

**THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY,
No.69, Anna Salai, Guindy, Chennai – 600 032.**

**D.M/ M.Ch
SUPER SPECIALTY DEGREE COURSE**



SYLLABUS AND CURRICULUM

2021-2022

D.M. - NEONATOLOGY

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI
Syllabus – D.M. Neonatology

1. AIMS:

The term “Neonatology” includes diseases of the foetus and neonate including the maternal influences on the fetus and perinatal interventions.

The aim of the DM Programme is to provide advanced training in neonatology to produce competent super-specialists who are able to provide clinical care of the highest order to newborn infants, and serve as future teachers, trainers, researchers and leaders in the field of Neonatology.

2. OBJECTIVES:

After completing the DM (Neonatology) course, the student should be able to:

1. Analyse neonatal health problems scientifically, taking into account the biological basis as well as the epidemiology of perinatal-neonatal disease, and advise and implement strategies aimed at prevention of neonatal morbidity and mortality.
2. Provide primary, secondary and tertiary care to all newborn infants including intensive care of the highest standard to the critically sick and the very low birth weight neonates using advanced therapeutic and supportive modalities and skills.
3. Implement a comprehensive follow up and early intervention programme for the ‘at risk’ newborn infants, and plan, counsel and advise rehabilitation of the Neuro developmentally challenged infants.
4. Take rational decisions in the face of ethical dilemmas in neonatal- perinatal practice.
5. Exhibit communication skills of a high order and demonstrate compassionate attributes befitting a caring neonatologist.
6. Plan and carry out research in neonatal health in clinical, community and laboratory settings.
7. Teach newborn care to the medical and the nursing students as well as grassroots health functionaries, and develop learning resource materials for them.
8. Plan, establish and manage level II and level III neonatal units independently.

9. Use and maintain the essential neonatal equipment and keep abreast with advances in newborn care technology.
10. Organize newborn care in the community and at the secondary level of health system, and play the assigned role in the national programmes aimed at the health of mothers and their infants.
11. Work as a productive member of the interdisciplinary team consisting of Obstetricians, Paediatricians, Paediatric Surgeons, other doctors, nurses, and grassroots functionaries providing care to the pregnant mother, the fetus and the newborn in any setting of health care system.
12. Seek and analyse new literature and information on neonatology, update the concepts, and practise evidence-based neonatology.

3. THEORY SYLLABUS:

A) BASIC SCIENCES

- Basic genetics
- Foetal and neonatal immunology
- Mechanism of disease
- Applied Anatomy and Embryology
- Feto-placental Physiology
- Neonatal adaptation
- Development and maturation of lungs, respiratory control, lung functions, ventilation, gas exchange, ventilation perfusion.
- Physiology and development of cardiovascular system, developmental defects, physiology and hemodynamics of congenital heart disease.
- Fetal and intrauterine growth.
- Development and maturation of nervous system, cerebral blood flow, blood brain barrier.
- Fetal and neonatal endocrine physiology
- Developmental pharmacology
- Developmental hematology, bilirubin metabolism
- Renal physiology
- Physiology of gastrointestinal tract, digestion, absorption.
- Electrolyte balance
- Metabolic pathways pertaining to major and minor nutrients
- Biochemical basis of inborn errors of metabolism
-

-
-

GENERAL TOPICS

Research

methodology

- Biostatistics
- Review of evidence, evidence based care, critical appraisal of scientific material.
- Ethics in perinatology/neonatology
- Principles of education (objectives, curriculum, assessment and use of media)
- Computers, information technology, internet

C) PERINATOLOGY

- Perinatal and neonatal mortality, morbidity, epidemiology.
- High risk pregnancy: detection, monitoring and management.
- Fetal monitoring, clinical, electronic; invasive, and non-invasive
- Intrapartum monitoring and procedures
- Assessment of foetal risk, and decision for termination of pregnancy
- Diagnosis and management of foetal diseases
- Medical diseases affecting pregnancy and foetus, psychological and ethical considerations
- Foetal interventions.
- Foetal origin of adult disease

D) NEONATAL RESUSCITATION

E) NEONATAL VENTILATION

- Non invasive ventilation
- Basic modes of ventilation
- Advanced modes of ventilation including High frequency Ventilation
- ECMO (Extra Corporeal Membrane Oxygenation)
- Nitric Oxide Therapy

F) BLOOD GAS AND ACID BASE DISORDERS

G) NEONATAL ASSESSMENT AND FOLLOW UP

□

- Assessment of gestation, neonatal behaviour, neonatal reflexes.
- Developmental assessment, detection of neuro-motor delay, Early intervention/ Developmentally supportive care
- Immunization

H) BODY SYSTEMS

i) RESPIRATORY SYSTEM

- Neonatal airways: physiology, pathology; management
- Pulmonary diseases: Hyaline membrane disease, transient tachypnea, aspiration pneumonia, pulmonary air leak syndromes, pulmonary

haemorrhage.

- Developmental defects
- Oxygen therapy and its monitoring
- Pulmonary infections
- Miscellaneous pulmonary disorders.

ii) CARDIOVASCULAR SYSTEM

- Fetal circulation, transition from fetal to neonatal physiology
- Persistent Pulmonary Hypertension.
- Examination and interpretation of cardiovascular signs and symptoms
- Special tests and procedures (Echocardiography, angiography)
- Diagnosis and management of congenital heart diseases
- Rhythm disturbances
- Hypertension in neonates
- Shock: pathophysiology, monitoring, management.

iii) GASTROINTESTINAL SYSTEM

- Disorders of liver and biliary system.
- Bilirubin metabolism
- Neonatal jaundice: diagnosis,
monitoring, management, phototherapy, exchange transfusion.
- Prolonged hyperbilirubinemia
- Kernicterus
- Congenital malformations
- Necrotising enterocolitis

iv) NUTRITION

- Fetal nutrition
- Physiology of lactation
- Breast feeding
- Lactation management, breast milk banking, maternal
- Parenteral nutrition
- Vitamins and micronutrients in newborn health

v) RENAL SYSTEM

- Developmental disorders
- Renal functions
- Fluid and electrolyte management
- Acute renal failure (diagnosis, monitoring, management).

vi) ENDOCRINE AND METABOLISM

- Glucose metabolism, hypoglycemia, hyperglycemia
- Calcium disorders

- Magnesium disorders
 - Thyroid disorders
 - Adrenal disorders
 - Disorders of sexual differentiation
 - Inborn errors of metabolism
- vii) HEMATOLOGY
- Physiology
 - Anemia
 - Polycythemia
 - Bleeding and coagulation disorders
 - Rh hemolytic disease
 - Use of blood products
- viii) NEUROLOGY
- Clinical neurological assessment
 - EEG, ultrasonography, CT scan
 - Neonatal seizures
 - Intracranial hemorrhage
 - Brain imaging
 - Hypoxic ischemic encephalopathy
 - Neuro-muscular disorders
 - CNS malformation
 - Therapeutic Hypothermia and other Neuro modulatory therapies
- ix) SURGERY AND ORTHOPAEDICS
- Diagnosis of neonatal surgical conditions
 - Pre and post operative care
 - Neonatal anaesthesia
 - Metabolic changes during anaesthesia and surgery
 - Orthopaedic problems
- x) NEONATAL INFECTIONS
- Intrauterine infections
 - Superficial infections
 - Diarrhea
 - Sepsis/Meningitis
 - Osteomyelitis and septic arthritis
 - Pneumonias
 - Perinatal HIV
 - Miscellaneous infective disorders including HBV and fungal infections
- xi) NEONATAL IMAGING
- X-rays, ultrasound, MRI, CT Scan etc.

1. ULTRASOUND CONCEPTS AND TECHNIQUES

2D methods

M-mode methods

Doppler imaging

Continuous wave Doppler

Pulse- wave Doppler

Colour flow Doppler

Tissue Doppler Imaging (TDI)

Myocardial Strain (ϵ) and Strain Rate (SR) Imaging

2. BASIC NEONATAL ECHOCARDIOGRAPHIC WINDOWS

Echocardiographic Windows and Newborn Imaging

The Subcostal View

The Apical View

Long Axis Parasternal View

The short Axis View

High Parasternal view

Ductal View

Aortic arch view

Suprasternal View

3. ASSESSMENT OF MYOCARDIAL FUNCTION

Characteristics of the preterm circulation

The myocardial status of the preterm infant

Evaluation of Left Ventricular Output

Evaluation of Right Ventricular Output

Evaluation of Superior Vena Cava Flow

Evaluation of Shortening Fraction and VCFc

Measuring Simpson's Biplane ejection fraction

Diastolic Performance

Measurement of Tissue Doppler velocities

Myocardial Performance Index

Tricuspid Annular Plane Systolic Excursion

Fractional area change of the Right Ventricle

4. TnECHO STANDARD NEONATAL FUNCTIONAL PROTOCOL

5. ASSESSMENT OF PDA AND CLINICAL RELEVANCE

Assessment of PDA Diameter

Markers of Pulmonary overcirculation

Technique for LA:Ao and LVEDD

Technique for Mitral valve Parameters

Left Pulmonary Artery Technique

Assessment of pulmonary vein Doppler

Assessment of the Intra-Atrial Shunt

Markers of Systemic Hypoperfusion

Imaging of the Aorta

Celiac Artery Flow

Measurement of Middle cerebral artery Doppler

Determining Clinical Significance of a PDA

Assessing the need for PDA ligation

6. ASSESSMENT OF PULMONARY HEMODYNAMICS

Inferior Vena Cava View

Atrial View

RV Inflow: Tricuspid Valve Regurgitation

RV outflow

Short axis parasternal view

Four Chamber View

Mitral Valve & Pulmonary Vein Doppler

Ductal view

APPROACH TO THE ASSESSMENT OF PPHN PROTOCOL

OTHER POTENTIAL APPLICATIONS OF TnECHO

7. INDWELLING CATHETER EVALUATION

8. Neonatal Cranial Ultrasound

Normal cranial anatomy of the brain, including:

- Ventricular structure
- Anatomy of major sulcal patterns
- Thalamus
- Caudate nucleus
- Corpus callosum
- Cerebellum

9. Point of care ultra sound in Neonatal emergencies, including lung ultrasound

10. Neonatal Abdominal Ultrasound

Normal abdominal anatomy will be presented, including: Anatomy and relationships of major organs

Anatomy and relationships of IVC and abdominal aorta

xii) NEONATAL OPHTHALMOLOGY

- Developmental aspects
- Retinopathy of prematurity
- Sequelae of perinatal infections

xiii) Neonatal Dermatology

I) TRANSPORT OF NEONATES

J) NEONATAL PROCEDURES

K) DEVELOPMENTAL ASSESSMENT AND FOLLOW UP

L) ORGANIZATION OF NEONATAL CARE

- Principles of design of Neonatal Unit
- Organisation of Primary/Secondary and Tertiary level Neonatal care

M) CLINICAL GENETICS

- Pre-implantation and fetal diagnosis
- Principles of dysmorphology
- Diagnosis of Genetic disorders
- Management and Organization of follow up care of newborn with genetic defects.

N) COMMUNITY NEONATOLOGY

- Vital statistics, health system;
- Causes of neonatal, perinatal death
- Neonatal care priorities
- Care at secondary level of care
- Care at primary health centre
- Role of different health functionaries
- National programmes
- National Neonatology Forum

O) Bioethics

1. Respect human life and the dignity of every individual.
2. Refrain from supporting or committing crimes against humanity and condemn all such acts. Treat the sick and injured with competence and compassion and without prejudice and apply the knowledge and skills when needed.
3. Protect the privacy and confidentiality of those for whom we care and breach that confidence only when keeping it would seriously threaten their health and safety or that of others.
4. Work freely with colleagues to discover, develop, and promote advances in medicine and public health that ameliorate suffering and contribute to human well being.
5. Educate the public about present and future threats to the health of humanity.
6. Advocate for social, economic, educational and political changes that ameliorate suffering and contribute to human well being.
7. Teach and mentor those who follow us, for they are the future of our caring profession.

4. CLINICAL TRAINING:

The total period of DM course is 36 months. Of this, at least three fourths (27 months) will be spent in the newborn service, 6 months will be meant for essential rotations in related specialties and the rest 3 months will be apportioned for either optional rotations or for the newborn service.

Newborn services (27 months)

The candidates will have at least 27 months of posting in the newborn services at concerned institutions. The candidates must get adequate exposure to Neonatal follow up, neonatal emergencies, delivery room care of neonates and acquisition of practical skills and management strategies related to all levels of neonatal care

Essential Rotations (6 months)

The candidate must have mandatory adequate exposure in the following fields. The duration of posting in each department or service can be decided by the individual departments based on whether training can be given within the department itself or the candidate needs specified external posting.

The 6 months can be apportioned to the following postings:

- Community Neonatology
- Perinatology/ Obstetrics (Dept. of Obstetrics)
- Neonatal surgery (Dept of Pediatric Surgery)
- Perinatal Cardiology and functional echocardiography
- Ultrasonography and imaging
- Child development clinic/ Developmental Pediatrics

Optional rotations (3 months)

The candidates can undertake up to 2 months elective rotation at the parent or other institutions of higher repute.

During II year, students are encouraged to undergo special postings for learning new advanced techniques / Procedure / Skills in institutions of higher repute where the requisite facilities are available without affecting the duties of the parent department.

The departments will have the flexibility of additional rotations for up to 1 month in the above mentioned disciplines or in other relevant areas (such as neonatal Cardiac Surgery, Genetics, Perinatal-pathology, Anaesthesiology, Neonatal Ophthalmology, Research etc.) depending upon the strength of the disciplines and functional requirements at the concerned institutions. [Under no circumstances however, would the training in neonatal services be of less than 27 months i.e. three fourths of the total course.]

5. SKILL TRAINING REQUIREMENTS:

The DM Candidate has to acquire certain skills which are certifiable along with practical skills which are acquired during day to day training within the department. In order to ensure Uniformity in acquiring these skills, the Log book for DM Neonatology course will have the uniform configuration for all colleges within the university.

Year of study	Certifiable skills	Practical skills
I year	Mandatory: Neonatal Resuscitation Program (NRP) Basic Epidemiology/ Research Methodology Quality Improvement projects-with minimum 2 days Training	• Neonatal examination, anthropometry and developmental assessment • Neonatal resuscitation • Neonatal ventilation : CPAP, IMV; newer modes of ventilation • Blood sampling : Capillary, venous, arterial • Insertion of peripheral venous, umbilical venous and umbilical arterial catheters
II year	Mandatory: 1. Developmental assessment (DASII/BSID/Griffiths etc) 2. Neonatal Ventilation(Basic) 3. Neonatal Ventilation (Advanced) 4. Functional Echocardiography	• Insertion of central venous catheter • Monitoring : invasive, non-invasive • Enteral feeding (katori- spoon, gavage, breast) • Lactation management • Parenteral nutrition • Lumbar puncture and ventricular tap • Insertion of intercostal

		drainage tube • Exchange transfusion • Neonatal drug therapy • Nursery housekeeping routines and asepsis procedures • Universal precautions • Handling, effective utilization and trouble shooting of neonatal equipment. • Neonatal cranial Ultrasound ○ Obtaining coronal and sagittal cranial ultrasound windows via anterior fontanelle to demonstrate normal anatomical structures. ○ Recognising intracranial bleeding with competent assessment of subependymal, intraventricular and parenchymal bleeding. ○ Recognising common structural abnormalities of cerebral development. Performing and interpreting Doppler studies of the anterior and middle cerebral artery • Neonatal Abdominal ultrasound ○ IVC and abdominal aorta including umbilical catheter and PIC tip location ○ Ascites/pleural effusions ○ Locating and identifying the kidneys ○ Locating the bladder, and assessing relative volume.
III year	Optional certification: Lactation Management Enteral & Parenteral Nutrition Developmentally supportive care ECMO	• Organization of Multidisciplinary team and management • Communication with parents, families and communities • Teaching skills :lectures, tutorials • Participatory and small group learning skill • Principles of educational objectives, assessment and

	Therapeutic Hypothermia	media
	Neonatal EEG and Brain monitoring	• Preparing learning resource material • Understanding Ethical Dilemmas
	Brain Imaging	

6. TEACHING METHODOLOGY:

Learning in D.M. Neonatology will essentially be self-directed and will take place while working in various areas and through interactions in the rounds.

Following minimum formal sessions are recommended in order to facilitate and supplement the efforts of the faculty and students :

- Ward rounds – daily
- Developmental follow up clinics - twice a week
- Journal club (once in 2 weeks)
- Perinatal round (once in 2 weeks)
- Perinatal Mortality meet (once in a month)
- Seminar (once in 2 weeks)
- Clinical case discussion (once a week)
- Protocol Development or discussion (Once a month)
- Neonatal Surgery Rounds
- Neonatal Morbidity and mortality meet (once a month)
- Radiology rounds
- One Quality Improvement project
- In addition, depending on the strength of the institution, Imaging, Pathology, Microbiology, as well as interdepartmental Seminars may be undertaken.

7. RESEARCH WORK:

The candidate should be trained in the ability to

- Frame a research question.
- Plan a study to answer the question.
- Collect the relevant information and
- Evaluate appropriately the collected data to draw a conclusion.

The candidate should become conversant with the reporting of these results as a research paper, in journals and as a presentation in conferences.

Students should compulsorily attend Research methodology workshop conducted by the University within first six months of D.M. Course.

8. LOG BOOK:

The Postgraduate student of a Postgraduate Degree Course in Super specialties shall maintain Log Book of the work carried out by them and the training programme undergone during the period of training including details of surgical operations assisted or done independently by.

The Log Book shall be checked and assessed by the faculty members imparting the training.

Periodical evaluation of Log Book to be done by the Head of the Department as per 52nd SAB.

The Evaluation of the candidates in both theory and practical aspects will help the candidate in the improvement of his/her knowledge skills & attitude.

NOTE: Refer Annexure for Mandatory Requirements in Logbook

9. COMPETENCY ASSESSMENT

Overall:

1. Communication / Commitment / Contribution / Compassion towards patients and Innovation	-	10 Marks
2. Implementation of Newly learnt techniques	-	10 Marks
3. Documentation of case sheets / discharge Summary / Review	-	10 Marks
4. Number of cases presented in Clinical Meetings/ Journal Clubs / Seminars / Papers presented in Conference.	-	10 Marks
5. No. Of Medals/ Certificates won in the conference / Quiz competitions and other academic meetings with Details.	-	10 Marks
Total		50 Marks

Assessment	I	- February	-	First Year
	II	- August	-	First Year
	III	- February	-	Second Year
	IV	- August	-	Second Year
	V	- February	-	Third Year
	VI	- May	-	Third Year

VIVA INCLUDING COMPETENCY ASSESSMENT – 100 Marks (50+50)

10. THEORY EXAMINATION

Paper I Applied Basic Sciences as applied to Neonatology and Perinatology; Research Methods

Paper II Clinical Neonatology

Paper III Clinical Neonatology and Neonatal Intensive Care including Neonatal Transport

Paper IV Community Neonatology, National MCH Programmes, Allied disciplines, Neuro development follow up, Recent Advances, Rehabilitation etc.,

Each paper will contain:

1.	Essay questions (2)	-2 X 15	=	30 Marks
2.	Short Notes (10)	-10 X 7	=	70 Marks
Total				100 Marks

11. CLINICAL EXAMINATION:

Particulars	Time for candidate to examine the cases	Time for Examiners to question the candidate	Maximum Marks
Long case(1 patient)- Neonate receiving intensive care	45 minutes	45 Minutes	100
Short case I- Growing preterm	30 Minutes	30 Minutes	50
Short case II — Developmental follow up	45 minutes	30 minutes	50
Ward rounds (3 patients)	10 minutes each patient	10 minutes each patient	100
OSCE – 5 stations	3 minutes each station	15 minutes	50
Viva Voce		15 minutes	100
Log book			50
Total marks			500

As per Medical Council of India Post Graduate Medical Education Regulations 2000 (amended upto 10th August 2016) clause 13.9 A Postgraduate student of a Postgraduate degree Course in broad specialties/Super Specialties would be required to present one poster presentation, to read one paper at a National/State conference and to present one Research paper which should be published/accepted for publication/sent for publication during the period of his Postgraduate studies so as to make him eligible to appear at the Postgraduate Degree Examination.

Apart from Poster/Oral paper presentation in National/State conferences, the Research paper published by the candidate in the University Journal of Medical Sciences will be considered as equivalent to the Research Paper as mentioned in 13.9. clause. Case Reports can also be published in University Journal of Medical Sciences but case reports will not be considered as Research Paper.

The candidate can also present Research Paper as per Clause 13.9 of Post Graduate Education Regulation 2000, and if the article sent for publication by the candidate as primary author or corresponding author which has not yet been published/accepted for publication, the candidate should submit a letter from the HOD, stating that the article sent for publication is of publishable merit and the proof of the Research Article submitted to the Journal for publication should be sent to the university forwarded through the HOD.(As per 53rd SAB).

The student can submit articles for the University journal anytime from the time of registration till 6 months prior to theory examination.

12. OSCE: 5 Stations

The OSCE will constitute 5 stations:

(3 stations- Unmanned and 2 stations- Manned)

Station I : Imaging

Station II: Counselling and communication

Station III: Neurosonography and POCUS

Station IV: Investigations (ECG, BERA, EEG, ABG etc)

Station V: General Neonatology / BIOSTATISTICS.

13. REFERENCE BOOKS:

Avery's Neonatology

Rennie & Robertson's Text Book of Neonatology
Klaus & Fanaroff's Care of the high risk neonate
Avery's Diseases of the new born

Cloherly's Manual of neonatal care

Remington & Klein's Infectious diseases of the fetus and newborn infants -Neonatal heart disease- Robert M Freedom

The normal child - Illingworth

The development of the infants and young child - Illingworth

Polin and Fox- Fetal and neonatal physiology

Hematologic problems of the neonate- Robert D Christensen

Dubowitz's The neurological assessment of the preterm & full term new born infants- Fetal and neonatal neurology and neuro surgery- Levene

Echocardiography for the neonatologist- Jonnathan Skinner

Assisted ventilation of the neonate - Goldsmith

Neonatal respiratory disorders - Greenough

Smith's recognizable patterns of human malformation

Smith's recognizable patterns of human deformation

Care of the new born – Meherban Singh

Martin & Fanaroff 's Neonatal perinatal medicine. Questions & Controversies- Richard Polin ed.

Gastroentrology and nutrition neonatology

Nephrology and fluid electrolyte

physiologyThe new born lung

Hematology immunology and infection disease

Neurology

Cardiology

Neurology of the newborn – Joseph

VolpeNeonatal resuscitation text book -

AAP

Drugs in pregnancy and lactation – Gerald G Briggs

Physical diagnosis in neonatology – Mary Ann Fletcher

Moss & Adam's Heart disease in infants children & adolescents –Caffey's Pediatric diagnosis

Evidence based neonatal infections- David Isaacs

****Note:** The editions are as applicable and the latest editions shall be the part of the syllabi.

14. JOURNALS:

INTERNATIONAL

Journal of Perinatology

Journal of Perinatal

medicine Clinics in

Perinatology

Early human

development Neo

reviews

Seminar in fetal & neonatal medicine

Archives of diseases in childhood – Fetal & Neonatal edition

Neonatology

Neonatal

Network

Pediatrics

Journal of Pediatrics

NATIONAL

Journal of

Neonatology Indian

Pediatrics

Indian Journal of Pediatrics

ANNEXURE

Mandatory Requirements in Logbook

1. Logbook should include list of congenital heart disease transthoracic echocardiogram cases with various cardiac anomalies done by the candidate. The candidate should be able to diagnose:

- Atrioventricular discordance
- Arterioventricular discordance
- Left heart obstructions
- Right heart obstructions
- Patent duct
- Situs anomalies, isomerism
- Postoperative congenital heart disease
- Endocarditis
- Left Ventricular Hypertrophy
- Hypertrophic Cardiomyopathy
- Dilated Cardiomyopathy
- Right Heart Failure
- Pericardial Disease
- Mass / Thrombus
- Coronary anomalies
- Functional Echo Assessment
- Miscellaneous
- No significant cardiac abnormality

2. 10 signed (Direct Observation of Procedural Skills) DOPS should be included in the log book.

Each DOPS must be accompanied by the candidate's original written report of the case.

Each DOPS must include:

- The clinical indication
- Date of examination
- Written feedback on the performance of each procedure including advice on improvements/deficiencies
- Candidate and faculty signatures

3. To document ----- no. cases of Neurosonogram done by the candidate