



# लाल बहादुर शास्त्री पैरामेडिकल काउंसिल उत्तर प्रदेश

Head Office: 2<sup>nd</sup> Floor Sunil Complex Near RG PG College Meerut



*Syllabus*

*M.R.I. Technician*

*at the*

*LBSPC*

**Exam: June & December**

**(To be implemented from 2023-24 session)**

# **LAL BHADUR SHASTRI PARAMEDICAL COUNCIL**

## **DIPLOMA IN M.R.I. Technician**

**DURATION: 02 YEARS**

### **SYLLABUS**

#### **FIRST YEAR**

#### **TOPICS**

1. Anatomy
2. Radiological Anatomy
3. Physics of MRI
4. Indication and Contraindication of MRI
5. Radiation Hazards, Radiation Protection
6. Contrast-Media

#### **SECOND YEAR**

1. Anatomy
2. Radiological Anatomy
3. Indication and Contraindication of MRI
4. Pathologies as seen on MRI
5. MRI Physics
6. Non Ionic & Ionic Contrast
7. Contrast Reaction and its Management.
8. MRI Patient Positioning & Preparation
9. MRI Procedures
10. Radiation Hazards, Radiation Protection, Contrast-Media
11. 3T MRI, MR angio, MRCP
12. Recent Advances.

# Diploma in M.R.I. Technician

## FIRST YEAR (FIRST PAPER)

Paper	Duration of Study	Topics	Duration of Paper	Marks
I	300 hours		3 hrs.	100 marks
		<b>Anatomy</b>		
	225 hours	<p>Introduction to Anatomy, Physiology, Human body, Anatomical Posture, Descriptive Terms in Anatomy, Planes of body, Cells, Tissues, System, Membranes, Glands, Body fluid. Cartilages, Bones muscles, Skeletal System, Function of Skeleton, Classification of bones, Descriptive terms used in osteology, Joints of Skeleton / myology/orbit/pns/face/ neck</p> <p>Bones of Appendicular Skeleton. Bone of limb. Vertebra, Sacrum, Coccyx. Sternum, Ribs. Bones of skull, sutures of skull, Paranasal sinuses, Facial bones. Abdominal Regions, Solid organs of abdomen/ Excretory organs, G.I.T. The urinary system, Mediastinum, Heart, Aorta. Respiratory System. Reproductive System. Nervous System . hepatobiliary/ lymphatic /vascular system</p>		50 marks
	75 hrs.	<p><b>Radiological Anatomy</b></p> <p>MRI slices—axial coronal and sagittal sections of human body</p>		25 marks
		<b>Internal assessment</b>		25 marks

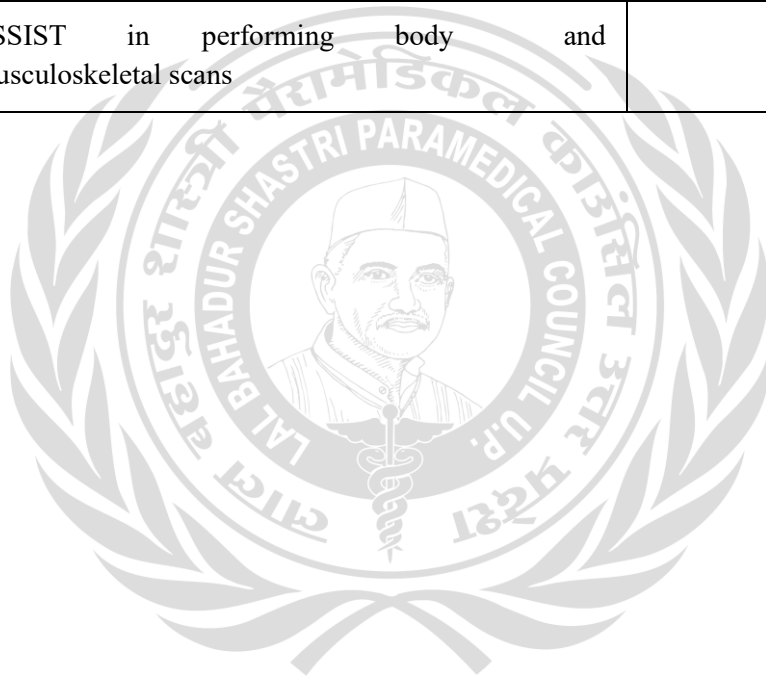
# Diploma in M.R.I. Technician

## FIRST YEAR (2<sup>nd</sup> PAPER)

Paper	Duration of Study	Topics	Duration of Paper	Marks
<b>II</b>	<b>300 hours</b>		<b>3 hrs</b>	<b>100 marks</b>
	30 hrs	<p>Basic Concepts- What is matter, anatomic structure, isotopes, ions specific gravity, temperature scales, electro, magnetic radiation.</p> <p>Electricity &amp; Magnetism- What is electrostatics, inverse square law, types of bonds, electrical field and electrical potential, electrification possible, conductors and insulators, electrostatics, static discharge. HISTORY AND DISCOVERY OF MRI/ NMR</p>		10 marks
	195 hrs	<p>PHYSICS OF MRI-</p> <ul style="list-style-type: none"> <li>• General overview</li> <li>• The concept of longitudinal magnetization</li> <li>• Larmor equation</li> <li>• The concept of transverse magnetization</li> <li>• Radio frequency pulses</li> <li>• The concept of t1 and t2 weighted images</li> <li>• Contrast enhanced MRI</li> <li>• MR Sequences</li> <li>• Fast imaging sequences Gradient fields and gradient coils</li> <li>• Summary of MR process Major components of an MRI</li> <li>• Magnets HELIUM SUPERCONDUCTION 1.5TESLA/3TESLA/8TESLA Self test</li> </ul>		40 marks
	75 hrs	Indications and Contraindication of MRI (Do's & Don't of MRI)		25 marks
		Internal assessment		25 marks

## PRACTICAL

	Duration of Study	Topics	Duration of Paper	Marks
II	600 hours		3 hrs	100 marks
		Patient Prerequisites, Patient Positioning, Patient Consent M.R.I Filming, Dark Room		25 marks
		Indication & Contraindication of MRI Contrast reaction management with IV Fluid: 02 /steroids etc.		25 marks
		Performing head and spine MRI		25 marks
		ASSIST in performing body and Musculoskeletal scans		25 marks



# Diploma in M.R.I. Technician

## SECOND YEAR (1<sup>ST</sup> PAPER)

Paper	Duration of Study	Topics	Duration of Paper	Marks
I	300 hours		3 hrs	100 marks
		<b>ANATOMY</b>		
	150 hrs	Nervous System (C.N.S., P.N.S., A.N.S.) Brain, Cerebrum, Basal Ganglia, Thalamus. Hypothalamus, Ventricles, CerebroSpinal Fluid and pathway, Brain Stem, Cerebellum, Spinal Cord. GIT Digestive System, Alimentary Tract, , Pharynx, Mesentery Oesophagus. Stomach, Small Intestine, Large Intestine, Salivary Glands FACE/ORBIT/PNS COURSE OF MAJOR VESSELS AND LYMPHATICS MAJOR NODES Neck and Larynx, Hepatobiliary Bones and muscles of limbs Circulatory System, Heart, Pulmonary Circulation, Systemic Circulation, Aorta. Respiratory System, Nose, Pharynx, Trachea, Bronchus, Lungs. Urinary System, Kidneys, Ureters, Urinary Bladder, Urethra.Orbit, Occipital Bone, Parietal Bone, Temporal Bone, Frontal Bone Frontal Bone, Sphenoid Bone, Ethmoid Bone, Vertebral Column,		35 marks
	90 hours	Slice Anatomy-Brain, Neck Thorax, Abdomen, Pituitary, Orbit, P.N.S., Limbs, Vertebra in C.T. Scan. Axial, Coronal & Saggital. Anatomy of Body--- Radiological Anatomy.		20 marks
	30 hours	MRI safety, Do's and don't's of MRI Indication and contraindication of MRI Non Ionic & Ionic Contrast NEGATIVE & POSITIVE CONTRAST Contrast Reaction and its Management.ROUTES OF CONTRAST		10 marks
	30 hours	Radiation Hazards and protection		10 marks
		Internal Assessment.		25 marks

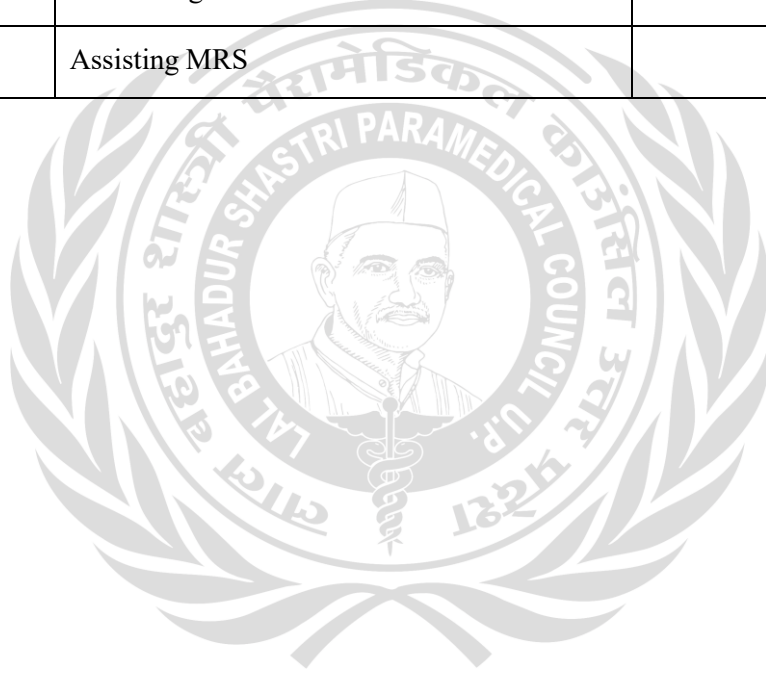
## Diploma in M.R.I. Technician

### SECOND YEAR ( 2<sup>nd</sup> PAPER )

Paper	Duration of Study	Topics	Duration of Paper	Marks
<b>II</b>	<b>300 hours</b>		<b>3 hrs</b>	<b>100 marks</b>
	120 hrs	<p><b>BASICS AND PHYSICS</b>  Magnetisation Properties, Types of Magnetic characteristics of the Nucleus, Nuclear Magnetic properties of the elements, Larmor Equation, Geometric Orientation. Resonance and excitation, Free induction decay: T2 Relaxation, Return of Equilibrium : T1 Relaxation, Comparison of T1 and T2. Angiography and magnetization transfer contrast, Time of flight (TOF)</p> <p><b>CONCEPTS</b>  Spin echo, Fast spin echo, Parts of MRI, Artifacts, Machine dependent artifacts, Motion artifacts, Motion artifacts, Chemical shift artifacts, Magnet, Resistive magnet, Superconductive magnet, Permanent Magnet, Safety and Bio-effects. Pulsesquences, Time of repetition and partial saturation-  (i) T1 Weighting (ii) Spin (proton density) weighting (iii) T2 weighting (iv) Inversion recovery (v) Short tau inversion recovery (STIR) (vi) Fluid attenuated Inversion recovery (FLAIR). Gradient recall echo (GRE), Perfusion weighted MRI, Diffusion weighted MRI, Magnetization transfer contrast. MRS, Tractography, DTI</p>		30 marks
	60 hrs	Patient preparation and positioning		15 marks
	75 hrs	Pathologies as seen on MRI		15 marks
	45 hrs	Recent Advances – 3T MRI, MR angio, MRCP, MRS, Tractography, DTI		15 marks
		Internal assessment		25 marks

## PRACTICAL

	<b>Duration of Study</b>	<b>Topics</b>	<b>Duration of Paper</b>	<b>Marks</b>
	<b>600 hours</b>		<b>3 hrs</b>	<b>100 marks</b>
		Pediatric MRI		10 marks
		Performing Contrast Head and spine MR		25 marks
		MRCP, MR angiography.		5 marks
		Performing body MR		25 marks
		Performing musculoskeletal MR		25 marks
		Assisting MRS		10 marks





## COURSE CONTENT OF Diploma in M.R.I. Technician

### (First year)

#### Paper-1<sup>st</sup>

S.NO.	COURSE CONTENT	NO. OF PERIODS (45 MINS EACH)	NO. OF HOURS
<b>I</b>	<b>ANATOMY</b>	<b>300</b>	
	Introduction to Anatomy	07	<b>225</b>
	Introduction to Physiology	03	
	Human body	07	
	Anatomical Posture	02	
	Descriptive Terms in Anatomy	05	
	Planes of body	03	
	Cells, Tissues, System, Membranes	03	
	Glands- incl endocrine, salivary	10	
	Body fluids –csf, lymph, blood etc	05	
	Myology – muscles of face,thorax,abdomen, limbs	10	
	Bones and muscles of body-	20	
	Lymphatic system	05	
	Skeletal system with Function of Skeleton	05	
	Classification of bones	02	
	Descriptive terms used in osteology	02	
	Joints of Skeleton	05	
	Bones of Appendicular Skeleton/ limbs	05	
	Vertebrae	04	
	Sacrum and coccyx	03	
	Pelvic bones and muscles	05	
	Sternum and ribs	02	
	Bones of orbit	04	
	Temporal bone	05	
	Bones of skull	04	
	sutures of skull	02	
	Paranasal sinuses & face	09	
	Abdominal regions	03	
	Solid and visceral organs of abdomen	20	

	Hepatobiliary system	10	
	Excretory organs	03	
	Digestive system	03	
	Mesentery and bowel	10	
	The urinary system-KUB	15	
	Mediastinum	04	
	Heart and aorta	05	
	Neck and larynx	10	
	Respiratory System incl pleura, bronchioles lung lobes & segment	20	
	Reproductive System	10	
	Nervous System with focus on brain, cord Meninges, ventricles, gray/white matter	30	
	Organs of special senses—tongue, nose, eye, ear	20	
<b>2</b>	<b>RADIOLOGICAL ANATOMY</b>	<b>100</b>	
	MRI slices—axial coronal and sagittal sections of BRAIN	20	
	MRI slices—axial coronal and sagittal sections Of ORBIT	05	
	MRI slices—axial coronal and sagittal sections Of PNS	05	
	MRI slices—axial coronal and sagittal sections Of NECK	10	
	MRI slices—axial coronal and sagittal sections Of THORAX	10	<b>75</b>
	MRI slices—axial coronal and sagittal sections Of ABDOMEN	10	
	MRI slices—axial coronal and sagittal sections Of PELVIS	10	
	MRI slices—axial coronal and sagittal sections Of LIMBS	10	
	MRI slices—axial coronal and sagittal sections Of HEPATOBILIARY SYSTEM	10	
	MRI slices—axial coronal and sagittal sections Of KUB	10	

## COURSE CONTENT OF Diploma in M.R.I. Technician

### (First year)

### Paper - 2<sup>nd</sup>

S.NO.	COURSE CONTENT	NO. OF PERIODS (45 MINS EACH)	NO. OF HOURS
<b>1</b>	<b>BASIC CONCEPTS, ELECTRICITY AND MAGNETISM</b>	<b>40</b>	
<b>A</b>	<b>BASIC CONCEPTS</b>		<b>30</b>
	What is matter.	02	
	anatomic structure	<b>02</b>	
	Isotopes, ions	<b>02</b>	
	specific gravity, temperature scales	<b>02</b>	
	heat, electro magnetic radiation.	<b>02</b>	
<b>B</b>	<b>ELECTRICITY AND MAGNETISM</b>		
	What is electrostatics, inverse square law, types of bonds,	<b>08</b>	
	electrical field and electrical potential, electrification possible,	<b>02</b>	
	conductors and insulators	<b>02</b>	
	electrostatics, electroscope, static discharge	<b>02</b>	
	<b>Basic principles of MRI</b>	<b>08</b>	
	<b>DISCOVERY OF NMR/MRI</b>	<b>08</b>	
<b>2</b>	<b>PHYSICS OF MRI</b>	<b>260</b>	
	General overview of MR PHYSICS	20	
	The concept of longitudinal magnetization	05	
	Larmour equation	10	
	The concept of transverse magnetization	05	
	Radio frequency pulses	10	
	The concept of t1 and t2 weighted images	20	
	Contrast enhanced MRI & GADOLINIUM	20	

	<b>MR Sequences</b>	35	<b>195</b>
	Fast imaging sequences	10	
	Gradient fields and gradient coils	10	
	Summary of MR process	10	
	Major components of an MRI	20	
	Magnets	10	
	self test	05	
	HELIUM / SUPERCONDUCTION &1.5TESLA,3TESLA 8TESLA MRI	20	
	SPIN ECHO	10	
	FAST SPIN ECHO	10	
	INVERSION RECOVERY	10	
	INSTALLATION OF MR MACHINE --- DO' & DONT'S	20	
<b>3.</b>	<b>Indications and Contraindication of MRI (Do's &amp; Don't of MRI) --- MRI SAFETY</b>	100	75 hrs

**PRACTICAL**

<b>S.NO.</b>	<b>PRACTICAL</b>	<b>NO. OF HOURS</b>
		<b>600 HRS</b>
	Patient prerequisites	20
	Patient positioning	100
	Patient consent	20
	MRI filming	50
	Dark Room	10
	Indication & contraindication of MRI	50
	Contrast reaction management with IV fluid, O2, steroids etc	50
	Performing head MRI scan	200
	ASSIST IN PERFORMING BODY AND MUSCULOSKELETAL SCANS	100

## COURSE CONTENT Of Diploma in M.R.I. Technician

### (Second year)

#### Paper - 1<sup>st</sup>

S.NO.	COURSE CONTENT	NO. OF PERIODS (45 MINS EACH)	NO. OF HOURS
<b>I</b>	<b>ANATOMY</b>	<b>200</b>	
	Introduction to Nervous System (C.N.S., P.N.S., A.N.S.)	05	<b>150</b>
	Brain	10	
	Cerebrum	05	
	Basal Ganglia	03	
	Thalamus	02	
	Hypothalamus	02	
	Ventricles	03	
	Cerebro Spinal Fluid and pathway	02	
	Brain Stem	03	
	Cerebellum	02	
	Spinal Cord	10	
	Digestive System & GIT	05	
	Visceral & solid organs of abdomen	10	
	Nasopharynx, oropharynx & pharyngeal spaces	05	
	Mesentery & peritoneum	03	
	Oesophagus	02	
	Stomach	03	
	Small Intestine	02	
	Large Intestine	02	
	Salivary Glands	03	
	diaphragm	02	
	Hepatobiliary	10	
	Bones and muscles of limbs	08	
	Introduction to Circulatory System	05	
	Heart	05	
	Pulmonary Circulation	02	
	Systemic Circulation	03	
	Aorta ,IVC with branches	02	
	Review of Respiratory System	02	
	Nose	03	
	Pharynx	02	
	Trachea	02	
	Bronchus & bronchioles	02	
	Lungs	03	
	Details of Genito Urinary System	03	
	Kidneys	05	
	Ureters	02	

	Urinary Bladder	03	
	Urethra	03	
	Orbit	05	
	FACE & PNS	05	
	ENT	05	
	Temporal Bone	03	
	Neck and larynx	05	
	Major nodes of body with classification	03	
	Basic course of major nerves, arteries,veinsAnd lymphatic channels	20	
<b>2</b>	<b>RADIOLOGICAL ANATOMY</b>	<b>120</b>	
	MRI slices—axial coronal and sagittal sections of BRAIN & SPINE	40	<b>90</b>
	MRI slices—axial coronal and sagittal sections Of ORBIT	05	
	MRI slices—axial coronal and sagittal sections Of PNS	05	
	MRI slices—axial coronal and sagittal sections Of NECK	10	
	MRI slices—axial coronal and sagittal sections Of THORAX	10	
	MRI slices—axial coronal and sagittal sectionsOf ABDOMEN	20	
	MRI slices—axial coronal and sagittal sections Of PELVIS	05	
	MRI slices—axial coronal and sagittal sections Of LIMBS	10	
	MRI slices—axial coronal and sagittal sections Of HEPATOBILIARY SYSTEM	10	
	MRI slices—axial coronal and sagittal sections Of KUB	05	
<b>3</b>	<b>MRI SAFETY</b>	<b>40</b>	<b>30</b>
	Do's & Don't of MRI	10	
	Indications and Contraindication of MRI	10	
	Ionic and non ionic contrast	05	
	Negative and positive contrast	05	
	Routes of contrast (IV, oral, rectal, vaginal)	05	
	Contrast reaction and its management	05	
<b>4</b>	<b>RADIATION</b>	<b>40</b>	<b>30</b>
	Radiation Hazards	20	
	Radiation Protection	20	

## COURSE CONTENT Of Diploma in M.R.I. Technician

### (Second year)

#### Paper - 2<sup>nd</sup>

S.NO.	COURSE CONTENT	NO. OF PERIODS (45 MINS EACH)	NO. OF HOURS
<b>1</b>	<b>BASICS, PHYSICS AND CONCEPTS OF MR</b>	<b>160</b>	<b>120</b>
<b>A</b>	<b>BASICS AND PHYSICS</b>		
	Magnetisation Properties	<b>05</b>	
	Types of Magnetic characteristics of the Nucleus	<b>05</b>	
	Nuclear Magnetic properties of the elements	<b>05</b>	
	Larmor Equation, Geometric Orientation	<b>10</b>	
	Resonance and excitation	<b>05</b>	
	Free induction decay: T2 Relaxation	<b>05</b>	
	Return of Equilibrium : T1 Relaxation	<b>05</b>	
	Comparison of T1 and T2.	<b>05</b>	
	Angiography and magnetization transfer contrast	<b>05</b>	
	Time of flight (TOF)	<b>05</b>	
<b>B</b>	<b>CONCEPTS:</b>		
	SPIN ECHO.	<b>05</b>	
	FAST SPIN ECHO	<b>05</b>	
	PARTS OF MRI MACHINE	<b>05</b>	
	Artifacts, Machine dependent artifacts, Motion artifacts, Motion artifacts, Chemical shift artifacts,	<b>10</b>	
	Magnet, Resistive magnet, Superconductive magnet, Permanent Magnet	<b>10</b>	
	Safety and Bio-effects. Pulse sequences	<b>15</b>	
	Time of repetition and partial saturation- (i) T1 Weighting (ii) Spin (proton density) weighting (iii) T2 weighting (iv) Inversion recovery (v) Short tau inversion recovery (STIR) (vi) Fluid attenuated Inversion recovery (FLAIR)	<b>20</b>	

	Gradient recall echo (GRE)	05	
	Perfusion weighted MRI	05	
	Diffusion weighted MRI	05	
	MR SPECTROSCOPY	10	
	MR TRACTOGRAPHY / DIFFUSION TENSOR IMAGING	10	
<b>2</b>	<b>PATIENT PREPARATION AND POSITIONING</b>	<b>80</b>	
	MRI Brain	15	60
	MRI Neck	02	
	MRI P.N.S	02	
	MRI Thorax	03	
	MRI Abdomen & MRCP	10	
	MRI of Spine.	10	
	MRI limbs	15	
	MRI Orbit	03	
	MRI JOINTS & MUSCULOSKELETAL	20	
<b>3.</b>	<b>PATHOLOGIES</b>	<b>100</b>	75
	Cranio Cerebral & body including musculoskeletal Trauma	10	
	Epidural / Subdural Haematoma	02	
	Subarachnoid Haemorrhage	03	
	Congenital brain lesions	05	
	Hydrocephalus	03	
	Stroke, Cerebral Infarction.	02	
	OVERVIEW OF Brain Tumours	05	
	COMMON Body Tumours---BENIGN & MALIGNANT	10	
	Pneumonia/pneumothorax/ pleural effusion	05	
	Spine- disc herniations, congenital lesions and spinal tumors	10	
	Tuberculosis—lung / bone /genito urinary/Brain/pleura /GIT	10	
	Carcinomas-----Hepatocellular carcinoma/,renal cell / bronhogenic, Gall bladder/ pancreatic head/ ub mass	5	
	Bone, Musculoskeletal tumors and avascular necrosis	10	
	Ring lesions in brain	05	
	COMMON Abdominal & Pelvic masses( inflammatory and malignant )	10	
	COMMON Vascular lesions	05	
<b>4</b>	<b>RECENT ADVANCES</b>	<b>60</b>	45
	1.5 TESLA/ 3TESLA / 8 TESLA MRI	20	
	MR ANGIO / M R C P /DIFFUSION/PERFUSION	20	
	MR SPECTROSCOPY	15	
	MR TRACTOGRAPHY	05	



## PRACTICAL

S.NO.	PRACTICAL	NO. OF HOURS
		<b>600 HRS</b>
	Pediatric MRI	20
	Performing Contrast HEAD MRI	150
	Performing Contrast SPINE MRI	150
	MRCP	20
	MR angiography	10
	Performing contrast body MRI	100
	Performing musculoskeletal MRI	100
	Assisting MR spectroscopy	50

