



**RAMAIAH
UNIVERSITY**
OF APPLIED SCIENCES

M.S. Ramaiah University of Applied Sciences
Programme Structure and Course Details
Of
DM Neurology 2022 onwards

M.S. Ramaiah University of Applied Sciences
Ramaiah Medical College


Registrar
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054


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**RAMAIAH
UNIVERSITY**
OF APPLIED SCIENCES

M.S. Ramaiah University of Applied Sciences

Programme Specifications

DM Neurology Programme 2022 onwards

Programme Code: MD150

M.S. Ramaiah University of Applied Sciences

Ramaiah Medical College

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University's Vision, Mission and Objectives

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

Vision

MSRUAS aspires to be the premier university of choice in Asia for student centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation and excellence in our teaching and research. We value integrity, quality and teamwork in all our endeavors. We inspire critical thinking, personal development and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to equip students and scholars to meet the needs of industries, business and society
2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society
3. To promote health, human well-being and provide holistic healthcare
4. To provide technical and scientific solutions to real life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences
5. To instill the spirit of entrepreneurship in our youth to help create more career opportunities in the society by incubating and nurturing technology product ideas and supporting technology backed business
6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in
7. To develop partnership with universities, industries, businesses, research establishments, NGOs, international organizations, governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programme

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Programme Specifications: DM Neurology

Faculty	Ramaiah Medical College
Department	Neurology
Programme	DM Neurology
Programme Code	DM150
Dean of Faculty	Dr Shalini C Nooyi
Head of the Department	Dr. Mahendra J.V

1. **Title of the Award:** DM Neurology
2. **Mode of Study:** Full-Time
3. **Awarding Institution /Body:** M. S. Ramaiah University of Applied Sciences, Bengaluru
4. **Joint Award:** Not Applicable
5. **Teaching Institution:** Ramaiah Medical College
6. **Date of Programme Specifications:** September 2022
7. **Date of Programme approval by the academic Council of MSRUAS :** 27th September 2022
8. **Programme Approving Regulating Body and Date of Approval:** National Medical Council of India
9. **Rationale for the Programme**

DM Neurology course is designed to train the candidates in the principles and practice of advanced Neurology to equip them to function as faculty / consultants / researchers in the field of Neurology. The goal is to bring out competent Neurologists who shall recognize the health needs of the society, provide quality health care and carry out professional obligations ethically to fulfill the objectives of National Health Policy.

The major components of the curriculum shall cover theoretical knowledge, practical and clinical skills, treatment protocols, interpersonal communication skills and training in research methodology. The course study shall be for a period of 3 academic years in the residency pattern with graded responsibilities in the management and treatment of patients entrusted to his / her care.

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Programme objectives (PO) for DM Neurology Postgraduate students

- PO1.** Develop the knowledge, skills and attitude to be a competent neurologist (C, P)
PO2. Demonstrate a commitment to excellence and continuous professional development with integrity, compassion and sensitivity to patient care. (A)
PO3. Acquire and develop the knowledge, skills and attitude required to be a competent and ethical researcher and teacher. (A, C, P)
PO4. Be able to independently manage neurological patients with a reasonable degree of professionalism and competence. (C,A,P)

Programme specific outcome (PSO) for DM Neurology Postgraduate students

- PSO1.** Achieve competence in history taking, detailed neurological examination and clinical analysis leading to accurate diagnosis of neurological illnesses. (C,A,P)
PSO2. Achieve competence in planning investigations and appropriate management of the patient. Should be adequately exposed to various sub-specialties of neurology mainly acute stroke care and interventions, comprehensive epilepsy and movement disorder management. This includes evaluation of drug refractory epilepsy for consideration of surgical options and also deep brain stimulation and injection Botulinum toxin in the management of movement disorders. Should be adequately exposed to management of critically ill patients in the intensive care unit and should be exposed to neurological emergencies. (C,A,P)
PSO3. Know the utility, limitations and interpretation of various investigative modalities such as EEG, EMG, Evoked potentials, CSF study, CT scan, MRI scan, Cerebral Angiography. Should develop procedural skills in Neurology such as lumbar puncture, Electrophysiological study and muscle / nerve biopsies. (C,A,P)
PSO4. To enable him/ her to function as Faculty / Consultants in the speciality. (A,C)
PSO5. To plan and set up an independent Neurology unit catering to clinical and investigative Neurology. (A,C)
PSO6. To carry out and help in conducting applied research in Neurosciences. (C)

Note: A- Affective Domain, C- Cognitive Domain & P- Psychomotor Domain



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Course-PO-PSO Mapping

Course Code and name	Program Outcomes				Program Specific Outcomes					
	POs				PSOs					
	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
DMC501A Basic sciences as related to Neurology.	2	1	3	2	1	3	2	2	3	1
DMC502A Clinical Neurology	3	1	1	1	2	3	3	2	2	1
DMC503A Investigative Neurology	2	2	1	1	2	2	3	3	2	1
DMC504A Recent advances in Neurology	1	1	1	1	2	2	3	3	2	3

10. Regulations:**(A) Attendance, Progress and Conduct**

1. A candidate pursuing degree course should work in the concerned department of the institution for the full period as a full time student. No candidate is permitted to run or work in clinic/laboratory/nursing home while studying postgraduate course. No candidate shall 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 study.
2. Each term shall be taken as a unit for the purpose of calculating attendance. Attendance of 80% every term is mandatory for appearing in the final university examination.
3. Every student shall attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, case presentation, clinics and lectures during each year as prescribed by the department and not absent himself / herself from work without valid reasons.
4. Every candidate is required to attend a minimum of 80% of the training during each academic term of the post graduate course. Provided further, leave of any kind shall not be counted as part of academic term without prejudice to minimum 80% attendance of

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training period every term.

- Any student who fails to complete the course in the manner stated above shall not be permitted to appear for the University Examinations.

(B) Monitoring of progress of Studies

- Work diary / Log Book - Every candidate shall maintain a work diary and record of his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. as per the model checklists and logbook specimen copy.
- Special mention may be made of the presentations by the candidate as well as details of clinical or planning procedures, if any conducted by the candidate. The work diary shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the university practical/clinical examination.
- Procedure for defaulters: There will be a committee constituted by all teachers to review such situations. The defaulting candidate is counselled by the guide and head of the department. In extreme cases of default, the departmental committee may recommend that defaulting candidate will be withheld from appearing the examination, if she/he fails to fulfil the requirements in spite of being given adequate chances to set himself or herself right.

11. Teaching Learning Methods:

Neurology being a clinical subject main emphasis during training is towards problem based learning with hands on experience in history taking, neurological examination, investigation and management of patients. Acquisition of practical competencies being the keystone of post graduate medical education, PG training should be skills oriented. Learning in PG program should be essentially self-directed and primarily emanating from clinical and academic work. The formal sessions are merely meant to supplement this core effort.

The residency training programme shall also include formal lectures in the subject and subspecialties, symposia, clinical discussions, training in diagnostic and therapeutic modalities, research, journal reviews /clinical presentations and teaching rounds. It shall also incorporate guest lectures, orientation classes. The day-to-day work of the trainees is supervised by the faculty of the department of Neurology.

The posting is so organized that the trainee gets posted in various areas of the department like Out-patient department, wards, Intensive Care Unit and laboratories. The students are frequently rotated in their departments and also posted for emergency duties. Their exposure to various sub-specialties of neurology are taken into account.

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The following teaching schedule is prescribed for the course:

Out Patient Service (OPD)	- Thrice a week
Major Ward Rounds	- Thrice a week
Subject Seminars	- Twice a month
Clinical Case Presentation	- Once a week
Journal Club	- Twice a month
Neuroradiology	- Twice a month
Clinical Neurophysiology	- Once a month
Inter departmental meeting	- Once in 3 months
Mortality Meeting	- Once in 3 months
Clinico Pathological conference / Case discussion	- Once in 3 months

Course plan

1. First Year

1. Out patient service (supervised) - three days in a week
2. In-patient care (supervised) - daily (Wards and ICU)
3. Ward rounds - daily
4. Emergency - on call
5. Subject seminars - Neuroanatomy
 - a. Neurophysiology
 - b. Diagnostic and Therapeutic Neurology
 - c. Recent advances
6. Clinical seminars - case discussion
7. Journal review
 1. Clinical Neurophysiology (supervised) - EEG, Nerve conduction study, Evoked potentials
8. Procedures - Lumbar punctures
9. Scientific paper presentation
10. Log books
11. Internal assessment

2. Second Year

1. Out patient service (supervised) - three days in a week
2. In-patient care (supervised) - daily (wards and ICU)
3. Ward rounds - daily
4. Emergency - on call
5. Subject seminar
6. Diagnostic and Therapeutic Neurology Recent advances
7. Clinical seminars - case discussion
8. Journal review
9. Clinical Neurophysiology (supervised) - EEG, Nerve conduction study, Evoked potentials
10. Procedures - Lumbar punctures
11. Scientific paper presentation



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12. Log books
13. Internal assessment
14. Neuropathology (external posting)
15. Neuroradiology (external posting - optional)

3. Third Year

1. Out patient service (supervised) - three days in a week
2. In-patient care (supervised) - daily (wards and ICU) (Independent decision making allowed)
3. Ward rounds – daily
4. Emergency - on call
5. Subject seminar - Diagnostic and Therapeutic Neurology Recent advances
6. Psychiatry posting
7. Neurosurgery posting
8. Clinical Neurophysiology (supervised) - EEG, Nerve conduction study, Evoked potentials & ENMG Studies
9. Research publications
10. Procedures - LP, Muscle and nerve biopsy
11. Completion of log books
12. Internal assessment
13. University examination

12. Innovative Teaching Learning Practices

1. Theme based teaching learning activities eg..Dementia for a full month.
2. Focused discussion during journal club inculcates culture in the areas of research and publication
3. Faculty Lecture during 4th week: Helps in bridging the gap between what is presented during the month and what is not about particular topic. Also it reinforces learning

13. Assessment

Formative assessment during the training includes:

Periodic internal assessment

1. Theory and practical examination including OSCE every year
2. Assessment of log book every 6 months

Attendance, progress and conduct:

1. A candidate pursuing degree course should work in the concerned department of the institution during the study period as a fulltime student. No candidate is permitted to run a clinic / laboratory / nursing home while studying postgraduate course.
2. Every student shall attend symposia, seminars, conferences, journal review meetings, grand rounds CPC, case presentation, clinics and lectures during each year as prescribed by the department and not absent himself/ herself from work without valid reasons.

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3. Every candidate is required to attend a minimum of 80% of the training during the postgraduate course.
4. Any student who fails to complete the course in the manner stated above shall not be permitted to appear for the University Examinations.
5. Attitude and aptitude.
6. Caring attitude
 - a. Reliability, initiative and Organizational abilities
 - b. Ability to cope with stress and responsibilities
 - c. Professional relationship and team work.

Monitoring progress of studies

Work diary / Log book : Every candidate shall maintain a log book and record of his / her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate. The log book shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the University practical / clinical examinations.

Periodic internal tests: During the course of three years the concerned departments may conduct three tests, two of them are annual tests, one at the end of first and the other in the second year. The third test may be held three months before the final examination. The tests may include written papers, practical and marks obtained in such tests will be maintained by the Head of the Department and sent to the University, when called for.

Continuous assessments: This will be based on a report by the unit in-charge who evaluates the progress of the candidate in cognitive, affective and psychomotor domains.

Research & Publications

1. One poster presentation in a National / State conference
2. One paper to be read in a National / State conference
3. One Research paper should be published / accepted for publication / sent for publication in an indexed journal.

Summative Assessment (final assessment at the end of the training)

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The post graduate examination shall be in two parts and will be as per the details given in Postgraduate Regulations, 2000.*

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1. Theory (written paper) 400 marks

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify postgraduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole.

Name of the course	Course Code	Topics	Marks
Basic sciences relevant to Neurology	DMC501A	Neuroanatomy, Neurophysiology, Neurochemistry, Neuropharmacology, Neuropathology, Neuromicrobiology, Neurotoxicology, Neurogenetics and proteomics, Neuroepidemiology	100
Clinical Neurology	DMC502A	Disturbances of sensorium, Seizures and Epilepsy and Syncope Headache and other cranial neuralgias, Cerebrovascular diseases Dementias, Parkinsonism and movement disorders, Ataxic syndromes Cranial neuropathies CNS infections, Neuroimmunologic diseases Neurogenetic disorders, Developmental disorders of nervous system Myelopathies Peripheral neuropathies, Myopathies and neuromuscular junction disorders, Paediatric neurology, Cognitive neurology and, neuropsychiatry Tropical neurology	100
Investigative Neurology	DMC503A	Diagnostic and interventional neurology including neurological instrumentation, Electrophysiology, Neuroradiology	100
Recent advances in Neurology	DMC504A	Advances in neuroimaging techniques Bionics in neural prostheses and rehabilitation neuroproteomics and neurogenetics Stem cell and Gene therapy Neuroepidemiological studies and clinical trials	100

2. Clinical / Practical and Oral/viva voce Examination:

Oral examination shall be comprehensive enough to test the student's overall knowledge of the subject. The clinical/practical examination shall be held as per norms and as per the prevailing rules of the training institute/ University rules. A broader outline is suggested below:

1. One long case - 100 marks
2. Two short cases – 50 marks each
3. Structured viva voce
4. Neuro-radiology
5. Neuro pathology
6. Electrophysiology
7. Laboratory reports

100 marks



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Practical / clinical examination:

1. The clinical examination should aim at examining clinical skills and competence of candidates for undertaking independent work as a specialist. Each candidate will be evaluated based on the examination of one long case and two short cases.
2. The practical examination should be aimed at assessing competence, skills of technique and procedures as well as testing student's ability to make relevant and valid observations, interpretations and experimental work relevant to his / her subject.
3. Practical examination shall consist of interpretation of
4. Gross Pathological specimens and Histopathological slides
5. Neuroradiology
6. Clinical neurophysiology graphs / recordings

(The maximum marks for the practical and clinical examination will be 200)

Viva voce examination:

will be conducted after the clinical case presentation and will be directed to the evaluation of the breadth and depth of the candidate's knowledge of neurology and pertinent allied specialties. The maximum marks for the viva voce examination is 100.

Number of candidates per day: The maximum number of candidates for practical / clinical and viva - voce examination shall be maximum of 3 per day (subject to revision by the University / NMC)

Passing: The candidate will be considered to have passed the examination provided he / she obtains 50% marks overall in all the spheres i.e theory (≥ 200 marks), clinical + practical and viva voce (≥ 150 marks) examinations (subject to revision by the University / NMC)

Examiners: The panel of examiners shall consist of four examiners (two internal & two external examiners) all whom shall be having postdoctoral degree in Neurology (DM Neurology or equivalent). Examiners are selected as per University / NMC guidelines.

Essential practical Knowledge

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Annexures

- Annexure 1_ Competency List
- Annexure 2_ Overall course plan year-wise
- Annexure 3_ Sample of monthly schedules
- Annexure 4_ PG outside posting policy
- Annexure 5_ Logbook entry
- Annexure 6_ Students appraisal form



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Annexure 1**Competency List**

- Following is the table where you will find the details
- Idea is to teach, assess in an on-going manner and document.
- K/S/A refers to Knowledge/skill/affective domain and what is mentioned is the predominant domain to gain that particular competency

Must know skills These are mandatory skills. The student should be able to perform the following procedures independently:	Desirable skills These are good to know skills. The student should be able to perform the following procedures independently or as a part of a team and/or interpret the results of:	Observed skills These are mandatory skills but need to be ONLY observed
Common neurological procedures to be performed: 1. Lumbar puncture 2. Muscle and nerve biopsy 3. CSF tap test for NPH 4. Nerve conduction studies and interpretation 5. EMG and interpretation 6. EEG and interpretation 7. Interpretation of VEEG 8. Interpretation of PSG and Sleep titration 9. Endotracheal intubation 10. Oro/nasogastric tube insertion 11. Central venous line insertion 12. Interpretation of VEP/BAER/SSEP 13. Interpretation of acute stroke imaging 14. Interpretation of cerebral angiogram 15. Application of CPAP 16. Intravenous cannulation 17. Peripheral arterial cannulation 18. Arterial stab sampling 19. Laboratory investigations 20. Perform the following basic tests in the side lab: microscopy of CSF and peripheral smear, point of care screening tests. and blood gas analysis.	1. Assessment Tools: NIHSS/MRS ADL Scores UPDRS Cognitive Scales EDSS 2. Botulinum Toxin injection for Spasticity, Vocal cord dystonia, other rarer conditions 3. Botulinum Toxin injection for Movement Disorders such as Blepharospasm, Hemi facial Spasm, Meigs Syndrome 4. TCD for stroke patients	1. Observe neurological surgery 2. Observe Epilepsy surgery 3. Observe DBS 4. Observe house-keeping protocols and asepsis routines of individual units. 5. Observe Digital Subtraction Angiography

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Annexure 2Month wise Teaching Schedule for Post Graduates Department Of Neurology

MONTH	SITE	Teacher
January	Cranial nerves	Moderator
February	Neuromuscular disorders	Moderator
March	Encephalitis	Moderator
April	Movement disorders	Moderator
May	Dementia	Moderator
June	Headache	Moderator
July	Epilepsy	Moderator
August	Stroke & Cerebrovascular disorders	Moderator
September	Neurological manifestations of systemic disorders	Moderator
October	Peripheral neuropathy	Moderator
November	Anterior Horn cell disorders	Moderator
December	Vertigo	Moderator

Note:

1. The respective faculty will be in charge of the entire process...planning, implementation and assessment.
2. It is preferable to put the time table latest by 20th of previous month.
3. PGs are expected to keep in touch with the respective teachers well ahead of the class.



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Annexure 3APRIL TEACHING SCHEDULE FOR POST GRADUATES THEME: MOVEMENT DISORDERS

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1 Case presentation	2 Chart rounds	3 Grand rounds
4 Sunday	5 Journal club	6 Chart rounds	7 Subject seminar	8 Case presentation	9 Chart rounds	10 Grand rounds
11 Sunday	12 Neuro Radiology	13 Chart rounds	14 Subject seminar	15 Case presentation	16 Chart rounds	17 Grand rounds
18 Sunday	19 Clinical Neurophysiology	20 Chart rounds	21 Subject seminar	22 Case presentation	23 Chart rounds	24 Grand rounds
25 Sunday	26 Journal club	27 Chart rounds	28 Subject seminar	29 Neuro Radiology	30 Chart rounds	

Instructions: -

- All classes will be based on discussion
- PPTS to be used only to show images /staging /RT planning details
- Both students should discuss with each other prior to the class and present
- The team shall discuss with the teacher atleast 3-5days before the date of the class.
- The week's doubts clarifications to be discussed with the faculty on Saturdays.
- All the best

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ANNEXURE – 4DEPARTMENT OF NEUROLOGYPolicy for outside PG postings

During the training period of three years, the student will be posted mainly in the department of Neurology for clinical neurology rotation along with posting at various other departments / sections as follows :

Clinical Neurophysiology	- 1 month
Neuropathology	- 15 days (minimum)
Neuroradiology	- 1 month (optional)
Neurosurgery	- 1 month
Neuropsychiatry	- 1 month



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Annexure 5Logbook entry

Date	
Setting/method	
Presented/attended	
Summary in brief	
Reflection	
Teachers comments	

Student's signature

Guide's Signature

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Annexure-6

Postgraduate Students Appraisal Form Name of the PG Student _____ Period of Training
Duration:.....to.....

Sl. No	Particulars	Not satisfactory (1,2,3)	Satisfactory (4,5,6)	More than Satisfactory (7,8,9,10)	Remarks
1	Journal based learning				
2	Patient care and rounds				
3	Bedside teaching, Clinical seminars				
4	Communication skills				
5	Log book				
6	Thesis work				
7	CME/Outreach programmes/Conference presentations				
8	Self-directed learning				
9	Under-graduate teaching				
10	Research/Publication				

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Sign of the assessor

Sign of Head of the Department

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Course Specifications DM Neurology

2022 onwards

Course Code: DMC501A

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Course Specifications

Course Title	Basic sciences as related to Neurology
Course Code	DMC501A
Department	Neurology
Faculty	Ramaiah Medical College

Course summary:

This course is designed in such a way that the student will master the basics of neurology, neuroanatomy, neurophysiology, electrophysiology, clinical neurology and management of neurological emergencies.

Course Outcome

At the end of the course, the students should be able to

CO1. Demonstrate basic skills in the clinical history taking and neurological examination along with documentation of detailed inpatient case sheets, sufficient skills in dealing with routine out-patient cases, planning investigations and course of treatment. (C,A,P)

CO2. Perform procedures like lumbar puncture independently and be able to assist with procedures related to tissue biopsies. Perform Electrophysiological procedures, including NCS, ENMG and EEG. Able to interpret CT & MRI scans (C,A,P)

CO3. Teach students effectively by using appropriate learning resources and teaching techniques. (A, C)

Course contents

AIM:

To produce specialists with necessary skills, judgement and sense of dedication to tackle all major and minor cardiac problems. The candidates will be trained in all aspects of Neurology starting from Basic Sciences to recent advances.

NEUROANATOMY

The Neuroanatomy with special emphasis on development of:

1. Neuroaxis (brain, spinal cord and neurons and glia),
2. Autonomic nervous system and their maturation process in the post-natal, childhood and adolescent states;
3. Location and significance of stem cells,
4. CSF pathways,
5. Blood supply and sino venous drainage of brain and spinal cord, the meninges,
6. Skull and vertebral column, the cranial nerves, spinal roots, plexuses, and their relation to neighboring structures;
7. Anatomy of peripheral nerves,
8. Neuromuscular junction and muscles;

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9. Histology of cerebrum, cerebellum, pituitary gland, brain stem and
 - a. spinal cord, nerves and neuromuscular junction and muscle.
10. Functional anatomy of lobes of cerebrum and white matter tracts of brain and spinal cord, craniovertebral junction, conus and epiconus and cauda equina, brachial and lumbosacral plexuses, cavernous and other venous sinuses;
11. New developments in understanding of:
 - a. Ultrastructural anatomy of neurons,
 - b. axonal transport,
 - c. neural networks and synapses and nerve cell function at molecular level.

NEUROPHYSIOLOGY

1. Neurophysiology will cover all the physiological changes in the nervous system during its normal function with special reference to nerve impulse transmission along myelinated fibers,
2. neuromuscular junction and synaptic transmission,
3. muscle contraction;
4. visual, auditory and somatosensory and cognitive evoked potentials;
5. Regulation of secretions by glands, neural control of viscera such as heart, respiration, GI tract, bladder and sexual function; sleep-wake cycles;
6. Maintenance of consciousness,
7. special senses,
8. control of functions of (a) pituitary, (b) autonomic system (c) cerebellum, (d) and extrapyramidal functions,
9. reflexes,
10. upper and lower motor neuron concepts and sensory system.

MOLECULAR BIOLOGY

Brain is the one structure where maximum genes are expressed in the human body. The topics include:

1. Principles of molecular biology including Gene Structure, Expression and regulation;
2. Recombinant DNA Technology;
3. PCR Techniques,
4. Molecular basis for neuronal and glial function,
5. Molecular and cellular biology of the membranes and ion-channels,
6. Mitochondrial genome,
7. Role of RNA in normal neuronal growth and functional expression,
8. Receptors of neurotransmitters,
9. Molecular and cellular biology of muscles and neuromuscular junction, etc.
10. The Human Genome and its future implications for Neurology including
 - a. developmental and neurogenetic disorders,
11. bioethical implications and genetic counselling,
12. Nerve growth and other trophic factors and neuroprotectors,
13. Neural Tissue modification by genetic approaches including Gene Transfer, stem cell therapy etc.
14. Molecular Development of neural tissue in peripheral nerve repair

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NEUROCHEMISTRY

1. All aspects of normal and abnormal patterns of neurochemistry including:
2. Neurotransmitters associated with different anatomical and functional areas of brain and spinal cord, especially with respect to dopaminergic, serotonergic, adrenergic and cholinergic systems,
3. Opioids,
4. Excitatory and inhibitory amino acids and their role in pathogenesis of Parkinsonism, depression, migraine, dementia, epilepsy,
5. Neuromuscular junction and muscle contractions,
6. Carbohydrate, amino acid and lipid metabolism,
7. Neural expression of disorders of their metabolism,
8. Electrolytes and their effect on encephalopathies,
9. Muscle membrane function, storage disorders,
10. Porphyria.

NEUROPHARMACOLOGY

- Application of neuropharmacology in medical therapy of epilepsy, Parkinsonism, movement disorders, neuropsychiatric syndromes, spasticity, pain syndromes, disorders of sleep and dysautonomia syndromes.
- Antiepileptic drugs, usage during disorders of renal, hepatic function and in dementia.
- Adverse drug reactions of common drugs used in Neurological disorders including antiepileptic drugs, antiplatelets, anticoagulants etc.

NEUROPATHOLOGY

1. Pathological changes in various neurological diseases with special reference to vascular, immune-mediated, demyelinating and dysmyelinating, metabolic and nutritional, genetic and developmental, infectious and iatrogenic and neoplastic etiologies and clinical correlation.
2. Pathological changes in nerve and muscle in neuropathies and myopathies.
3. Ultrastructural pathology such as apoptosis, ubiquitinopathies, mitochondrial diseases, channelopathies, peroxisomal disorders, inclusion bodies, prion diseases, disorders mediated by antibodies against various cell and nuclear components, paraneoplastic disorders etc.

NEUROMICROBIOLOGY

Microbiological aspects of infectious neurologic diseases including:

1. Encephalitis, meningitis, brain abscess, granulomas, myelitis, cold abscess, cerebral malaria, parasitic cysts of nervous system, rhino cerebral mycoses, leprous neuritis, neuro leptospirosis, primary and secondary Neuro HIV infections, congenital TORCH infections of brain, slow virus infections such as CJD and SSPE.
2. Neurological complications of viral infections such as Polio, EBV, Chickenpox, Rabies, Herpes, Japanese encephalitis and other epidemic viral infections.



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NEUROTOXICOLOGY

Diagnosis and effective therapy of:

1. Organophosphorus poisoning,
2. hydrocarbon poisoning,
3. lead, arsenic, botulinum toxin and tetanus toxicity,
4. snake, scorpion, spider, wasp and bee stings.

NEUROGENETICS AND PROTEOMICS:

1. Autosomal dominant and recessive and X-linked inheritance patterns,
2. disorders of chromosomal anomalies,
3. Gene mutations, trinucleotide repeats, dysregulation of gene expressions,
4. Enzyme deficiency syndromes,
5. Storage disorders,
6. Disorders of polygenic inheritance,
7. Proteomics in health and disease.

NEUROEPIDEMIOLOGY:

1. Basic methodology in community and hospital based neuro-epidemiological studies such as systematic data collection, analysis, derivation of logical conclusions,
2. Concepts of case-control and cohort studies, correlations,
3. Regressions and survival analysis,
4. Basic principles of clinical trials.



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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes					
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
DMC 501A Basic sciences as related to Neurology	CO 1	3	3	1	3	3	3	2	3	2	1
	CO 2	2	1	1	3	2	2	3	3	3	2
	CO 3	2	2	3	2	3	3	2	3	2	3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution											



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Course Specifications DM Neurology

2022 onwards

Course Code: DMC502A



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Course specifications

Course Title	Clinical Neurology
Course Code	DMC502A
Department	Neurology
Faculty	Ramaiah Medical College

Course summary: The student should be able to master detailed clinical examination and perform various outpatient procedures.

Course Outcomes:

At the end of the course, the students should be able to

CO1. Demonstrate basic skills in the clinical history taking and neurological examination along with documentation of detailed inpatient case sheets, sufficient skills in dealing with routine outpatient cases, planning investigations and course of treatment. (C,A,P)

CO2. Perform procedures like lumbar puncture independently and be able to assist with procedures related to tissue biopsies. Perform Electrophysiological procedures, including NCS, ENMG and EEG. Able to interpret CT & MRI scans (C,A,P)

CO3. Teach students effectively by using appropriate learning resources and teaching techniques. (A, C)

Course Contents:**GENERAL EVALUATION OF THE PATIENT**

1. The science and art of history taking,
2. Physical examination including elements of accurate history taking, symptoms associated with neurological disease,
3. Physical examination of adults, children, infants and neonates, syndromes
4. associated with congenital and acquired neurological disease, cutaneous markers,
5. Examination of unconscious patients,
6. Examination of higher mental functions, cranial nerves, the ocular fundus,
7. Examination of tone, power of muscles,
8. Proper elicitation of superficial and deep reflexes including alternate techniques,
9. Neonatal and released reflexes,
10. Neurodevelopmental assessment of children, sensory system, peripheral nerves, signs of Meningeal irritation, skull and spine examination including measurement of head circumference, shortness of neck and carotid pulsations and vertebral bruits.

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DISTURBANCES OF SENSORIUM

1. Pathophysiology and diagnosis of COMA,
2. Diagnosis and management of coma, delirium and acute confusional states, reversible and irreversible causes,
3. Persistent vegetative states and brain death,
4. Neurophysiological evaluation and confirmation of these states,
5. Mechanical ventilation and other supportive measures of comatose patient,
6. Prevention of complications of prolonged coma,
7. The significance of timely brain death in organ donation and ICU
 - a. resource utilization.

SEIZURES and EPILEPSY and SYNCOPE

1. Diagnosis of seizures, epilepsy and epileptic syndromes,
2. Recognition, clinical assessment and management of seizures especially their electrodiagnosis, video monitoring with emphasize on phenomenology and their correlation with EEG,
3. Structural and functional brain imaging such as CT and MRI and fMRI
 - a. and SPECT scan,
4. Special situations such as epilepsy in pregnant and nursing mothers, driving, risky occupations, its social stigmas differentiation from pseudo seizures,
5. Use of conventional and newer antiepileptic drugs, their drug interactions and adverse effects etc.,
6. Modern lines of management of intractable epilepsies, such as ketogenic diet, vagal nerve stimulation, epilepsy surgery,
7. Pre-surgical evaluation of patients,
8. Management of status epilepticus and refractory status epilepticus,
9. Differentiation of seizures from syncope, drop attacks, cataplexy, startles etc.

HEADACHES and OTHER CRANIAL NEURALGIAS

1. Acquisition of skills in analysis of headaches of various causes such as those from raised intracranial pressures, migraines, cranial neuralgias, vascular malformations,
2. Meningeal irritation, Psychogenic etc. and their proper pharmacologic management.

CEREBROVASCULAR DISEASES

1. Vascular anatomy of brain and spinal cord,
2. Various causes and types of cerebrovascular syndromes, ischemic and hemorrhagic types, arterial and venous types, anterior and posterior circulation strokes,
3. OSCP and TOAST classifications,
4. Investigation of strokes including neuroimaging using Dopplers,
5. CT and MR imaging and angiography, acute stroke therapy including

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- a. thrombolytic therapy,
6. Interventional therapy of cerebrovascular diseases,
7. Principles of management of subarachnoid hemorrhage etc.
8. Special situations like strokes in the young, strategies for primary and secondary prevention of stroke.

DEMENTIAS

1. Concept of minimal cognitive impairment,
2. Reversible and irreversible dementias, causes such as Alzheimer's and other neurodegenerative diseases and vascular and nutritional and infectious dementias, their impact on individual, family and in society.
3. Genetic and familial syndromes.
4. Pharmacotherapy of dementias, potential role of cognitive rehabilitation and special care of the disabled.

PARKINSONISM AND MOVEMENT DISORDERS

1. Disorders of extrapyramidal system such as Parkinsonism, chorea, dystonia, athetosis, tics, their diagnosis and management,
2. Pharmacotherapy of Parkinsonism and its complications,
3. Management of complications of Parkinsonism therapy, including principles of deep brain stimulation and lesion surgeries.
4. Use of EMG guided botulinum toxin therapy,
5. Management of spasticity using intrathecal baclofen and TENS.

ATAXIC SYNDROMES:

1. Para infectious demyelination, cerebellar tumors, hereditary ataxias, vestibular disorders,
2. Diagnosis and management of brainstem disorders,
3. Axial and extra-axial differentiation.

CRANIAL NEUROPATHIES:

1. Disorders of smell, vision, visual pathways, pupillary pathways and reflexes,
2. Internuclear and supranuclear ophthalmoplegia,
3. Other oculomotor disorders,
4. Trigeminal nerve testing,
5. Bell's palsy,
6. Differentiation from UMN facial lesions,
7. Brain stem reflexes,
8. Investigations of vertigo and dizziness,
9. Differentiation between central and peripheral vertigo,
10. Differential diagnosis of nystagmus,
11. Investigations of deafness, bulbar and pseudobulbar syndromes.



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CNS INFECTIONS:

Diagnosis and management of viral encephalitis, meningitis bacterial, tuberculous, fungal, parasitic infections such as cysticercosis, cerebral malaria, SSPE, Neuro HIV primary and secondary infections with exposure to gram stain and cultures, bac tec, QBC, ELISA and PCR technologies.

NEUROIMMUNOLOGIC DISEASES

Diagnosis and management of CNS conditions such as Multiple Sclerosis, PNS conditions such as GBS, CIDP, Myasthenia gravis, polymyositis.

NEUROGENETIC DISORDERS

1. Various chromosomal diseases,
2. Single gene mutations such as enzyme deficiencies,
3. Autosomal dominant and recessive conditions and X-linked disorders,
 - a. trinucleotide repeats,
4. Disorders of DNA repair. Genetics of Huntington's disease, familial dementias, other storage disorders, hereditary ataxias,
5. Hereditary spastic paraplegias, HMSN, muscular dystrophies, mitochondrial inheritance disorders.

DEVELOPMENTAL DISORDERS OF NERVOUS SYSTEM

1. Neuronal migration disorders,
2. Cranio vertebral junction diseases,
3. Spinal dysraphism,
4. Phacomatoses and other neurocutaneous syndromes- their recognition and management.

MYELOPATHIES

1. Clinical diagnosis of distinction between compressive and non-compressive myelopathies,
2. Spinal syndromes such as anterior cord, subacute combined degeneration,
3. Central cord syndrome,
4. Brown-Sequard syndrome,
5. Tabetic syndrome,
6. Ellsberg phenomenon.
7. Diagnosis of spinal cord and root compression syndromes,
8. CV junction lesions,
9. Syringomyelia, conus cauda lesions,
10. Spinal AVMs,
11. tropical and hereditary spastic paraplegias,
12. Fluorosis.



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PERIPHERAL NEUROPATHIES

Immune mediated, hereditary, toxic, nutritional and infectious type peripheral neuropathies; their clinical and electrophysiological diagnosis.

MYOPATHIES AND NEUROMUSCULAR JUNCTION DISORDERS

1. Clinical evaluation of patients with known or suspected muscle diseases aided by EMG,
2. Muscle pathology, histochemistry, immunopathology and genetic studies,
3. Dystrophies, polymyositis, channelopathies, congenital and mitochondrial myopathies,
4. Neuromuscular junction disorders such as myasthenia, botulism, Eaton-lambert syndrome,
5. Snake and organophosphorus poisoning, their electrophysiological diagnosis and management.
6. Myotonia, stiff person syndrome.

PAEDIATRIC NEUROLOGY:

1. Normal development of motor and mental milestones in a child, Cerebral palsy,
2. Attention deficit disorder,
3. Autism,
4. Developmental dyslexia,
5. Intrauterine TORCH infections,
6. Storage disorders,
7. Inborn errors of metabolism affecting nervous system,
8. Developmental malformations,
9. Child hood seizures and epilepsies,
10. Neurodegenerative diseases.

COGNITIVE NEUROLOGY AND NEUROPSYCHIATRY:

1. Detailed techniques of higher mental functions evaluation,
2. Basics of primary and secondary neuropsychiatric conditions such as anxiety, depression, schizophrenia, acute psychosis, acute confusional reactions (delirium), organic brain syndrome,
3. Primary and secondary dementias, differentiation from pseudodementia.

TROPICAL NEUROLOGY

Conditions which are specifically found in the tropics like to be taught in detail;

1. Neuro-cysticercosis,
2. Cerebral malaria,
3. Tropical spastic paraplegia,
4. Snake/scorpion/ Chandipura
5. Encephalitis,
6. Madras Motor Neuron disease etc.



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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes					
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
DMC502A Clinical Neurology	CO 1	3			3	3	3	2	3	3	2
	CO 2	2			3			1	3	3	2
	CO 3			3	3					2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution											



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Course Specifications DM Neurology

2022 onwards

Course Code: DMC503A



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Course Specifications

Course Title	Investigative Neurology
Course Code	DMC503A
Department	Neurology
Faculty	Ramaiah Medical College

Course Summary: It is designed in such way that the student will learn to interpret various investigations.

Course outcome:

At the end of the course, the students should be able to

CO1. Demonstrate basic skills in the clinical history taking and neurological examination along with documentation of detailed inpatient case sheets, sufficient skills in dealing with routine out-patient cases, planning investigations and course of treatment. (C,A,P)

CO2. Perform procedures like lumbar puncture independently and be able to assist with procedures related to tissue biopsies. Perform Electrophysiological procedures, including NCS, ENMG and EEG. Able to interpret CT & MRI scans (C,A,P)

CO3. Teach students effectively by using appropriate learning resources and teaching techniques. (A, C)

Course Contents:

DIAGNOSTIC and INTERVENTIONAL NEUROLOGY INCLUDING NEUROLOGICAL INSTRUMENTATION, DIAGNOSTIC NEUROLOGY

1. Performing and interpreting Digital Electroneurogram, Electromyogram,
2. Evoked potentials, Electroencephalography,
3. Interpretation of skull and spine X-rays,
4. Computerized tomography of brain and spine,
5. Magnetic resonance images of brain including correct identification of various sequences, angiograms, MR spectroscopy,
6. Basics of functional MRI,
7. Interpretation of digital subtraction imaging, SPECT scans of brain, subdural EEG recording, transphenoidal electrode EEG techniques for temporal lobe seizures,
8. video EEG interpretation of phenomenology and EEG-phenomenology correlations,
9. EEG telemetry,
10. Transcranial Doppler diagnosis and monitoring of acute ischemic stroke,
11. Subarachnoid hemorrhage,
12. Detection of right-to-left shunts etc;
13. Color duplex scanning in Carotid and vertebral extracranial segment screening.

NEUROINSTRUMENTATIONS

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Acquire skills in procedures like:

1. Intrathecal administration of antispasticity drugs, beta interferons in demyelination, opiates in intractable pain etc.,
2. EMG guided Botox therapy for dystonia,
3. Subcutaneous administration of antimigraine and antiparkinsonian drugs,
4. Intraarterial thrombolysis in extended windows of thrombolysis in ischemic strokes,
5. Transcranial Ultrasound clot-bust intervention in a registry in acute stroke care unit,
6. Planning in deep brain stimulation therapy in uncontrolled dyskinesias and on-off phenomena in long standing Parkinsonism,
7. Planning in vagal nerve stimulation in intractable epilepsy.



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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes					
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
DMC503A Investigative Neurology	CO 1	3			3				3		3
	CO 2	2			3			1	3		3
	CO 3			3	3					2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution											



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Course Specifications DM Neurology

2022 onwards

Course Code: DMC504A



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Course Specifications

Course Title	Recent advances in Neurology
Course Code	DMC504A
Department	Neurology
Faculty	Ramaiah Medical College

Course Summary: This is designed in such a way that the students keep abreast with the latest in the field of Neurology.

Course outcome:

At the end of the course, the students should be able to

CO1. Demonstrate basic skills in the clinical history taking and neurological examination along with documentation of detailed inpatient case sheets, sufficient skills in dealing with routine out-patient cases, planning investigations and course of treatment. (C,A,P)

CO2. Perform procedures like lumbar puncture independently and be able to assist with procedures related to tissue biopsies. Perform Electrophysiological procedures, including NCS, ENMG and EEG. Able to interpret CT & MRI scans (C,A,P)

CO3. Teach students effectively by using appropriate learning resources and teaching techniques. (A, C)

Course Contents:**RECENT ADVANCES IN NEUROLOGY:**

ADVANCES IN NEUROIMAGING TECHNIQUES, BIONICS IN NEURAL PROSTHESIS and REHABILITATION, NEUROPROTEOMICS and NEUROGENETICS, STEM CELL and GENE THERAPY
ADVANCES IN NEUROIMAGING TECHNIQUES:

1. Integration of CT, MR, SPECT, and PET images with each other and with EEG.
2. EVOKED potentials based brain maps in structural and functional localization in neurological phenomena and diseases.
3. DSA interpretation and diagnosis.

BIONICS IN NEURAL PROSTHESIS AND REHABILITATION:

Advanced techniques in neuro-rehabilitation such as TENS, principles of man-machine interphase devices in cord, nerve and plexus injuries, cochlear implants, artificial vision.

NEUROPROTEOMICS AND NEUROGENETICS:

Brain functions are regulated by proteomics and genomics linked to various proteins and genes relevant to the brain, body's maximum number of proteins and genes being expressed in brain as neurotransmitters or channel proteins and predisposing brain to a number of disorders of abnormal functioning of these proteins.

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STEM CELL AND GENE THERAPY:

Principles of ongoing experiments on stem cell therapy for nervous system disorders such as foetal brain tissue transplants in parkinsonism; intrathecal marrow transplants in MND, MS, Spinal trauma; myoblasts infusion therapy in dystrophies.

NEUROEPIDEMIOLOGICAL STUDIES AND CLINICAL TRIALS:

The students of the DM course will be trained in conducting sound Neuro-epidemiology studies on regionally and nationally important neurological conditions as well as on diseases of scientific and research interest to the department. They will also be trained in principles of clinical trials.



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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes					
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
DMCS04A Recent advances in Neurology	CO 1	3			3				3		3
	CO 2	2			3			1	3		3
	CO 3			3	3					2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution											

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Course Materials**Essential Books (Latest Editions)**

Sl.No	Title	Author
1	Neurology in Clinical Practice (volume 1 & 2)	Bradley W G, Daroff R B
2	Merritt's Textbook of Neurology	Rowland L .P
3	Pediatric Neurology Principles & Practice	Swaiman, Ashwal, Ferriero
4	Adams and Victor's Principles of Neurology	Ropper AH, Brown RH
5	Localization in Clinical Neurology	Brazis P W, Masdeu JC
6	De Jong's Neurological Examinations	William W, Campbell
7	Carpenter's Human Neuroanatomy	Andre Parent
8	Greenfield's Neuropathology (vol. 1&2)	Graham DI, Lanton P
9	Brain's Diseases of the Nervous system	Donaghy M

1. References (Latest Editions)

Sl.No	Title	Author
1	Current Therapy in Neurologic Disease	Johnson RT, Griffin J W
2	Text Book of Clinical Neurology	Goetz C G
3	Current practice of Clinical Electroencephalography	Ebersole J S, Pedley T A
4	Atlas and Classification of Electroencephalography	Luders H O, Hoachtar S
5	Epilepsy – A Comprehensive Textbook	Engel J, Pedley T A
6	Electrodiagnosis in Clinical Neurology	Aminof M A
7	Peripheral Neuropathy Vol I & II	Dyck P J, Thomas P K
8	Diabetic Neuropathy	Dyck P J, Thomas P K
9	Dementias	Mendez MF, Cummings JL
10	Stroke Pathophysiology, Diagnosis and Management	Barnett H J M
11	Caplan's Stroke: A Clinical Approach	Caplan L R
12	Disorders of Voluntary Muscles	Waston
13	Neurological Surgery	Youmans
14	Mechanism and Management of Headache	Lance J W, Goadsby PJ
15	Neurological Practice in Indian Perspective	N H Wadia

JOURNALS

1. Neurology
2. Journal of Neurological Sciences
3. Journal of Neurology, Neurosurgery and Psychiatry
4. Archives of Neurology
5. Clinical Neurology and Neurosurgery
6. Continuum
7. Lancet Neurology
8. JAMA Neurology

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9. Brain
10. Annals of Neurology
11. Stroke
12. Epilepsia
13. Muscle and Nerve
14. Clinical Neurophysiology
15. Acta Neurologica Scandinavica
16. Neurology India
17. Annals of Indian Academy of Neurology

REFERENCES SERIES

1. Handbook of Clinical Neurology – Vinken PT, Bruyn GW
2. Advances in Neurology (Raven Press)
3. Annual Review of Neurosciences
4. Neurology Clinics of North America
5. Year Book of Neurology and Neurosurgery
6. Butterworth's International Medical Reviews in Neurology

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