the subsynaptic membrane
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6) Postsynaptic receptors include all the following types, except :-
   a- G-protein coupled receptors
   b- ligand-gated cation channels
   c- G-protein regulated K + channels
   d- voltage-gated Cl- channels

7) When opened, the ligand-gated cation channels do not allow diffusion of Cl- because :-
   a- the size of Cl- is bigger than the bore of the channels
   b- intracellular negativity causes complete inhibition of Cl- influx
   c- the channels are specific for diffusion of Na + only
   d- the inner surface of the channels is negatively charged

8) Opening of ligand-gated Cl- channels causes :-
   a- inhibition of the postsynaptic neuron
   b- depolarization of the postsynaptic neuron
   c- initiation of an action potential
   d- block of ligand-gated cation channels

9) IPSP differs from EPSP in :-
   a- being of shorter duration
   b- being unable o summate spatially
   c- moving the membrane potential away from threshold
   d- depending upon opening of voltage K + channels

10) When EPSp and IPSP occur simultaneously the postsynaptic membrane :-
    a- becomes depolarized
    b- becomes hyperpolarized
    c- initiates an action potential
    d- shows potential changes that depend upon the summation of their effects

11) When a postsynaptic neuron is adequately stimulated, action potentials develop at the initial segment of the axon because :-
    a- it contains many voltage-gated Na + channels
    b- it contains the highest concentration of ligand-gated cation channels
    c- it contains many voltage-gated Ca ++ channels
    d- it is more sensitive to the direct stimulant effect of neurotransmitters

12) IPSP could result from :-
    a- opening of K + channels
    b- opening of ligand-gated cation channels
    c- closure of Cl- channels
    d- closure of potential-gated Ca ++ channels
13) Synaptic transmission is terminated by :-
a- block of presynaptic receptors
b- elevation of Ca ++ concentration in synaptic cleft
c- reuptake of neurotransmitters by postsynaptic neurons
d- degradation of neurotransmitters by specific enzymes

14) Presynaptic inhibition is characterized by all the following, except :-
a- increased Cl- influx into presynaptic terminals
b- increased Ca ++ influx into presynaptic terminals
c- decreased response of postsynaptic receptors
d- hyperpolarization of presynaptic terminals

15) Presynaptic inhibition depends upon :-
a- augmented release of chemical transmitter from presynaptic terminals
b- continued depolarization of presynaptic terminals
c- GABA receptors in presynaptic terminals
d- opening of voltage-gated Ca ++ channels in presynaptic terminals

16) In chemical synapses, transmission occurs in a forward direction because :-
a- neurotransmitter receptors are found only in the postsynaptic membrane
b- the subsynaptic membrane does not contain neurotransmitter vesicles
c- the subsynaptic membrane is more sensitive than the membrane of synaptic knob to the effect of neurotransmitters
d- the subsynaptic membrane contains both ligand-gated and voltage-gated ionic channels

17) Synaptic delay :-
a- is the time needed for release of neurotransmitter from synaptic vesicles
b- the minimal delay time in the central nervous system is about 0.5 millisecond
c- is determined by the type of the neurotransmitter
d- is determined by the number of postsynaptic receptors

18) Synaptic fatigue is due to :-
a- decreased synthesis of neurotransmitters
b- inability to release neurotransmitters by exocytosis
c- failure of action potentials to open voltage-gated Ca ++ channels in presynaptic terminal
d- imbalance in between rates of synthesis and release of neurotransmitters
19) Synaptic transmission is inhibited by all the following, except :-
   a- oxygen lack
   b- alkalosis
   c- acidosis
   d- prolonged activity of synapse

20) Post-tetanic Potentiation in synapses :-
   a- is due to increased Ca ++ concentration in postsynaptic neurons
   b- is due to increased Ca ++ influx into presynaptic neurons
   c- results from slow prolonged stimulation of synapse
   d- causes fatigue of the synapse

21) Long-term potentiation of synaptic transmission :-
   a- is involved in pain control system
   b- is caused by increased Ca ++ concentration in presynaptic neurons
   c- results from fast repetitive stimulation of synapse
   d- is associated with decreased Ca ++ concentration in postsynaptic neurons

22) Drugs which open Cl- channels in synapses :-
   a- cause depolarization of postsynaptic membrane
   b- cause hyperpolarization of postsynaptic membrane
   c- enhance release of neurotransmitters from synaptic knobs
   d- enhance response of postsynaptic neurons

23) Small-molecule neurotransmitters include all the following types, except :-
   a- Substance P
   b- gamma amino butyric acid
   c- acetylcholine
   d- norepinephrine

24) Neuropeptides :-
   a- are synthesized in the synaptic knobs
   b- consist of small molecules
   c- interact with ligand-receptors
   d- could produce prolonged changes in the structure of postsynaptic neurons

25) All the following transmitters are neuropeptides, except :-
   a- neuropeptide Y
   b- somatostatin
   c- dopamine
   d- enkephalin
26) Actions of neuropeptides include all the following, except:
   a- inhibition of gene transcription
   b- decreased cyclic AMP synthesis
   c- changing intracellular Ca ++ level
   d- activation of ligand-gated receptors
Section 8

Motor Functions of the Spinal Cord: Spinal Reflexes

1) Higher motor commands originate in all the following centers, except :-
   a- cerebral cortex
   b- thalamus
   c- caudate nucleus
   d- cerebellum

2) A reflex action :-
   a- is a fast brief response to a sensory stimulus
   b- is involved in regulation of voluntary movements
   c- includes at least three sequential sets of neurons in its pathway
   d- is always initiated whenever its specific receptors are effectively stimulated by a specific stimulus

3) Reflex actions could be classified according to :-
   a- the type of sensory receptors initiating them
   b- the type of afferent nerves mediating them
   c- the type of efferent nerves mediating them
   d- the type of neurotransmitters mediating them

4) Events of reflex actions include all the following, except :-
   a- stimulation of sensory receptors
   b- stimulation of central synapses
   c- inhibition of sensory receptors
   d- inhibition of central synapses

5) A reflex arc includes :-
   a- at least two sets of sequential neurons
   b- at least two sequential sets of central synapses
   c- at least two types of sensory receptors
   d- at least two types of efferent neurons
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6) The central terminals of afferent neurons mediating spinal reflexes are distributed within the spinal cord, so that :-  
a- all of them terminate in the same spinal segment of their entry to the cord  
b- all of them terminate on interneurons  
c- all of them subserve spinal reflexes  
d- they provide pathways for divergence of the incoming sensory impulses

7) Interneurons :-  
a- provide communication between the central ends of afferent neurons  
b- provide communication between dendrites of the efferent neurons  
c- influence the rate of discharge from the alpha motor neurons  
d- participate in ascending sensory pathways

8) The divergence function of interneurons is involved in :-  
a- temporal summation  
b- spatial summation  
c- reverberation  
d- irradiation

9) Interneuron after-discharge circuits prolong the duration of :-  
a- sensory input to the spinal motor centers  
b- synaptic delay in central synapses  
c- discharge of efferent neurons  
d- conscious perception of the evoked sensation

10) A flexor withdrawal reflex shows all the following properties, except :-  
a- recruitment  
b- prepotent  
c- non-fatigable  
d- irradiation

11) Flexor reflexes do not involve :-  
a- flexor muscles  
b- extensor muscles  
c- reciprocal inhibition  
d- reflex spasm of the involved muscles

12) The ability of stronger stimuli to produce wider range of reflex responses depends upon :-  
a- presence of reverberating circuits in reflex pathway  
b- presence of parallel-chain circuits in reflex pathway  
c- convergence of interneurons  
d- divergence of interneurons
13) Recruitment of a reflex response is due to :-
   a- difference in the amount of presynaptic inputs to the various efferent
      neurons initiating the reflex
   b- difference in the conduction velocity of the various afferent neurons
      mediating the reflex
   c- delay at the neuromuscular junction
   d- presence of inhibitory interneurons in the reflex pathway

14) After-discharge of reflex responses :-
   a- increase the magnitude of the reflex responses
   b- delays the onset of fatigue of reflex responses
   c- involves interneuron circuits
   d- depends upon spatial summation

15) Central delay of reflex actions :-
   a- is due to presence of inhibitory interneurons in the reflex pathway
   b- is the time between stimulation of receptors and response of the effector
      muscle
   c- is longer in the flexor reflex than in the stretch reflex
   d- is determined by the velocity of conduction of impulses along the afferent
      and efferent neurons in the reflex pathway

16) Fatigue of reflexes :-
   a- develops gradually and recovers rapidly
   b- develops rapidly and recovers slowly
   c- develops gradually and recovers slowly
   d- develops rapidly and recovers rapidly

17) In flexor withdrawal reflexes contraction of flexor muscles is associated
    with reciprocal inhibition of :-
    a- synergistic flexor muscles
    b- contralateral extensor muscles
    c- ipsilateral extensor muscles
    d- both ‘a’ and ‘b’ are correct

18) Reciprocal inhibition between reflexes depends upon all the following,
    except :-
    a- presence of inhibitory interneurons in the reflex pathways
    b- presence of excitatory interneurons in the reflex pathways
    c- presence of anion channels in membranes of the involved neurons
    d- release of inhibitory transmitters which block cation channels in the
       reflex pathways
19) stretch reflex is characterized by the following except :-
a- disynaptic reflex
b- high localization
c- shows reciprocal innervations.
d- it is of graded response

20) Stretch of an innervated muscle evokes :-
a- contraction of its spindles
b- contraction of its extrafusal fibers
c- contraction of antagonistic muscles
d- relaxation of synergistic muscles

21) Muscle spindles :-
a- are found in all skeletal muscles
b- are found only in large skeletal muscles
c- consist of small numbers of extrafusal muscle fibers
d- consist of a large number of extrafusal muscle fibers

22) The nuclear-bag fibers of muscle spindles are innervated by :-
a- Aγ nerve fibers
b- Aβ nerve fibers
c- Aδ nerve fibers
d- Ia nerve fibers

23) The nuclear-chain fibers of spindles are innervated by :-
a- Aα and Aδ nerve fibers
b- Aδ and C nerve fibers
c- Ia and II nerve fibers
d- only type II nerve fibers

24) The central ends of afferents from muscle spindles synapse with all the following types of neurons, except :-
a- α-motor neurons of the same muscle
b- γ-motor neurons of the same muscle
c- local interneurons
d- 2nd order neurons of ascending sensory pathways
25) γ-motor innervation of muscle spindles produces:
   a- contraction of the central region of the spindle fibers
   b- increased sensory discharge from the central region of the spindle fibers
   c- decreased sensory discharge from the central region of the spindle fibers
   d- relaxation of the peripheral regions of the spindle fibers

26) Discharge from muscle spindles could be increased by all the following, except:
   a- increased α-motor neuron discharge
   b- increased γ-motor neuron discharge
   c- stretch of the intrafusal muscle fibers
   d- stretch of the extrafusal muscle fibers

27) Increased γ-motor neuron discharge stimulates muscle spindles, because:
   a- it produces stretch of the extrafusal muscle fibers
   b- it causes stretch of the peripheral regions of the intrafusal fibers
   c- it causes stretch of the central region of the intrafusal fibers
   d- it stimulates directly the sensory fibers innervating muscle spindles

28) γ-motor neuron discharge to a muscle is inhibited by impulses reaching the γ-motor neurons from all the following source, except:
   a- Golgi tendon organs of the same muscle
   b- spindles of antagonistic muscles
   c- medullary reticular formation
   d- pontine reticular formation

29) When the γ-motor neuron discharge to a muscle decreases, it causes:
   a- increased muscle spindle discharge
   b- shortening of the spindle fibers
   c- stronger contraction of the extrafusal muscle fibers
   d- decreased spindle sensitivity to stretch

30) The role of muscle spindles in the maintenance of the upright posture depends upon all the following, except:
   a- contraction of the peripheral contractile part of spindle fibers
   b- increased sensory discharge from spindles of postural muscles
   c- increased supraspinal facilitation to the γ-motor neurons of postural muscles
   d- presence of greater numbers of spindles in postural muscles
31) The role of $\gamma$-motor neurons in regulation of equilibrium is achieved by:
   a- initiating contraction of spindle fibers which directly antagonize postural deviation
   b- increasing spindle sensitivity to stretch
   c- directly stimulating extrafusal muscle fibers to antagonize postural deviation
   d- directly adjusting the discharge of $\alpha$-motor neurons innervating the extrafusal muscle fibers to antagonize postural deviation

32) Interruption of $\gamma$-motor neuron discharge to a skeletal muscle produces:
   a- contraction of the muscle
   b- contraction of the spindle fibers
   c- relaxation of the spindle fibers
   d- increased sensory discharge from the spindle fibers

33) Co-activation of $\alpha$ and $\gamma$-motor neurons:
   a- increases $\gamma$-motor neuron discharge whenever the activity of $\alpha$-motor neurons rises to a high level
   b- is mediated by interneurons that link the $\alpha$ and $\gamma$-motor neurons
   c- maintains the proprioceptive information to higher centers during muscle contraction
   d- increases the $\alpha$-motor neuron discharge whenever the activity of $\gamma$-motor neurons rises to a high level

34) Increased sensory discharge from muscle spindles:
   a- decreases muscle tone
   b- increases muscle tone
   c- could either increase or decrease muscle tone according to the muscle affected
   d- has no effect on muscle tone

35) Interruption of spindle discharge from a muscle causes contraction of the muscle to become jerky and irregular due to:
   a- increased activity of reverberating circuits causing fluctuation of the motor discharge to the muscle
   b- increased activity of inhibitory interneurons causing oscillating inhibition of the $\alpha$-motor neurons of the muscle
   c- irregular discharge of excitatory inputs to the $\alpha$-motor neurons of the muscle
   d- post-tetanic potentiation of the $\alpha$-motor neurons of the muscle
36) Whenever the position of a joint is stabilized at a certain attitude, the nervous system produces this by :-
   a- increasing the α-motor neuron discharge to all muscles attached to the joint
   b- increasing the γ-motor neuron discharge to all muscles attached to the joint
   c- increasing γ-motor neuron discharge to postural muscles
   d- co-activation of α and γ-motor neurons innervating the involved muscles

37) The highly localized nature of stretch reflex is due to :-
   a- the limited number of interneurons in the reflex pathway
   b- all the central ends of afferents from spindles of the stretched muscle terminate on the α-motor neurons of the muscle
   c- the α-motor neurons of the stretched muscle receive most of the central terminals of afferents coming from spindles of the muscle
   d- activation of inhibitory interneurons which inhibit the motor neurons of the surrounding muscles

38) The shortest reflex time is recorded with :-
   a- a flexor withdrawal reflex
   b- an inverse stretch reflex
   c- a stretch reflex
   d- a scratch reflex

39) When a skeletal muscle is suddenly stretched :-
   a- it relaxes suddenly
   b- it develops a static stretch reflex
   c- it develops a dynamic stretch reflex
   d- it develops clonic contractions

40) Sensory impulses from spindles of a stretched muscle could inhibit antagonistic muscles by :-
   a- directly inhibiting γ-motor neurons of the antagonistic muscles
   b- directly inhibiting the α-motor neurons of the antagonistic muscles
   c- inhibiting the transmitter release from the central terminals of afferents from the spindles of the antagonistic muscles
   d- activation of inhibitory interneurons

41) Antigravity muscles maintain stretch reflex for prolonged periods without fatigue, because :-
   a- they are heavily innervated by α-motor neurons
   b- they obtain their energy needs mainly from anaerobic metabolic processes
   c- they contain exceptionally high levels of creatine phosphate
   d- they are rich in mitochondria
42) The discharge from Golgi tendon organs initiated by excessive stretch of a skeletal muscle produces :-

a- inhibition of $\alpha$-motor neurons of antagonistic muscles  
b- inhibition of $\gamma$-motor neurons of antagonistic muscles  
c- inhibition of $\alpha$-motor neurons of the same muscle  
d- stimulation of $\gamma$-motor neurons of the same muscle

43) Inverse stretch reflex :-

a- increases the possibility of avulsion of the excessively stretched muscle from its bony attachments  
b- has no reciprocal innervation circuits  
c- is clinically manifested by lengthening reaction  
d- is clinically tested by examining the tendon jerks

44) Skeletal muscle tone :-

a- is a dynamic stretch reflex  
b- has a dynamic state  
c- is increased during rest  
d- is decreased during standing upright

45) $\gamma$-motor neurons control muscle tone by :-

a- adjusting the supraspinal facilitatory discharge  
b- adjusting the $\alpha$-motor neuron discharge  
c- adjusting the muscle spindle discharge  
d- adjusting the activity of interneurons in the reflex arc of muscle tone

46) Adequate level of muscle tone is essential for the accurate performance of voluntary movements, because :-

a- it adjusts the $\alpha$-motor neuron discharge initiating voluntary movements  
b- it adjusts posture of proximal joints of the acting limbs  
c- it adjusts the upright posture of the whole body during voluntary movements  
d- it adjusts sensitivity of the spindles of the involved muscles

47) A tendon jerk :-

a- is a dynamic stretch reflex  
b- is a static stretch reflex  
c- is evoked by gradually stretching the muscle  
d- is evoked by stimulation of tendon receptors
48) The tendon jerk which has its center in the 5th and 6th cervical segments of the spinal cord is :-
   a- the jaw jerk 
   b- the deltoid jerk 
   c- the biceps jerk 
   d- the triceps jerk 

49) Tendon jerks are clinically examined to assess :-
   a- integrity of muscle spindles 
   b- integrity of reflex pathway 
   c- the total reflex time of the jerk 
   d- central delay time of the jerk 

50) Absence of a tendon jerk could result from any of the following conditions, except :-
   a- lesions of supraspinal facilitatory centers 
   b- lesions of the efferent neurons 
   c- lesions of the afferent neurons 
   d- lesions of the spinal nerve centers 

51) Exaggeration of tendon jerks could result from any of the following conditions, except :-
   a- lesions of supraspinal facilitatory centers 
   b- lesions of supraspinal inhibitory centers 
   c- increased \( \gamma \)-motor neuron discharge 
   d- anxiety 

52) Clonus :- 
   a- is a sign of decreased supraspinal facilitation 
   b- initiated by briefly stretching the tendon of the muscle 
   c- is manifested as oscillating mechanical vibrations following tendon jerks 
   d- associates exaggeration of tendon jerks
Section 9

The Descending Motor Systems

1) All of the following are descending motor tracts, except :-
   a- Rubrospinal tract
   b- Spinotectal tract
   c- Reticulospinal tract
   d- Corticobulbar tract

2) Corticospinal tract originates from all the following areas, except :-
   a- premotor area in the frontal lobe
   b- prefrontal area in the frontal lobe
   c- supplemental motor area in the frontal lobe
   d- somatic sensory area in the parietal lobe

3) The cranial motor nuclei which receive innervation only from the contralateral corticobulbar tract are :-
   a- nuclei of the trigeminal and vagus nerves
   b- nuclei of the vagus and glossopharyngeal nerves
   c- nuclei of the facial and hypoglossal nerves
   d- nuclei of the facial and glossopharyngeal nerves

4) Axons of the lateral corticospinal tract synapse mainly with :-
   a- lateral motor neurons
   b- medial motor neurons
   c- intermediolateral neurons
   d- interneurons

5) The lateral motor system includes :-
   a- the lateral Reticulospinal tract
   b- the lateral corticospinal tract
   c- the lateral vestibulospinal tract
   d- all the above tracts

6) The corticobulbospinal tract is involved in all the following, except :-
   a- voluntary movements
   b- postural adjustment
   c- automatic movements
   d- initiation of tendon jerks
7) The Rubrospinal tract :-
   a- originates from the pontine reticular formation
   b- descends contralaterally
   c- controls activity of axial muscles
   d- is a component of the medial motor system

8) The reticulospinal tracts :-
   a- are inhibitory to muscle tone
   b- are excitatory to muscle tone
   c- are either excitatory or inhibitory to muscle tone
   d- have effect on muscle tone

9) Vestibulospinal tracts :-
   a- adjust the discharge of vestibular receptors
   b- adjust muscle tone
   c- antagonize the effects of rubrospinal tract
   d- terminate on the lateral motor neurons in the spinal cord

10) Tectospinal tract :-
    a- originate mainly from the inferior colliculus
    b- originate mainly from the medial geniculate body
    c- mediate responses initiated by sudden changes of head position
    d- terminate in the cervical segments of the cord

11) representation of the body in the primary motor area :-
    a- is ipsilateral
    b- is upright
    c- is disproportionate to the actual anatomical size of the represented region
    d- all the above are correct

12) the primary motor area receives inputs arising from all the following centers, except :-
    a- basal ganglia
    b- cerebellum
    c- hypothalamus
    d- thalamus

13) The primary motor area projects efferent fibers to all the following centers, except :-
    a- 1ry somatic sensory area
    b- premotor area
    c- supplemental motor area
    d- brainstem motor nuclei
14) The premotor area includes all the following, except:
   a- Broca’s area
   b- head rotation area
   c- supplemental motor area
   d- hand skills area

15) Supplemental motor area is involved in all the following functions, except:
   a- adjusting posture
   b- orienting responses
   c- motor programming
   d- coordinating bilateral movements
Section 10

LMN Lesions, UMN Lesions, and Spinal Cord Lesions

1) Lower motor neuron lesions cause all the following, except :-
   a- decreased number of transmitter receptors in the denervated muscle
   b- atrophy of the denervated muscle
   c- flaccid paralysis of the denervated muscle
   d- loss of flexion withdrawal reflex

2) Fasciculations of lower motor neuron lesions :-
   a- are caused by injury currents initiated in the denervated muscle fibers
   b- can be recorded by electromyogram
   c- consist of asynchronous contraction of the muscle fibers composing a motor unit
   d- develop later than fibrillations of the muscle fibers

3) Denervation supersensitivity of the muscle in LMN lesions is due to :
   a- increased release of neurotransmitter from the degenerating nerve terminals
   b- decreased release of neurotransmitter from the degenerating nerve terminals
   c- increased number of transmitter receptors in fibers of the denervated muscle
   d- decreased number of transmitter receptors in fibers of the denervated muscle

4) When compared to normal muscle, the response of the denervated muscle to electrical stimulation shows :
   a- decreased chronaxie
   b- greater response to faradic stimulation
   c- abnormal response to galvanic stimulation
   d- CCC becomes greater than ACC

5) The most dramatic effects of an UMN lesion occurs with lesions at the level of :-
   a- the 1ry motor area
   b- internal capsule
   c- medullary pyramids
   d- lateral column of spinal white mater
MCQ : Central Nervous System

6) Motor defects that result from an internal capsular lesion include :-
   a- Paralysis of all skeletal muscles on the opposite side of the body
   b- Paralysis of all skeletal muscles on the same side of the body
   c- Paresis of axial muscles on the same side of the body
   d- Paralysis of the distal muscles on the opposite side of the body

7) Internal capsular lesions cause marked paralysis of the following muscles,
   except :-
   a- Tongue muscles
   b- Upper facial muscles
   c- Lower facial muscles
   d- Distal limb muscles

8) Hypertonia of UMN lesions is characterized by :-
   a- Increased inhibitory discharge from the premotor area
   b- Inhibition of pontine reticular formation
   c- Increased γ-motor neuron discharge
   d- Decreased muscle spindle discharge

9) In UMN lesions the response to plantar reflex :-
   a- Becomes exaggerated
   b- Becomes inhibited
   c- Becomes modified
   d- Is absent

10) In UMN lesions the response of the paralyzed muscles to electrical
    stimulation is :-
    a- Exaggerated
    b- Inhibited
    c- Not changed
    d- Is absent

11) Spasticity of the paralyzed muscles in UMN lesions is associated with :-
    a- Inhibition of tendon jerks
    b- Remarkable wasting of the muscle
    c- Clonus
    d- None of the above

12) Spinal shock is due to :-
    a- Severe pain felt at the site of the lesion
    b- Severe hypotensive shock
    c- Interruption of the ascending sensory pathways
    d- Interruption of the descending facilitatory tracts
13) The stage of spinal shock is characterized by the following except:-
   a- failure of spinal reflexes below the level of the lesion
   b- loss of sensations from the body below the level of the lesion
   c- loss of voluntary movement from the body below the level of the lesion
   d- exaggerated tendon jerks below the level of the lesion

14) In humans the usual duration of the stage of spinal shock is :-
   a- from 2-6 hours
   b- from 2-6 days
   c- from 2-6 weeks
   d- from 2-6 months

15) failure of spinal reflexes during the stage of spinal shock causes :-
   a- automatic micturition
   b- hypotension
   c- Babinski sign
   d- Spasticity of the paralyzed muscles

16) Complete transection of the spinal cord produces all of the following effects, except :-
   a- permanent loss of all sensations mediated by the cord below level of lesion
   b- permanent loss of voluntary movements by muscles innervated by the cord below level of lesion
   c- permanent loss of reflexes mediated by the cord below level of lesion
   d- temporary loss of micturition reflexes

17) Complete transection of the spinal cord did not affect arterial blood pressure when the lesion occurs at level of :-
   a- mid-cervical segments
   b- upper thoracic segments
   c- lower thoracic segments
   d- mid-lumbar segments

18) The earliest spinal reflex that recovers after the stage of spinal shock is :-
   a- the micturition reflex
   b- the scratch reflex
   c- the stretch reflex
   d- the flexor reflex
19) With recovery of arterial blood pressure following spinal cord transection, the recovered blood pressure tends to :-
   a- be higher than normal
   b- be lower than normal
   c- show abnormal oscillations
   d- drop progressively

20) Recovery of micturition reflexes following the stage of shock :-
   a- is due to recovery of supraspinal facilitation to the micturition center in the sacral segments
   b- is due to recovery of activity of the micturition center in the sacral segments
   c- causes retention with overflow
   d- causes normal micturition

21) Failure of the spinal reflexes is manifested by :-
   a- automatic micturition
   b- appearance of Babinski sign
   c- loss of sensations from regions innervated by the cord below the level of the lesion
   d- disappearance of the tendon jerks

22) Brown-Sequard syndrome is characterized by all the following, except :-
   a- loss of vibration sense on the opposite side below level of the lesion
   b- loss of voluntary movements on the same side below the level of the lesion
   c- loss of reflex movements on the same side at the level of the lesion
   d- loss of pain sensation on the opposite side below the level of the lesion
Section 11
Vestibular Apparatus

1) All the following are components of the vestibular apparatus, except :-
   a- crista ampullaris
   b- vestibular hair cells
   c- vestibular nucleus
   d- saccule

2) Which of the following are co-planar canals :-
   a- Anterior vertical canal on one side and posterior vertical canal on same side
   b- Anterior vertical canal on one side and posterior vertical canal on opposite side
   c- Anterior vertical canal on one side and anterior vertical canal on opposite side
   d- Anterior vertical canal on one side and anterior horizontal canal on same side

3) The crista ampullaris is sensitive to :-
   a- sound vibrations
   b- force of gravity
   c- linear acceleration
   d- angular acceleration

4) Vestibular hair cells :-
   a- are provided with cilia allover their surface
   b- are innervated by cochlear nerve fibers
   c- are stimulated by a chemical transmitter released from the terminals of the innervating nerve fibers
   d- are sensitive to mechanical stimuli

5) Hair cells of the crista are stimulated by :-
   a- bending of their stereocilia toward any direction
   b- movement of endolymph in any direction
   c- bending of stereocilia toward kinocilium
   d- bending of stereocilia away from kinocilium
6) Maculae of vestibular apparatus are:
   a- stimulated by movement of endolymph over their surface
   b- stimulated during standing upright but inhibited in the recumbent posture
   c- alter the pattern of their discharge by head tilting
   d- contain otoconia that press on hair cells to initiate resting basal discharge

7) Asymmetrical bilateral discharge from the SCCs occurs:
   a- on exposure to a linear movement
   b- during constant speed angular movement
   c- by tilting of the head
   d- in labyrinthitis

8) Vertigo:
   a- is a post-rotational sense of being rotated toward opposite side of original rotation
   b- is a post-rotational sense of being rotated toward same side of original rotation
   c- is a rotational sense of being rotated toward opposite side of original rotation
   d- is a rotational sense of being rotated toward same side of original rotation

9) Nystagmus:
   a- occurs as a result of symmetrical bilateral discharge from the SCCs at the onset of rotation
   b- occurs as a result of symmetrical bilateral discharge from the SCCs at the end of rotation
   c- prevents stabilization of the eye balls on visual objects
   d- is a vestibulo-ocular reflex

10) Post-rotational alteration of muscle tone:
   a- results from altered pattern of macular discharge
   b- maintains equilibrium during this phase
   c- results from increased discharge from the SCCs on both sides
   d- results from increased discharge from the SCCs on opposite side of rotation.
**Section 12**

**Thalamus and Reticular Activating System**

1) Specific thalamic nuclei include all the following, except :-
   a- reticular nuclei
   b- medial geniculate body
   c- pulvinar
   d- medial nuclei

2) The posteroventral nucleus of the thalamus projects to all the following centers, except :-
   a- frontal motor areas
   b- primary somatic sensory area
   c- somatic sensory association area
   d- parieto-occipito-temporal association area

3) The intralaminar thalamic nuclei produce :-
   a- inhibition of cerebral cortex during sleep
   b- inhibition of reticular activating system during sleep
   c- activation of reticular activating system during wakefulness
   d- activation of cerebral cortex during wakefulness

4) The reticular activating system is stimulated by all the following, except :-
   a- epinephrine
   b- serotonin
   c- acetylcholine
   d- norepinephrine
**Section 13**

**Basal Ganglia**

1) Basal ganglia include all the following, except :-
   a- caudate nucleus
   b- dentate nucleus
   c- subthalamic nucleus
   d- substantia nigra reticulate

2) Chemical transmitters in basal ganglia include all the following, except :-
   a- GABA
   b- Dopamine
   c- Glutamate
   d- Glycine

3) Functions of basal ganglia include all the following, except :-
   a- planning and programming of voluntary movements
   b- initiation of reflex movement.
   c- postural regulation
   d- executing learned pattern of movement.

4) Basal ganglia send direct projections to :-
   a- primary motor area
   b- premotor area
   c- VA and VL thalamic nuclei
   d- lower motor neurons in spinal cord

5) Parkinson’s disease results from damage of :-
   a- caudate nucleus
   b- subthalamic nucleus
   c- globus pallidus
   d- substantia nigra

6) Manifestations of Parkinsonism include all the following except :-
   a- kinetic tremors
   b- rigidity
   c- bradykinesia
   d- disturbance of speech
Section 14
Cerebellum

1) Coordination of complex movements by the cerebellum involves all the following mechanisms, except:
   a- sequencing of movements
   b- decomposition of movements
   c- damping of movements
   d- timing of movements

2) The cerebellum controls performance of rapid movements by:
   a- directly stimulating AHCs of the acting muscles
   b- by storing pre-planed motor programs for these movements
   c- by rapidly receiving proprioceptive information from the acting muscles
   d- by inhibiting antagonistic muscles

3) Cerebellar ataxia is manifested by all the following, except:
   a- dysdiadochokinesia
   b- static tremors
   c- dysmetria
   d- staccato speech
Section 15

Hypothalamus and Limbic System

1) The hypothalamus protects the body against hypoglycemia by :-
   a- inhibiting insulin release
   b- increasing glucagon release
   c- increasing thyroxin release
   d- increasing epinephrine release

2) The hypothalamic nucleus that act as a biological clock of the body is :-
   a- supraoptic nucleus
   b- preoptic nucleus
   c- arcuate nucleus
   d- suprachiasmatic nucleus

3) The role of the limbic system in control of emotional behavior involves all
   the following, except :-
   a- homeostasis
   b- somatic motor responses
   c- consolidation of memory
   d- generalized sympathetic stimulation
Section 16

Cerebral Cortex

1) \( \beta \) – waves of the EEG:
   a- are observed during relaxed wakeful state
   b- are faster than \( \alpha \) – waves but slower than theta waves
   c- disappear when the person becomes alert
   d- are observed during REM sleep

2) SW – sleep is characterized by:
   a- predominance of the slow \( \alpha \) – waves in EEG
   b- occurrence of dreams
   c- irregularity of heart rate and respiratory rate
   d- being a deep type of sleep

3) The prefrontal area is concerned with all the following, except:
   a- adjusting behavior
   b- motor guidance within the surrounding environment
   c- planning timing of movements
   d- recall of memories

4) Damage of the general interpretative area causes all the following effects, except:
   a- failure of articulate speech
   b- failure to understand written words
   c- failure to understand spoken words
   d- sensory aphasia

5) Lesions of the speech center in frontal lobe results in:
   a- paralysis of speech muscles
   b- inability to select appropriate words for use in speech
   c- inability to understand spoken language
   d- failure of coordination of speech muscles

6) Retrograde amnesia indicates:
   a- inability to consolidate memories
   b- Inability to recall memories
   c- Failure of working memory
   d- Presence of lesions in the hippocampus
## Answers Key

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<td>7 - d</td>
<td>8 - a</td>
<td>9 - d</td>
<td>10 - d</td>
</tr>
</tbody>
</table>

**Section 12**

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</thead>
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**Section 13**

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<th>5 - d</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tr>
</tbody>
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**Section 14**

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**Section 15**

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</thead>
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**Section 16**

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</tr>
</thead>
<tbody>
<tr>
<td>6 - b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>