ರಾಜೀವ್ ಗಾಂಧಿ ಆರೋಗ್ಯ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು
RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA, BENGALURU
4th T Block, Jayanagar, Bengaluru - 560 041

No. RGU/AUTH/124-SYN/105/2016-17 Date. 28.08.2017

NOTIFICATION

Sub: Ordinance governing B.Sc Neuro Science Technology Course

Ref: 1) Minutes of the meeting of Board of Studies- Allied Health Sciences held on 30.11.2016
2) Minutes of the meeting of the Academic Council held on 22.12.2016
3) Minutes of the 124th Syndicate Meeting held on 06.01.2017

* * *

As per the decision of the Syndicate in its 124th meeting held on 06.01.2017 and in exercise of the powers conferred under section 35(2) of RGUHS Act, 1994, it is hereby notified the Ordinance governing B.Sc Neuro Science Technology as per the annexure appended herewith.

The ordinance shall be applicable syllabus as above shall be effective for the students admitted to B.Sc Neuro Science Technology course from the academic year 2015-16 onwards.

By Order,

REGISTRAR

To
Principals of all affiliated colleges conducting B.Sc Neuro Science Technology

Copy to :-

1. The Secretary to Governor, Governors Secretariat, Raj Bhavan, Bengaluru- 560 001
2. The Secretary to Government, Health & Family Welfare Department (Medical Education), M.S. Building, Bengaluru- 560 001
3. The Director, Department of Medical Education, Ananda Rao Circle, Bengaluru- 560 009
4. PA to Vice-Chancellor/Registrar/Registrar(Evaluation)/Finance Officer
5. Director, Curriculum Development Cell
6. Public Information Officer
7. The homepage of RGUHS Website
8. Guard File/Office copy

ANNEXURE TO NOTIFICATION NO: RGU/AUTH/124-SYN/105/2016-17 DATED:28.08.2017

Ordinance governing Regulation and Curriculum for B.Sc Neuro Science Technology Course.

Rajiv Gandhi University of Health Sciences, Karnataka

4th 'T' Block, Jayanagar, Bangalore – 560 041

INTRODUCTION AND ADVANCEMENT

Neuroscience technology is a fast developing field in medical science. It operates the cross-ing of neurosciences, cellular engineering and signal processing.

This course enables the neurotechniologist to perform and interpret electrophysiology procedures. The students will acquire skills to assess the patient and plan various electrodiagnostic procedures and implement them.

Exclusiveness of the course

The students will have hands on training in

- Sleep studies
- Autonomic function tests
- Presurgical evaluation of epilepsy
- EEG (including Neonatal and long term monitoring)
- Nerve conduction studies, Electromyogram, Visual evoked potential, Brain-stem auditory evoked potential, Somatosensory evoked potential

Career Options after completion of Neuroscience technology

- As neurotechnology is an integral part of neurology, the neurotechnologists are highly in demand in all hospitals.
- Easily placements with high remuneration are available for the neurotechnicians.
- neurotechnologists have high placement records in International hospitals (USA, UK, Canad, Mioddle East) etd and is highly in demand nationwide.
- There is also ample scope for neurotechnologists to pursue higher studies, research; Masters & PhD programs are available in India & overseas.

MAIN OBJECTIVES OF THE COURSE

- Ability and skills to perform and interpret electrophysiology procedures
- Ability to search online, use information technology to his/her advantage and critically evaluate medical literature and draw his/her own conclusion.
- The student should be able to assess the patient and plan various electrodiagnostic procedures and implement them.

The student should be able to achieve the following.

- Technical skills needed to conduct the various diagnostic procedures and their interpretations as a part of the training.
- In the EEG lab, plan montages and do the recording without artifacts. He / She should also be well versed with the technical aspects and preparations of provi-sional reports. They should be familiar with semiology of various seizure types, giving first aid in case of emergency and seek timely medical help when needed.
- In the neurophysiology lab, assist neurologists in Electromyography (EMG) pro-cedures.
- Nerve conduction studies (NCV) – procedures to be performed independently and basic interpretation of the findings.
- Theoretical, technical and basic knowledge of procedures like Visual Evoked Po-tential (VEP), Somatosensory Evoked Potential (SSEP), Brainstem Auditory Evoked Response (BAER).
- Conduct the various clinical and technical tests in the autonomic lab.
- Hands on training in sleep lab – patient instructions, clinical interpretations, sleep staging based of Epworth's scale and procedure skills in Polysomnography (PSG) to be acquired.

Regulations governing Neuroscience technology Course

Eligibility for Admission, Duration, Attendance and Scheme of Examination.

1. ELIGIBILITY

1.1 Qualifying Examination

A candidate desiring to join the four year programme leading to the **Neuroscience technology** degree

a. should have passed the two year Pre University examination conducted by Department of Pre University Education, Karnataka State with English as one of the subjects and Physics, Chemistry , Biology / Maths as optional subjects. The candidate shall have passed the subjects of English, Physics, Chemistry, Biology / Maths individually also.

OR

b. Shall have passed any other examination conducted by Boards/Councils/Intermediate examination established by State Governments/Central Government and recognized as equivalent to two year Pre University examination by the Rajiv Gandhi University of Health Sciences/Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry and Biology as optional Subjects ad the candidate shall have passed subjects of English, Physics, Chemistry, Biology / Maths individually also.

c. Shall have passed Intermediate examination in Science of an Indian University/Board/Council or other recognized examining bodies with Physics, Chemistry and Biology, which shall include a practical test in these subjects and also English as compulsory subject. The candidate shall have passed subjects of English, Physics, Chemistry, Biology / Maths individually also.

d. Shall have passed first year of the three year degree course of a recognized University with Physics, Chemistry and Biology including a practical test in these subjects provided the examination is an 'University Examination' provided that the candidate shall have passed subjects of English, Physics, Chemistry, Biology / Maths individually in the pre university or other examinations mentioned in the clauses above.

e. Shall have passed B.Sc. Examination of an Indian University, provided that he/she has passed the B.Sc. examination with not less than two of the following subjects : Physics, Chemistry, Biology (Botany, Zoology) provided the candidate has passed subjects of English, Physics, Chemistry Biology / Maths individually in the qualifying examinations mentioned in clauses a, b and c.

1.2 Age: A candidate should have completed the age of 17 years as on 31st December of the year of admission.

1.3 Selection

Selection of the candidates should be based on the merit in the entrance examination held by the University or competent authority.

2. DURATION OF THE COURSE

The student shall undergo a period of certified study extending over 3 academic years from the date of commencement of his study for the subject comprising the prescribed curriculum to the date of completion of the examination followed by one year compulsory Internship.

3. ATTENDANCE

Every candidate should have attendance not less than 80% of the total classes conducted in theory and practicals separately in each calendar year calculated from the date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed to the eligible to appear for the university examination. A candidate pursuing the course shall study in the college for the entire period as a full time student. No candidate should join any other course of study or appear for any other examination conducted by this university or any other university in India or abroad during the period of registration.

A candidate lacking in the prescribed attendance should not be permitted to appear for the examination in that subject(s)

4. MEDIUM OF INSTRUCTION

English shall be the medium of instruction for all subjects of study and for examinations.

5. TEACHING HOURS

1ST Year

Subject	Method / Number of Hours	
	Theory	Practicals
Anatomy	70hrs	20hrs
Physiology	70hrs	20hrs
Biochemistry	70hrs	20hrs
Pathology	70hrs	20hrs
Microbiology	70hrs	20hrs
Computer Basics /Computer Programming	34	34
Functional English, Communications and personality development	34	-
Health Care	40	
Kannada	17	

2ND Year

Subject	Method / Number of Hours	
	Theory	Practicals
Basic electroencephalography	70	30
Physics and Electronics	70	50
Pharmacology	50	
Medical Psychology	20	-

QUALITY ASSURANCE AND ACCREDITATION	60	
Clinical practice in OPD	-	310

3RD Year

Subject	Method / Number of Hours	
	Theory	Practicals
Advanced Neuroscience technique 1	70	30
Advanced Neuroscience technique 2	70	30
Systemic diseases	60	
Research methodology & statistics	68	-
Clinical practice in OPD	-	310

SCHEME OF EXAMINATION

6 Regular Assessment

Regular periodic assessment shall be conducted throughout the course.

7. University Examination – Subjects and Distribution of Marks

Non- University Examination: These are internal examination subject for which no university assessment would be made.

Bachelors in Neuroscience technology

University Examination – Subjects and Distribution of Marks

7.1 1st Year Examination

Subject	University Examination				Total
	Theory	Internal	Practicals	Viva Voce	
Anatomy	80	20	No practical		100
Physiology	80	20	No practical		100
Biochemistry	80	20	No practical		100
Pathology	80	20	No practical		100
Microbiology	80	20	No practical		100
Non- University Examination					
Computer Basics /Computer Programming	50				
Functional English, Communications and personality development	50				
Health Care	50				
Kannada	50				

Note : * I A = Internal Assessment

Main Subjects shall have University Examination. There Shall be no University Practical Examination.

** Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

Mark Distribution

The mark distribution for all the subjects is as follows:

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
Short answer 5 Questions	07 (attempt 5)	5 x 2	10

7.2 2nd Year Examination

Subject	Theory			Practicals			Total
	Theory	Viva Voce	Internal	Sub total	Practicals	Internal	
Basic electroencephalography	80	50	20	150	40	10	200
Basic Nerve Conduction Study (NCS)	80	50	20	150	40	10	200
Applied Anatomy & Physiology Related to Neuroscience	80		20	100	No practical		100
Pharmacology	80		20	100	No practical		100

Non- University Examination						
Medical Psychology			**50**			
QUALITY ASSURANCE AND ACCREDITATION			**50**			

** Subsidiary subjects : Examination for subsidiary subjects shall be conducted by respective colleges

Mark Distribution

1. Basic electroencephalography

1. Long essay 4 Questions
2. Short essay 7 Questions
3. Short answer 10 Questions

3x 10=30 marks
6x 5= 30 marks
10x 2= 20 marks
Total=100

2. Physics and Electronics

1. Long essay 4 Questions
2. Short essay 7 Questions
3. Short answer 10 Questions

3x 10=30 marks
6x 5=30 marks
10x 2=20 marks
Total=100

3. Pharmacology

1. Long essay 4 Questions
2. Short essay 7 Questions
3. Short answer 10 Questions

3x 10= 30marks
6x 5= 30 marks
10x 2= 20 marks
Total=100

7.3 3rd Year Examination

Subject	Theory				Practicals		Total
	Theory	Viva voca	Internal	Sub total	Practical	Internal	
Advanced Neuroscience technique 1	80	50	20	150	40	10	200
Advanced Neuroscience technique 2	80	50	20	150	40	10	200
Systemic diseases	80		20		No practical		100
Non- University Examination							
Public health, Epidemiology & Biostatistics *		50					

** Practicals-One common practical for the two papers with equal weightage of marks i.e. 40 practical mark and 10 I.A. marks for each paper.

** Subsidiary subjects : Examination for subsidiary subjects shall be conducted by respective colleges

Mark Distribution

1. Advanced Neuroscience technique 1

1. Long essay 4 Questions — 3x 10= 30 marks
2. Short essay 7 Questions — 6x 5= 30marks
3. Short answer 10 Questions — 10x 2= 20 marks

Total=100

2. Advanced Neuroscience technique 2

1. Long essay 4 Questions — 3x 10= 30marks
2. Short essay 7 Questions — 6x 5= 30 marks

3. Short answer 10 Questions — 10x 2= 20 marks

Total=100

3. Systemic diseases

1. Long essay 4 Questions — 3x 10= 30marks
2. Short essay 7 Questions — 6x 5= 30 marks
3. Short answer 10 Questions — 10x 2= 20 marks

Total=100

8. Eligibility for Examination

To be eligible to appear for University examination a candidate

a. Shall have undergone satisfactorily the approved course of study in the subject/subjects for the prescribed duration.

b. Shall have attended at least 80% of the total number of classes in theory and practical/clinical to become eligible to appear for the examination in those subject/subjects.

c. Shall fulfill any other requirement that may be prescribed by the university from time to time.

9. Criteria for pass

First year examination.

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures, 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the Commencement of the University examination.

Second and Third year Examination

a. Main Subjects: A candidate is declared to have passed the Examination in a subject if he/she secures 50% of the marks in theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination, internal assessment and Viva-Voce added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

In the third year a candidate is declared to have passed only if he/she passes all the two theory papers and one practical examination in a single attempt failing which wherein the candidate fails in one or more theory papers and /or practical examination he/she will have to re appear for all the two theory papers and the practical examination in the subsequent attempt.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

10. Carry over benefit

10.1 First year examination:

A candidate who fails in any two of the five main subject of first year shall be permitted to carry over those subject to second year. However, he/she must pass the carry over subject before appearing for second year examination; otherwise he/she shall not permitted to proceed to third year.

10.2 Second year examination.

A candidate is permitted to carry over any one over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

11. Declaration of Class

a. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with distinction.
b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 65% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.
c. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 65% of grand total marks prescribed will be declared to have passed the examination in Second Class.
d. A candidate passing a university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

Fraction of marks should not be rounded off for clauses (a), (b) and (c).

Degree would be awarded after passing all examination and completing the one year internship.

SYLLABUS

I year - B.Sc. Neuroscience technology

ANATOMY

Theory: 70hrs
Practicals: 20hrs

I. INTRODUCTION: HUMAN BODY AS A WHOLE

THEORY:
Definition of anatomy and its divisions
Terms of location, positions and planes
Cell and its organelles
Epithelium – definition, classification, describe with examples, functions
Glands – classification, describe serous and mucous glands with examples
Basic tissues – classification with examples

PRACTICALS:
Histology of types of epithelium
Histology of serous, mucous and mixed salivary gland

II. LOCOMOTION AND SUPPORT

THEORY:
Cartilage – types with examples and histology
Bone – classification, names of bone cells, parts of long bone, microscopy of
Compact bone, names of all bones, vertebral column, intervertebral disc,
Fontanelles of fetal skull
Joints – classification of joints with examples, synovial joint (in detail for radiology)
Muscular system – classification of muscular tissue and histology
Names of muscles of the body

PRACTICALS:
Histology of 3 types of cartilages
Demo of all bones showing parts, radiographs of normal bones and joints
Histology of compact bone (TS and LS)
Demonstration of all muscles of the body
Histology of skeletal, smooth and cardiac muscle (TS and LS)

III. CARDIOVASCULAR SYSTEM

THEORY:
Heart – size, location, chambers, exterior and interior
Blood supply of heart
Systemic and pulmonary circulation
Branches of aorta, common carotid artery, subclavian artery,
Axillary artery, brachial artery, superficial palmar arch, femoral artery,
Internal iliac artery
Peripheral pulse
Inferior venacava, portal vein, portosystemic anastomosis
Great saphenous vein
Dural venous sinuses
Lymphatic system – cisterna chyli and thoracic duct
Histology of lymphatic tissues
Names of regional lymphatics, axillary and inguinal lymph nodes in brief

PRACTICALS:
Demonstration of heart and vessels in the body
Histology of large artery, medium sized artery and vein, large vein
Microscopic appearance of large artery, medium sized artery and vein,
Large vein pericardium
Histology of lymph node, spleen, tonsil and thymus
Normal chest radiograph showing heart shadows
Normal angiograms

IV. GASTRO-INTESTINAL SYSTEM

THEORY:
Parts of GIT, oral cavity (lip, tongue – with histology, tonsil, dentition, pharynx,
Salivary glands, Waldeyer's ring)
Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas,
Radiographs of abdomen

V. RESPIRATORY SYSTEM
Parts of RS – nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments
Histology of trachea, lungs and pleura
Names of paranasal air sinuses

PRACTICALS:
Demonstration of parts of respiratory system
Normal radiographs of chest
Histology of lung and trachea

VI. PERITONEUM

THEORY:
Description in brief

PRACTICAL:
Demonstrations of reflections

VII. URINARY SYSTEM
THEORY:

Kidney, ureter, urinary bladder, male and female urethra
Histology of kidney, ureter and urinary bladder

PRACTICAL:
Demonstration of parts of urinary system
Histology of kidney, ureter, urinary bladder
Radiographs of abdomen – IVP, retrograde cystogram

VIII. REPRODUCTIVE SYSTEM

THEORY:
Parts of male reproductive system, testis, vas deferens, epididymis,
Prostate (gross and histology)
Parts of female reproductive system, uterus, fallopian tubes,
Ovaries (gross and histology)
Mammary gland – gross

PRACTICAL:
Demonstration of section of male and female pelvis with organs in situ
Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes,
Ovaries
Radiographs of pelvis – Hysterosalpingogram

IX. ENDOCRINE GLANDS

THEORY:
Names of all endocrine glands, in detail on pituitary gland, thyroid gland,
Parathyroid gland, suprarenal gland (gross and histology)

PRACTICAL:
Demonstration of the glands
Histology of pituitary, thyroid, parathyroid, suprarenal glands

X. NERVOUS SYSTEM

THEORY:
Neuron
Classification of NS
Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord

With spinal nerve (gross and histology)
Meninges, ventricles and cerebrospinal fluid
Names of basal nuclei
Blood supply of the brain
Cranial nerves
Sympathetic trunk and names of parasympathetic ganglia

PRACTICAL:
Histology of peripheral nerve and optic nerve
Demonstration of all plexuses and nerves in the body
Demonstration of all parts of brain
Histology of cerebrum, cerebellum, spinal cord

XI. SENSORY ORGANS

THEORY:
Skin – histology, appendages of skin
Eye – parts of eye and lacrimal apparatus
Extra-ocular muscles and nerve supply
Ear – parts of ear- external, middle and inner ear and contents

PRACTICAL:
Histology of thin and thick skin
Demonstration and histology of eyeball
Histology of cornea and retina

XII. EMBRYOLOGY

THEORY:
Spermatogenesis and oogenesis
Ovulation, fertilization
Fetal circulation
Placenta

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
Short answer 5 Questions	07 (attempt 5)	5 x 2	10
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaursia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

PHYSIOLOGY

Theory 70 hours
Practical 20hours

Introduction
Composition and function of blood
Red blood cells – Erythropoiesis, stages of differentiation function, count physiological Variation.
Haemoglobin –structure, function, concentration physiological variation, Methods of Estimation of Hb
White blood cells – Production, function, life span, count, differential count
Platelets – Origin, normal count, morphology functions.
Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen,
Prothrombin functions.
Haemostasis & Blood coagulation
Haemostasis – Definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.

Blood Bank
Blood groups – ABO system, Rh system
Blood grouping & typing
Crossmatching
Rh system – Rh factor, Rh incompatibility.
Blood transfusion – Indication, universal donor and recipient concept.
Selection criteria of a blood donor. Transfusion reactions
Anticoagulants – Classification, examples and uses
Anaemias : Classification – morphological and etiological. Effects of anemia on body
Blood indices – Colour index, MCH, MCV, MCHC
Erythrocyte sedimentation Rate (ESR) and Paced cell volume
Normal values, Definition. Determination
Blood Volume -Normal value, determination of blood volume and regulation of blood volume Body fluid – pH, normal value, regulation and variation
Lymph – lymphoid tissue formation, circulation, composition and function of lymph

Cardiovascular system
Heart – Physiological Anatomy, Nerve supply
Properties of Cardiac muscle
Cardiac cycle-systole, diastole.
Intraventricular pressure curves.
Cardiac Output – only definition
Heart sounds- Normal heart sounds Areas of auscultation.
Blood Pressure – Definition, normal value, clinical measurement of blood pressure. Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension. Pulse – Jugular, radial pulse, Triple response
Heart sounds – Normal heart sounds, cause characteristics and signification. Heart rate
Electrocardiogram (ECG) –significance.

Digestive System - Physiological anatomy of Gastro intestinal tract
Functions of digestive system.
Salivary glands - Structure and functions.
Deglutination –stages and regulation
Stomach – structure and functions.
Gastric secretion – Composition function regulation of gastric juice secretion.
Pancreas – structure, function, composition, regulation of pancreatic juice
Liver – functions of liver.
Bile secretion, composition, function, regulation of bile secretion. Bilirubin metabolism, types of bilirubin, Vandernberg reaction, Jaundice- types, significance.
Gall bladder – functions.
Intestine – small intestine and large intestine.
Small intestine –Functions- Digestion, absorption, movements.
Large intestine – Functions, Digestion and absorption of Carbohydrates, Proteins, Fats, Lipids. Defecation

Respiratory system
Functions of Respiratory system, Physiological Anatomy of Respiratory system, Respiratory tract, Respiratory Muscles, Respiratory organ-lungs, Alveoli, Respiratory membrane, stages of respiration.

Mechanism of normal and rigorous respiration. Forces opposing and favouring expansion of the lungs. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall.

Transportation of Respiratory gases: Transportation of Oxygen: Direction, pressure gradient, Forms of transportation, Oxygenation of Hb. Quantity of Oxygen transported.

Lung volumes and capacities - Regulation of respiration what? Why? How? Mechanisms of Regulation, nervous and chemical regulation. Respiratory centre. Hearing Brier, Reflexes.

Applied Physiology and Respiration : Hypoxia, Cyanosis, Asphyxia, Dyspnea, Dysbarism, Artificial Respiration, Apnoea.

Endocrine System –
Definition, Classification of Endocrine glands & their Hormones Properties of Hormones.

Thyroid gland hormone – Physiological, Anatomy, Hormone secreted, Physiological function, regulation of secretion. Disorders – hypo and hyper secretion of hormone

Adrenal gland, Adrenal cortex physiologic anatomy of adrenal gland, Adrenal cortex, cortical hormones – functions and regulation Adrenal medulla – Hormones, regulation and secretion. Functions of Adrenaline and nor adrenaline

Pituitary hormones – Anterior and posterior pituitary hormones, secretion, function.

Pancreas – Hormones of pancreas. Insulin – secretion, regulation, function and action.
Diabetes mellitus – Regulation of blood glucose level.

Parathyroid gland – function, action, regulation of secretion of parathyroid hormone.

Calcitonin – function and action

Special senses
Vision – structure of eye. Function of different parts.
Structure of retina.
Hearing structure and function of can mechanism of hearing
Taste – Taste buds functions.
Smell physiology, Receptors.

Nervous system
Functions of Nervous system, Neuron structure, classification and properties. Neuroglia, nerve fiber, classification, conduction of impulses continuous and saltatory. Velocity of impulse transmission and factors affecting. Synapse – structure, types, properties.
Receptors – Definition, classification, properties. Reflex action – unconditioned properties of reflex action. Babinski's sign. Spinal cord nerve tracts. Ascending tracts, Descending tracts
Pyramidal tracts – Extrapyramidal tracts. Functions of Medulla, pons, Hypothalamic, disorders. Cerebral cortex lobes and functions, Sensory cortex, Motor cortex, Cerebellum, functions of Cerebellum. Basal ganglion-functions. EEG.
Cerebro Spinal Fluid(CSF) : formation, circulation, properties, composition and functions lumbar puncture.
Autonomic Nervous System: Sympathetic and parasympathetic distribution and functions and comparison of functions.

Excretory System
Excretory organs

Kidneys: Functions of kidneys structural and functional unit nephron, vasarecta, cortical and juxtamedullary nephrons – Comparision, Juxta Glomerular Apparatus –Structure and function. Renal circulation peculiarities.

Mechanism of Urine formation: Ultrafiltration criteria for filtration GFR, Plasma, fraction, EFP, factors effecting EFR. Determination of GFR selective reabsorption – sites of reabsorption, substance reabsorbed, mechanisms of reabsorption Glucose, urea.
H + Cl aminoacids etc. TMG, Tubular lead, Renal threshold % of reabsorption of different substances, selective e secretion.
Properties and composition of normal urine, urine output. Abnormal constituents in urine. Mechanism of urine concentration.

Counter – Current Mechanisms : Micturition, Innervation of Bladder, Cystourethrogram. Diuretics : Water, Diuretics, osmotic diuretics, Artificial kidney Renal function tests – plasma clearance Actions of ADH, Aldosterone and PTH on kidneys. Renal function tests.

Reproductive system
Function of Reproductive system, Puberty
Male reproductive system- Functions of testes, spermatogenesis site, stages, factors, influencing semen.
Endocrine functions of testes
Androgens – Testosterone structure and functions.
Female reproductive system. Ovulation, menstrual cycle. Physiological changes during pregnancy, pregnancy test.
Lactation : Composition of milk factors controlling lactation.

Muscle nerve physiology
Classification of muscle, structure of skeletal muscle, Sarcomere contractile proteins, Neuromuscular junction. Transmission across, Neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction muscle tone, fatigue Rigour mortis.

Skin -structure and function
Body temperature measurement, Physiological variation, Regulation of body Temperature by physical chemical and nervous mechanisms .Role of Hypothalamus, Hypothermia and fever.

Practicals
Haemoglobinometry
White Blood Cell count
Red Blood Cell count
Determination of Blood Groups
Leishman's staining and Differential WBC count
Determination of packed cell Volume
Erythrocyte sedimentation rate [ESR]
Calculation of Blood indices
Determination of Clotting Time, Bleeding Time
Blood pressure Recording
Auscultation for Heart Sounds
Artificial Respiration
Determination of vital capacity

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL

Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
Short answer 5 Questions	07 (attempt 5)	5 x 2	10
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

REFERENCE BOOKS:

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

BIOCHEMISTRY I
No. Theory classes: 70 hours
No. Practical classes: 20 hours

I. Clinical Laboratory

- Responsibilities of health care personnel
- Laboratory hazards- Physical, Chemical and Biological. Laboratory safety measures- Safety regulations and first aid in laboratory

II. Laboratory apparatus : Different types, use, care and maintenance (Where appropriate, diagrams to be drawn in practical record)

- Glass ware in laboratory – Significance of boro silicate glass. Plastic ware in laboratory
- Cleaning of glass ware and plastic ware
- Pipettes - Glass and Automated
- Burettes, Beakers, Petri dishes, Porcelain dish
- Flasks - different types (volumetric, round bottomed, Erlenmeyer, conical etc.,)
- Funnels – different types (Conical, Buchner etc.,)
- Bottles – Reagent, Wash bottles
- Measuring cylinders, reagent dispensers
- Tubes – Test tube, Centrifuge tube, Folin-Wu tube
- Cuvettes and its use in measurements , cuvettes for visible and UV range
- Racks – Bottle, Test tube, Pipette and draining racks
- Tripod stand, Wire gauze, Bunsen burner, Dessicator, Stop watch, timers

III. Instruments: Use, care and maintenance (Where appropriate, pictures/diagrams and schematic diagrams to be drawn in practical record)

- Water bath, Oven & Incubators, Distillation apparatus - water distillation plant and water deionisers, Reflux condenser, Cyclomixers , Magnetic stirrer, Shakers
- Refrigerators, Deep freezers, Cold box
- Centrifuges*: Principle, Svedberg unit, centrifugal force, centrifugal field, rpm, Conversion of G to rpm and vice versa) Components, working.

Different types of centrifuges

- Laboratory balances*: Physical and analytical. Mono & double pan, Electronic balances. Weighing different types of chemicals, liquids, hygroscopic compounds etc. Precautionary measures while handling (Diagram)
- Photometry - Colorimeter*- Principle, limitations of Beer-lambert's law, components, working.
- pH meter*- Principle, components-pH measuring electrodes, Working, Precautions taken while handling. (Diagram of pH meter)

(*Diagrams mandatory)

IV. Units of measurement

- Metric system. Common laboratory measurements, Prefixes in metric system
- International system of units- SI units- definition, classification, Conversion of conventional and SI Units

V. Introduction to general Bio-molecules:

- Chemistry of carbohydrates: Classification (structures for monosaccharides*), Functions of carbohydrates
- Chemistry of amino acids*: Classification–based on structure and nutritional requirement, Occurrence. Functions of amino acids.
- Chemistry of lipids: Classification of lipids and fatty acids. Functions of lipids
- Chemistry of nucleotides*: Purine and Pyrimidine bases. Composition of nucleosides and nucleotides. Occurrence of bases.

*** Structures mandatory**

VI. Fundamental Chemistry

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

VII. Solutions: Definition, use, classification where appropriate, preparation and storage

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H_2SO_4, H_3PO_4, CH_3COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard.
  Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

VIII. Acids, Bases, Salts and Indicators : Basic concepts. Determination of pH- Henderson Hasselbalch's equation. Buffer solutions. pH determination of buffers. Blood pH.
Fluid buffers.

IX. Biomedical waste management

ASSIGNMENT TOPICS:

- Radio active isotopes
- Arterial Blood gases

PRACTICAL DEMONSTRATION (Record book to be maintained)

- Laboratory apparatus - All glass ware and plastic ware (all appropriate diagrams in practical record)
- Water bath, Oven & Incubators, Water Distillation plant*, refrigerators, cold box, cool barns, reflux condensers.
- Preparation of solutions: 1N HCl, 1M NaOH. Standard solutions of glucose and albumin
- Centrifuges*- Technique of Centrifugation

- Analytical balance* - Weighing of chemicals to prepare standard and different types of solutions. Care while weighing acids, deliquescent and hygroscopic compounds.
- Colorimeter* - Absorbance readings of a colored solution and graphing
- pH meter* - Checking pH of urine and buffer

Diagrams to be drawn

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry I shall be as given under

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
Short answer 5 Questions	07 (attempt 5)	5 x 2	10
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.

- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6 th editions

PATHOLOGY I
Histopathology, Clinical Pathology, Hematology and Blood Banking

Theory-70 hours
Practicals-20 hours

I. Histopathology- Theory

- Introduction to Histopathology
- Receiving specimens in the laboratory
- Grossing techniques
- Mounting techniques- various mountants
- Maintenance of records and filing of slides
- Use and care of Microscope
- Various fixatives, mode of action, preparation and indications
- Biomedical waste management
- Section cutting
- Tissue processing for routine paraffin sections
- Decalcification of tissues
- Staining of tissues-H & E Staining

II. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

III. Hematology – Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Various instruments and glass ware used in Hematology, preparation and usage of glass wares
- Laboratory safety guidelines
- SI units and conventional units in Hospital laboratory
- Quality control of laboratory findings
- Hemoglobin estimation, different methods and normal values
- Packed cell volume

- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

IV. Blood Bank- Theory

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

Practicals

1. Urine analysis- Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time
5. Histopathology- section cutting and H & E Staining (for BSc MLT only

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Pathology I shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
Short answer 5 Questions	07 (attempt 5)	5 x 2	10
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996

Microbiology I

Theory: 70 Hours
Practicals: 20 Hours

1. Introduction (6 hrs)

History of Microbiology, classification of microorganisms, use of microscope in the study of bacteria, Morphology of bacterial cell

2. Growth and nutrition (6 hrs)

Nutrition, growth and multiplication of bacteria, culture media and culture methods

3. Sterilization and disinfection (8 hrs)

Principles and use of equipments of sterilization, chemicals used in disinfection

4. Biomedical waste management principle and practice

5. Immunology (5 hrs)

Immunity, vaccines
Immunization schedule
Definition of Antigen, antibody, list of antigen antibody reactions.

5. Infection (5hrs)

Definition, types and mode of transmission
Hospital infections – causative agents, mode of transmission and prophylaxis
Antimicrobial susceptibility testing

6. Systematic bacteriology (15 hrs)

Disease caused and lab diagnosis of medically important bacteria (Staphylococcus, Streptococcus, Gonococcus, Echerichia coli, Salmonella, Shigella, Vibrio, Mycobacteria, Treponema, Leptospira) **(No need of classification, antigenic structure, virulence mechanism)**

7. Parasitology (10hrs)

Introduction to Parasitology
List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma)
Lab diagnosis of parasitic infections

8. Virology (10hrs)

Introduction to virology
List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arboviruses)
Lab diagnosis of viral infections

9. Mycology (5hrs)

Introduction to Mycology
List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis and Mucor mycosis)
Lab diagnosis of fungal infections

PRACTICALS (20hrs)

Compound Microscope
Demonstration and sterilization of equipments
Demonstration of commonly used culture media and media with growth
Antibiotic susceptibility test
Demonstration of common serological tests –widal, VDRL,
Grams stain, Acid fast staining
Stool exam for Helminthic ova

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY
There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Microbiology I shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
Short answer 5 Questions	07 (attempt 5)	5 x 2	10
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruckshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd

Computer Basics /Computer Programming

SL NO	TOPICS	HOURS
1	Introduction to computers	
2	Definition ✓ Input ✓ Output ✓ CPU	
3	Input output devices (types)	
4	Basis of computer system ✓ Switching computer on & off ✓ What is bias? ✓ Computer generations	
5	Keyboard practices	
6	Definitions of terms ✓ Desktop ✓ Software	
7	Computer systems: Hardware & software definitions	
8	Windows'98 ✓ Definition & Why ✓ Calculator - Word pad - Short cuts - Start menu - Media player - Note pad - Win amp – Paint - Control panel	
9	Microsoft word ✓ Opening, saving, deleting, typing, print , Page border, spelling, table, grammar, margin, Clip art, BIU, word art, Colour text &background, Picture drawing using word	34
10	Excel ✓ Formulas - Design charts- Format tables	
11	PowerPoint ✓ Designing a presentation - Inserting some animation with sound	

12	Internet &its applications ✓ Interconnection to HTML ✓ E- mailing – Browsing - Chatting	
13	Computers Architecture /Organization: Basic architecture, Functional Block diagram, Types of computers, Performance parameters	
14	✓ Operating System: Booting/Start up Procedure of machines, Introduction to Operating System, Functions and Classification of Operating Systems, Basic introduction to DOS, UNIX/LINUX OS, Windows.	
15	Basic Introduction to Computer Networks: Data Communication, Network devices (Hub, Switches, Modems, Routers etc.), LAN, LAN topologies, WAN, MAN, Internet: Introduction, Basics of E-mail, Web browsers (IE, Google Chrome, Mozilla), Structure of Universal Resource Locator, Domains (.com, .in, .country specific, .org and rationale behind them), IP address, Backbone network, Network connecting devices, HTTP, DNS, Network Security and Search Engine.	

ENGLISH

COURSE OUTLINE

COURSE DESCRIPTION: This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

BEHAVIOURAL OBJECTIVES :

The student at the end of training is able to

1. Read and comprehend english language
2. Speak and write grammatically correct english
3. Appreciates the value of English literature in personal and professional life.

UNIT -I : INTRODUCTION :

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis Use of the dictionary

Enlargement of vocabulary Effective diction

UNIT - II : APPLIED GRAMMAR :

Correct usage

The structure of sentences The structure of paragraphs
Enlargements of Vocabulary

UNIT - III : WRITTEN COMPOSITION :

Precise writing and summarising Writing of bibliography
Enlargement of Vocabulary

UNIT - IV : READING AND COMPREHENSION :

Review of selected materials and express oneself in one's words. Enlargement of Vocabulary.

UNIT - V : THE STUDY OF THE VARIOUS FORMS OF COMPOSITION :

Paragraph, Essay, Letter, Summary, Practice in writing

UNIT - VI : VERBAL COMMUNICATION :

Discussions and summarization, Debates, Oral reports, use in teaching

Scheme of Examination

Written (Theory): Maximum Marks: -80 marks

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

HEALTH CARE

Teaching Hours : 40

Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept. National Health Policy

National Health Programmes (Briefly Objectives and scope) Population of India and Family welfare programme in India

Introduction to Nursing

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine. Observation of sputum, Understand use and care of catheters, enema giving.

Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Recording of body temperature, respiration and pulse, Simple aseptic technique,

sterlization and disinfection. Surgical Dressing: Observation of dressing procedures

First Aid :

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

2nd year - B.Sc. Neuroscience technology

Applied Anatomy & Physiology Related to Neuroscience

Course Objective

This course will provide an outline of anatomy and physiology to improve the students understanding of the technical and diagnostic procedures used with special emphasis on applied aspects.

Unit I

Neuro Anatomy

Cranial vault

Base of skull and relations

The meanings

Cerebral hemispheres – Frontal, parietal, temporal and occipital lobes

Basal ganglia & diencephalons

Midbrain

Brain Stem

Pons

Medulla oblongata

Cerebellum

The ventricular system & cisterns

Arterial supply (major vessels)

Veins and venous sinuses

The cranial nerves 1 to 12

Surface anatomy of cranial nerves

Unit- II

Neurophysiology

Physiology of vision – optic pathway

Physiology of hearing – auditory pathway

Motor control – pyramidal system

Extra pyramidal system

Cerebellum

Physiology of the ANS – divisions, chemical

Transmission functions & higher centers for regulation

The autonomic nervous system

Sympathetic nervous system

Parasympathetic nervous system

Formation

Neuro transmitters

Unit – III

The spinal cord

The bony canal and ligaments and meanings and their extent; organization of structures in the cord at various levels

Arterial supply and Venous drainage

Spinal segments and spinal Nerve

Unit – IV

The skeletal muscles Myotomes & their innervations Dermatomes & their innervation

Membrane potentials

Action potential

Synaptic transmission – excitation, inhibitition

The physiology of Neuro-muscular transmission – the n-m junction

Types of somatic sensations & sensory pathways

Physiology of muscle – mechanisms of contraction & relaxation

The motor unit – its composition & function

Practicals: Includes the above mentioned theory units

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
long essay type	3(attempt 2)	2x 10	20
Short answer type	8 (attempt 6)	6 x 5	30
Short answer 5 Questions	12 (attempt 10)	10x 3	30
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Recommended Books

1. Clinical Neuroanatomy – Richard.S.Snell

Reference Books

1. Manual of Practical Anatomy - Cunningham's (G.J. Romones)
2. Textbook of Anatomy with colour atlas - Inderbir Singh
3. Textbook of Medical Physiology – Guyton & Hall

Basic electroencephalography

Theory 70 hours
Practical 30hours

COURSE OBJECTIVE:

To introduce the student a significance of electroencephalography related to neurophysiology. He should know absent definition and the use of electrodes. amplifiers filters and stimulators.

COURSE CONTENT

Unit – I

Basics of Instrumentation

Electrical concepts

Atomic structure

Conduction, insulation

Voltage current, resistance, power

Capacitance, inductance

DC/AC

Impedance

Vaccum tubes

Transistors

Unit – II

The Electroencephalography & Instrumentation

Differential power amplifier

Filter-Hi frequency

Low frequency

Time constant Biological filters

50Hz filters

Sensitivity

Calibration

Paper speed

Pen mechanism

Unit – III

Electroencephalography Recording technique

Recording techniques

Electrodes-Types, materials

Modes of application

The 10-20 system

Montages-Bipolar/Referential

Unit – IV

Normal rhythms & Artifacts in EEG

Normal rhythms

Abnormal waveforms

EEG in sleep/diseased

Unit - V

Patients grounding & safety

Computer application in EEG

Practicals: Includes the above mentioned theory units

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

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SCHEME OF EXAMINATION THEORY

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Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	50	20	150	40	10	50	200

Recommended Books

1. EEG in Clinical in Practice – John R. Hughes
2. Electroencephalography – Ernst Niedermeyer, Fernando Lopes da Silva

Reference Books

1. Primer of EEG: With A Mini-Atlas, 1e - A. James Rowan MD and Eugene Tolunsky MD

Basic Nerve Conduction Studies (NCS)

Theory 70 hours

Practical 30hours

Course Objective

This course will cover basic instrumentation parameters, fundamentals of NCS, appropriate electrode stimulation and recording parameters, machine operation and instrumentation, waveform pattern recognition, basic troubleshooting skills, relate skills for performing basic and uncommon NCS procedures and identify potential disease or injury processes correlates with NCS results.

Unit – I

Basics of Nerve conduction studies

Nerve conduction velocity

CMAP & SNAP

Stimulation parameters

Recording Techniques

Unit – II

Motor & Sensory Nerve conduction

Median.N

Ulnar.N

Radial.N

Tibail.N

Peroneal.N

Sciatic.N

Femoral.N

Facial.N

Sural.N

Unit – III

Late Responses

F-waves

H-reflex

Unit – IV

Repetitive Nerve Stimulation

Unit – V

Nerve conduction studies in Neuropathies

-Traumatic

-Demyelinating

-Axonal

-Motor neuron disease

Computer application in Nerve conduction studies

Practicals: Includes the above mentioned theory units

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

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Short answer 5 Questions	12 (attempt 10)	10x 3	30
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	50	20	150	40	10	50	200

Recommended Books

4. Laboratory Reference for Clinical Neurophysiology – Jay.A.Liveson Dong.M.Ma
5. Electrodiagnostic Medicine – Daniel Dumitru

Reference Books

1. Electrodiagnosis in Diseases of Nerve and Muscle: Principles and Practice by Jun Kimura
2. Aminoff's Electrodiagnosis nin Clinical Neurology – Micheal J. Aminoff

Practicals

- Electrodes Identification
- Electrode Application
- Care of Electrodes

Calculation of Nerve Conduction Parameters
Interpretation of basic Nerve Conductions studies

PHARMACOLOGY

Theory 50 hours

COURSE OBJECTIVE:

To introduce the student a significance of medicine related to general pharmacology.

COURSE CONTENT:

1. Introduction to Pharmacology
2. Pharmacokinetics
3. Pharmacodynamics
4. Adverse effects of drugs
5. Classification of drugs
6. 6.1. Autonomic nervous system

✓ Introduction. Neurotransmitters, their mechanism of action
✓ Drugs affecting-
- Pupillary size and light reflex
- Intraocular tension
- Accommodation

✓ Skeletal muscle relaxants

7. .1. Cardiovascular system

✓ Antihypertensives and drugs useful in angina

8.1. Diuretics

✓ IN ocular disorders

9.1. Central nervous system

✓ Alcohol, sedative hypnotics, general & local anesthetics, opioids & non-opioids

10.1. Chemotherapy

✓ Introduction, general chemotherapy
✓ Specific chemotherapy – antifungal, Antiviral, Antitubercular, Antileprotic

10.1.Hormones

- ✓ Corticosteroids
- ✓ Anitidiabetics

11.1.Blood

12. Coagulants
13. Antibiotics
14. Anti inflammatory
15. Analgesic and antipyretic
16. Muscle relaxant etc.
17. Classification, effects, mechanism of action, indication and contra indication.

PHARMACOLOGY RELATED TO NEUROSCIENCE TECHNOLOGY

Course Objective

This course will cover general pharmacology with special emphasis on common drugs, routes of administration, types of formulations, dose and frequency of administration, side effects and toxicity, management to toxic effects, drugs interactions, knowledge of chemical and trade names, importance of manufacturing and expiry dates and instructions about handling drugs.

Unit – I

Epilepsy

Neurotransmitters, Therapeutics, Antiepileptic drugs, dosage & side effects (toxicity), Phenytoin (eptoin, dilantin 100) also parenteral, Phenobarbitone (Gardenal 30, 60 also parenteral.), Carbamezapine (tegretol, zeptol, mazetol, Zen 100, 200, 400), Carbamazepine – controlled release (or), Valproate sodium (valparin, epile x 200, syrup), Ethosuximide (zarontin), Primidone, Colonzepam (rivotril, lanazep 0.5,2)

New drugs

Gabappentin (neuortin 300, 400, 600), Vigabatrin, Lamotrigne, Drugs used in emergency: - diazepam (IV), IM, Lorazepam (IV, IM), Phenytoin (IV), Phenobarbitone (IV), Lignocaine (IV), Valproate (IV), Pentothal Sodium (IV), Pharmacology of neuromuscular transmission

Unit – II

Neurotransmitters

Receptors, Types, Mechanisms

Drugs used - Neostigmine, Pyridostigmine, Edrophonium, guanidine

Unit – III

Cerebral Vascular Accident

Drugs used, Antiplatelet agents, Aspirin, ticlopidine, anti Coagulants, Heparin, Warfarin, anti hypertensives, Oral hypoglycemics (anti diabetic), Anti edema agents (Diuretics) Mannito, Steroids, Frusemide (lasix), Thazides.

Unit – IV

Extraphyramindal disease

Drugs used - Levodopa, Pacitane, Haloperidol,

Unit – V

Infections – Antibiotics, Anti parasitic, Anti viral, Anti fungal agents, Anti mycobacterial,

Miscellaneous – Steroids, Anti inflammatory agents, Pain Mechanism, Analgesics. Other psychotropic, Drugs

Practicals: Includes the above mentioned theory units

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

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Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Recommended Books

1. Essentials of Medical Pharmacology - Triparthi
2. Medical Pharmacology for Allied Health Sciences – Padmaja Udayakumar

Clinical practice in OPD

COURSE OBJECTIVES:

- To assist the neurologist in OPD and ward and ward management, patient care.

COURSE CONTENTS:

1. Maintain patient, ward record.
2. Proper labelling of patient investigation.
3. History taking.
4. Investigations.
5. Patient preparation for procedure.
6. Pre procedure medication
7. Neurology procedure.
8. Post procedure care

RECOMMENDED BOOKS:

1. Clinical Snail Anatomy by Richard Snail 7th edition 2002 by churchill living stone.
2. Anatomy and physiology in health and illness by Anne Wauge Allison arrant illustrated by aralme chambers by Churchill living stone in Spain

CLINICAL PSYCHOLOGY

SL NO	TOPICS	HOURS
	1. Introduction to psychology 2. Intelligence, Learning, Memory, Personality, Motivation 3. Body integrity- one's body image 4. Patient in his Milan 5. Self concept of the therapist, Therapist patient relationship-some guidelines 6. Illness and it's impact on the patients 7. Maladies of the age and their impact on the patient's own and others concept of his body image 8. Adapting changes in vision 9. Why Medical Psychology needs / demands commitment?	20

QUALITY ASSURANCE AND ACCREDITATION

Total - **80hrs**

Course Objectives:

Modernization and its brand conscious make an organization thrive towards perfection in the comparative world of business. The underlying factor that al-lows an organization to stand the test of time is quality. The students are given the working knowledge of the subject.

Course Content:

Detailed Course Plan

Unit- I

Introduction to quality –Definition, concept, Benefits-Functions-Design- Formulation- Standardization

Unit-II

Implementation –Factors affecting quality –Need for Quality Cycle –Quality objec-tives- Quality policy

Unit-III

Quality measurable –Quality Control Quality Standards. Q C Tools –NABH, NABL, JCI~Quality Documents, QC Records. Kazen Technique such as Market-in, TQC .Q C Circles –Suggestion scheme. TPM, Kanban –JIT, Zero defect programmes

Unit-IV

ISO- Quality management system- Quality manual-Quality procedure- Quality re-cords- Quality audit

Unit- V

Corrective and preventive action –SQC (Statistical Quality Control technique)

Cost effectiveness- Cost of quality system- Benefit in total cost –Cost

Measuring system- TOM- concept, awareness, aspects training

Reference Text:

1. Dale H Bester field. Carol Bester field, Glen H Bester field, Mary Bester field –Scare, Total Quality Management .Wesley Logman (Singapore)Pte.Ltd. Indian Branch, 482F.I.E, Patparganj, Delhi 110092, India

2. K.Shridhara bhat, Total Quality management .Himalaya Publishing Hollse. "Ramdoot" Dr Bhalerao Mag. Girgaon, Mumbai-400004

3rd year - B.Sc. Neuroscience technology

Advanced Neuroscience technique 1

Theory 70 hours
Practical 30hours

COURSE OBJECTIVE:

This course will cover basic instrumentation parameters, fundamentals of EP's, appropriate electrode placement stimulation and recording parameters, machine operation and instrumentation, waveform pattern recognition, basic troubleshooting skills, relate skills for performing basic and uncommon EP's procedures and identify potential disease or injury processes correlates with Ep's results

COURSE CONTENTS:

Unit – I

Evoked Potentials - Basics of Instrumentation

Evoked potentials-definition

Principles of averaging/recording techniques

Evoked potential Instrumentation

- General
- Analogue
- Digital

Signal to noise ratio

Common mode rejection

Frequency response

Internal noise

Unit – II

B.A.E.R

Unit – III

V.E.P

Unit – IV

SSEP – Upper limbs - Median eps

SSEP - Lower limbs – Tibial Motor eps

Special techniques - MEPs

Unit – V

SSEP in brainstem/spinal cord/ optic pathway /cerebral disorders and their clinical applications

Computer application in evoked potentials

Practicals: Includes the above mentioned theory units

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
long essay type	3(attempt 2)	2x 10	20
Short answer type	8 (attempt 6)	6 x 5	30
Short answer 5 Questions	12 (attempt 10)	10x 3	30
Grand total			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	50	20	150	40	10	50	200

Recommended Books

1. Laboratory Reference for Clinical Neurophysiology – Jay.A.Liveson Dong.M.Ma
2. Electrodiagnostic Medicine – Daniel Dumitru

Reference Books

1. Electrodiagnosis in Diseases of Nerve and Muscle: Principles and Practice by Jun Kimura
2. Aminoff's Electrodiagnosis nin Clinical Neurology – Micheal J. Aminoff

Advanced Neuroscience technique 2

Theory 70 hours
Practical 30hours

COURSE OBJECTIVE:

The student should have basic knowledge of physics only regarding the slow of currents. He should know absent definition and the use of electrodes, amplifiers filters and stimulators. He should have the knowledge as to where and from what region the brain waves are recorded on electroencephalography machine

COURSE CONTENTS:

Electromyography & Special studies

Unit – I

Basics of EMG - Recording technique & Types of Needles

Recording techniques

Muscle & their localisation

Insertion activity

Spontaneous activity

Motor units

Polyphasics

Types of needles

S.EMG

SFEMG

QEMG

Unit – II

Normal & Abnormal patterns in EMG

End plate potentials

MUPS

Localisation techniques

Neurogenic patterns

Myopathic patterns

Unit – III

Special studies

Blink Reflex

VII nerve palsy

Cerebello pontine angle disorders

Brainstem disorder

Jaw jerk - V & VII nerve disorders

Unit – IV

Autonomic Function Studies

-Sympathetic skin response

-R-R interval

Unit – V

Patient safety in EMG

Computer application in Electromyography

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

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80	50	20	150	40	10	50	200

Practicals: Includes the above mentioned theory units

Recommended Books

1. Electrodiagnosis An Anatomical & Clinical Approach – Chu-Andrews, Robert J, Johnson
2. Laboratory Reference for Clinical Neurophysiology – Jay.A.Liveson Dong.M.Ma

SYSTEMIC DISEASES

CONCEPTS OF DISEASE AND OUTLINES OF CLINICAL EVALUATION RELATED TO NEUROSCIENCE TECHNOLOGY

Theory 50 hours

Course Objective

This course will cover common diseases and their causes, pertinent microbiology and pathology of the system involved, outline of major signs and symptoms and management of the disease including medical and surgical intervention.

The basic neurological examination with emphasis on

Unit – I

- CVA Cause, Types, syndromes, treatment
  Ischaemic diseases
  Thrombotic
  Embolic
- Trauma Head injury
  Spinal
  Peripheral
  Vascular diseases
- Hemorrhagic

Unit – II

- Infectious diseases
  Bacterial
  Mycobacterial
  Viral

Fungal

Spirochetal

Rickettsial

- ❖ Demyelinating disease
  CIDP

  Central Multiple sclerosis

  Peripheral other Demylinating neuropathies

Unit – III

- ❖ Somatic disorders
  Pain

  Headache

  Backache

  Craniofacial pains

  Cervical spondylosis

  Thoracic out let syndrome

Unit – IV

- ❖ Disorders of speech & Language
  Aphasia & its types

  Articulation & phonation

Disease of cranial nerves

V & VII nerve

Unit – V

- ❖ Inherited metabolic disease
  Autosomal disease

  Mitochondrial disease

- ❖ Disturbances of cerebrospinal fluid - Hydrocephalus

Unit – VI

- ❖ Sleep & its abnormalities
  Physiology

  Sleep disorders

- ❖ Developmental disease of nervous system
  Microcephaly, Macrocephaly

Unit –VII

Epilepsies

Classification & clinical approach

Epileptic syndrome

Treatment

Unit – VIII

Disorders of PNS & Neuromuscular transmission

Neuropathies/entrapment and infective neuropathies-Leprosy, Rabies

Myasthenia gravis

Myasthenic syndrome

Botulism

Unit – IX

Disorder of muscle

Twitches & pain & cramps

Inflammatory myopathies

Muscular dystrophies – Classification

Metabolic & toxic myopathies

Congenital muscular disorders

Myotonia

Unit – X

RGUHS

Degenerative disorders & Classification

Alzheimers

Dementia

Chorea

Extrapyramidal disorders

Parkinsonism

Unit – XI

Disorders of Autonomic Nervous system

Physiology

Regulation of BP

Unit – XII

Disorders of equilibrium

Vertigo

Toxic and metabolic disorders

Deficiency disorders

Practicals: Includes the above mentioned theory units

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

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Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Recommended Books

1. Principles of Neurology – Victor Adams
2. Neurology and Neurosurgery Illustrated - Kenneth W. Lindsay

Reference Books

1. Neurology in Clinical Practice Principles of Management and Diagnosis – Bradley Daroff Fenichel Jankovic

RESEARCH METHODOLOGY & STATISTICS

SL NO	TOPICS	HOURS
1	**Introduction I: Biostatistics** ✓ Definition ✓ role of statistics in health science and health care delivery system	
2	**Introduction II: Research Methodology** ✓ Research process ✓ Steps involved in research process ✓ Research methods and methodology	
3	**Variables and scales of measurements** ✓ Definitions and examples of qualitative, quantitative, continuous discrete, dependent and independent variables. ✓ Definitions, properties and examples of nominal, ordinal, interval and ratio scales of measurements.	
4	Sampling ✓ Population, sample, sampling, reasons for sampling, probability and non-probability sampling. ✓ Methods of probability sampling – simple random, stratified, systematic- procedure ✓ Merits and demerits. ✓ Use of random number table.	
5	**Organization of data** ✓ Frequency table, histogram, frequency polygon, frequency curve, bar diagram, pie chart	
6	**Measures of location** ✓ Arithmetic mean, median, mode, quartiles and percentiles – definition ✓ Computation (for raw data), merits, demerits and applications	

7	**Measures of variation** ✓ Range, inter-quartile range, variance, standard deviation, coefficient of variation- definition ✓ Computation (for raw data), merits, demerits and applications	
8	**Normal distribution** ✓ Concept, graphical form, properties, examples ✓ Concept of Skewnes and Kurtosis	
9	**Correlation** ✓ Scatter diagram ✓ concept and properties of correlation coefficient, examples [No computation]	60
10	**Health Information System** ✓ Definition, requirement, component and uses of health information system. ✓ Sources of health information system- Census, Registration of vital events, Sample registration system (SRS), Notification of diseases, Hospital records, Disease registries, Record linkage, Epidemiological surveillance, Population survey	
11	**Vital statistics and hospital statistics** ✓ Rate, ratio, proportion, Incidence, Prevalence. Common morbidity, mortality and Fertility statistics – Definition and computation.	
12	**Hypothesis** ✓ What is hypothesis ✓ Formulation of hypothesis ✓ Characteristics of good hypothesis.	
13	**Epidemiology** ✓ Concept of health and disease ✓ Definition and aims of Epidemiology, ✓ Descriptive Epidemiology- methods and uses.	
14	Concept of reliability & validity	
		60 Hrs

RECOMMENDED BOOKS

1. Methods in Biostatistics for medical students & Research workers edition — Mahajan B.K.- 6th

2. Research methodology – Methods & techniques — Kothari.C.R

3. Introduction to Biostatistics: A manual for students in health sciences — Sundar Rao PSS, Richard.J

4. Text book of Preventive and social medicine — Park.E.Park

FOURTH YEAR

Internship

Description:

One-year compulsory internship in various clinical areas in Amrita Institute of Medical Sciences during which the students get to hone their skills and knowledge acquired in the three years of rigorous study. During this period their work is very similar to what is expected from them after the completion of their training. The training ensures their readiness to approach a patient in any setting.

Eligibility:

Student who has successfully completed his/her theory and practical in the three years of the programme.

Duration:

One year (compulsory Internship)