

**List of equipments for the department of Radiology**

Sl. No.	Name of Equipments
1	128 Slice C.T.
2	3.0 Tesla MRI
3	800mA X-ray remote control Radiography with IITV
4	Computerized Radiography system (CR)
5	High End Colour Doppler ultrasound equipment
6	Mobile DR X-ray system

MRI Specs 3.0 Tesla

Sl. No	Specification	Detailed Specification
1	Magnet	3 Tesla (superconducting) Magnet of 70 cm or more bore diameter with Multitransmit/Multidrive/TIM TX True shape or equivalent.
		<b>All vendor should quote their latest System with Maximum Number of Channels.</b>
	a) Field Strength	(i) Helium only 3 T (superconducting) Magnet along with Magnet Power supply Facility for quick shutdown of the magnet in case of emergency.
	b) Field Stability over time	(i) Should have active shielding, external interference shielding with good field stability. (ii) Mention the RF frequency of operation and the field drift.
	c) Homogeneity	(i) Best homogeneity possible should be given. Specify homogeneity in VRMS at 10 cm, 20 cm, 30 cm and 40 cm DSV and at max. FOV achievable with the quoted scanner. (ii) Should be very good for Single voxel and CSI spectroscopy. Specify values (iii) Please specify the homogeneity at 40 cm FOV. (guaranteed homogeneity). (iv) Automatic shimming in phantom. Please quote the shim value at 10x10x10 mm <sup>3</sup>
	d) Magnet Bore	(i) 70 cm or more magnet bore diameter, after positioning of gradient, shim and RF coils.
	e) Active Shielding/ Fringe field	(i) Quote values for 5 Gauss and 1 Gauss line.
	f) Ext. Shielding	(i) Ext. interference shield (sufficient to house the Magnet, Anaesthesia and physiologic monitors) should be provided
	g) Magnet Cooling System	(i) Specify the boil off rate
		(ii) Devices for helium level monitoring in the magnet should be supplied.
		(iii) Liquid helium should be supplied during warranty period and Comprehensive AMC.
		(iv) The vendor should include the Cold Head maintenance and replacement during warranty period and also during Comprehensive AMC.
	h) Shim System	(i) High performance and highly stable shim system with global

*Handwritten signature and date: 19/8/14*

		and localized manual and auto-shimming for high homogeneity magnetic field required for imaging (MRI / fMRI), single voxel spectroscopy (MRS), and spectroscopic imaging (MRSI). 3D shimming for volume imaging and CSI.
		(ii) Auto shim (global and voxel shim) should take minimum time to shim the magnet with patient in position (specify the time).
6		(iii) Specify number of shim coils including higher order.
		(i) Computer controlled subject table movement in vertical and horizontal direction.
2	a) Patient Table	(ii) The vendor should supply Dockable Table/ Table Top/ Table Top with dockable trolley for the main MRI patient table.
		(iii) Subject table should be able to take at least 140 Kg load.
		(iv) Emergency manual traction of the subject from the magnet.
	b) Patient monitoring	(i) Patient monitoring devices for ECG, respiratory, pulse rate, oxygen saturation, at the console etc. A comprehensive solution at patient side and at main console capable of gating the sequence protocols with respect to patient's heart (ECG) and respiratory rates. Remote display of gating signals on magnet and at console.
	c) Patient Comfort Features	(i) Two-way Patient communication with headphone, microphone and necessary accessories
		(ii) Patient audio alarm
		(iii) Lighting
		(iv) Music system (complete)
		(v) One MR compatible patient trolley (to transfer patient to the magnet table)
		(vi) One MR compatible wheel chair
		(vii) Closed circuit TV and CCD video camera for patient Monitoring
		(viii) Provide other standard patient comfort devices, with quoted system (please specify)
3	Gradient System	(i) Actively shielded gradient system in X, Y, Z planes.
	a) General	(ii) Minimum Gradient Strength should be 40 mT/m or more along each axis and a slew rate of 200 T/m/s in each axis.
		(iii) In case of dual gradient systems, please mention the details in each axis separately.
		(iv) Quote the minimum rise time at the maximum gradient strength offered. .
		(v) Quote the Slew rate at the maximum gradient strength

		(vi) Specify the linearity of the gradients at full FOV. (vii) 100% duty cycle for full FOV.
	b) Resolution Parameters	(i) Specify the minimum and maximum FOV achievable for the quoted MR system (preferable to have 5 - 450 mm FOV). (ii) Specify min. slice thickness in 2D and 3D modes at 128x128, 256x256, 512x512 and 1024x1024 matrices (quote higher matrix resolution, if available). (iii) The system should be capable of performing single shot EPI (in 64x64, 128x128, and 256 x 256 matrixes) including conventional and fluoroscopic imaging in the three orthogonal and also oblique planes. (iv) Effective cooling system for gradient coil and power supply, for uninterrupted operation during summers also. The system should have efficient and adequate provision for eddy current compensation.
4	RF Transmitter, Receiver, Coils a) RF Transmitter	The vendor should quote the latest RF transmit technology available with them globally, as per the datasheet. (i) A fully digital RF system capable of transmitting enough power (please quote the value) (as per FDA guidelins), and the operating frequency should cover 1H, and 31P nuclei (for multinuclear spectroscopy of 1H/31P) (ii) Specify max. transmitter RF power available (at 50Ω impedance)
	b) RF Receiver	(i) Optical/ Digital RF receiver system with/ high efficient RF receiver system / or its equivalent located on the magnet inside the shielded scan room (ii) Minimum 32 independent RF receiver channels or channel independent. Please provide the list of coils / coil-combinations that use this configuration (iii) Specify the RF receiver bandwidth for each channel. (iv) The system should have necessary hardware to support quadrature phased array and flex coils
	c) RF Transmit technology	(i) Latest RF transmit system (like Multi-transmit/ Multi Drive transmit system or its equivalent/Trueshape multi-transmit, etc) with at least two independent output channels should be offered to improve RF uniformity and signal homogeneity and to reduce patient induced in-homogeneities (ii) If the vendor has two RF amplifiers for producing better image quality/ features, the same should be quoted
	d) SAR limits	(i) SAR limits should be as per FDA guidelines for all protocols,

 19/8/14

e) Coils (in addition to the in-built body coil)	<p>including neuro/ abdominal imaging</p> <p>(i) The number of channels and number of elements for each coil should be the maximum that the vendor has in their product list. All coils (other than coils for exclusive spectroscopy, like surface coils) should be compatible for parallel acquisition. In case the vendor does not have or manufacture a particular coil, third party coil(s) can be provided. However, it is the responsibility of the vendor to provide necessary interface (both hardware and software) to make the coil work with appropriate RF sequences, etc</p> <p>(ii) Standard Head coil (15-channel or more)</p> <p>(iii) Head coil (32-channel or more) for EPI/DTI applications Compatible with fMRI projection device quoted with the system</p> <p>(iv) Neurovascular coil (20-channel or more) for neurovascular applications. If separate neck coil can work in combination with head coil, then the neck coil is to be quoted, and the vendor should make sure NV application is satisfied.</p> <p>(v) Spine array coil (12 Channel or more)</p> <p>(vi) Body array coil / Phased Array coil (32 Channel) If a single coil is not available with the vendor, then a combination of coils should be quoted (capable of single station Cardiac/ abdominal imaging), so that the resolution over 40 FOV is not compromised.</p> <p>(vii) Breast array coil (4 Channel or more)</p> <p>(viii) Shoulder array coil (8 Channel or more)</p> <p>(ix) Dedicated wrist coil (8 Channel or more)</p> <p>(x) Extremity coil (8 Channel or more)</p> <p>(xi) Knee imaging (Transmit/Receive 8 Channel or more)</p> <p>(xii) Peripheral angiography coil (32 Channel or more) for carrying out with high SNR and high spatial resolution.</p> <p>(xiii) Eye/ear coil</p> <p>(xiv) Endorectal coil (quantity-10)</p> <p>(xv) 31P surface coil for Heart/ Liver/calf muscle.</p> <p>(xvi) Carotid coil for plaque imaging</p> <p>(xvii) Flex coils in available sizes (minimum 2) for extremity Imaging</p>
f) Coil technology	<p>(i) Integrated coil technology, latest as available with the vendor to be quoted: Equivalent of TIM / GEM / DStream to be offered.</p>

CA  
19/8/14

	g) Table technology	(i) Bolus chasing with automatic / continuous moving table should be offered and should be available with fluoro triggered MR angiography for manual and fast switchover in less than 1 sec for CE-MRA.  (ii) Latest table technology available with the vendor (globally) should be offered.
5	Computer Control System	(i) The vendor should supply the latest computer system along with the MR system, to handle all the latest applications available on the MR platform. (ii) During the warranty period, any hardware updates that are launched globally should be supplied and installed.
	a) Host Computer and Array Processors	(i) Latest state-of-art computer system with sufficient RAM (8 GB or more) and computational speed to match the single shot Echo Planar Imaging (EPI), interactive angiogram, multi-planar three dimensional (3D) reconstruction, surface rendering and dynamic imaging, vascular imaging/angiography, and adequate storage for images and other applications.  (ii) Necessary image processor with sufficiently large RAM (iii) (4 GB or more) for ultra-fast image reconstruction, capable of performing real-time image reconstruction. (iv) Total hard disk memory capable of storing a minimum of 2,00,000 (two lakh) images  (v) Monitor 19" or more TFT monitor with enhanced graphics accelerator. (vi) One measurement (Main) console capable of data acquisition and all online calculations and Post processing  (vii) Licenses for acquisition post-processing and for special packages should be given explicitly, listing all the capabilities of the vendor's quoted product (basic standard package, premium packages, etc).

CA  
19/8/14

	(viii) The main console/workstation should have pulse sequence software license that may be required to modify and run pulse sequences. If this is not possible, the vendor should provide the necessary hard and software's necessary for such application (like laptop with system interface solution). Appropriate procedures (like research agreement) should be finalized before the installation of the equipment, so that there is no delay in operation of any requirement.
b) Additional workstation	<p>(i) One workstation with color TFT display (19" or more) with evaluation capabilities</p> <p>(ii) Separate licenses for all the post-processing (including special packages) should be provided for this workstation</p> <p>(iii) Specify clearly the algorithms that require extra license and list them whether these have been included or not.</p> <p>(iv) Filming also should be possible from this workstation.</p> <p>(v) The vendor should mention which are the post-processing capabilities that have been quoted with additional workstation.</p> <p>(vi) The vendor should mention which are the post-processing capabilities that are not quoted or not available with additional workstation.</p>
c) CD/DVD archival	<p>(i) DVD RW drive for writing of images, spectra and raw data along with the necessary software for reading the images and spectra on DVD/CD storing capabilities.</p> <p>(ii) Provision for archival of k-space data and raw (unprocessed) images.</p> <p>(iii) Protocol - Ethernet TCP/IP standards - based image transfer with DICOM 3.0 over standard Ethernet IEEE 903 (DICOM send, receive and DICOM query modes).</p> <p>(iii) The vendor should provide the connectivity with PACS, with the user departments in future.</p> <p>(iv) The network speed and cables should match the latest industry standards (eg. 10BaseT/100BaseT/1 GB)</p> <p>(i) Colour Laser Network Printer (PCL6/PS) for printing of colour CSI/ Perfusion/BOLD maps and images and film documentation on paper (minimum 24 ppm).</p>
f) Printer	

CA  
19/8/14

6	a) Data Acquisition	(i)	The system should be capable of 2D and 3D acquisitions in conventional, fast & ultra-fast spin echo and gradient echo modes so that real-time online images can be observed if needed. All the sequences that are available with the vendor at the time of quote/delivery should be provided as per their manual.
		(ii)	2D multi-slice imaging should be possible in all planes (axial, sagittal, coronal, oblique and double oblique)
		(iii)	Up to 1024 x 1024 matrix acquisitions preferred for all applications. Wherever 2048 matrix available, please mention.
		(iv)	Half Fourier or other techniques to reduce scan acquisition time while maintaining adequate SNR.
		(v)	3D volume, multiple contiguous slabs, multiple interleaved and multiple overlapping slabs
		(vi)	Slice thickness in 2D and partition in 3D to be freely selectable.
		(vii)	Dynamic acquisition (serial imaging) with capability to initiate scan sequences either from the magnet panel or from the console.
		(viii)	Dynamic acquisition: number of repeat scans with delay time either identical time interval or selectable
		(ix)	Auto-slice positioning from the localizer images.
		(x)	Maximum-off center positioning both anterior-posterior and lateral direction and should be selectable.
		(xi)	Gating: physiological signals like ECG, pulse, respiratory, External signal triggering (interface for triggering input pulse from external source). The provision should be available at the console also (for fMRI, EEG, etc).
		(xii)	Simultaneous acquisition, processing and display of image data in 2D multi-slice mode.
		(xiii)	Selection of voxels from oblique slices should be possible while doing spectroscopy.
		(xiv)	Artefact reduction/imaging enhancement / image filtering / image subtraction / addition / multiplication/division techniques:
		(xv)	Flow: 1st and 2nd order flow artifact compensation

 19/12/14



	(xvi)	Presentation slabs: a number of relocatable saturation bands to be placed either inside or outside the region of interest
	(xvii)	Graphic prescription.
	(xviii)	Fat saturation techniques: frequency selective RF pulses to suppress fat signals in the measured image FOV. ROI selective (regional) fat suppression should also be given.
	(xix)	Magnetization transfer saturation: Off resonance RF pulses to suppress signals from stationary tissue in FOV
	(xx)	Phase contrast capability in 2D and 3D mode.
	(xxi)	Image intensity correction
	(xxii)	Breath hold acquisition
	(xxiii)	EPI mode
	(xxiv)	DTI with MDDW or equivalent with a minimum of 12 and selectable up to 128 direction encoding
	(xxv)	Data acquisition in all three standard planes (axial, sagittal, coronal) and oblique and double oblique planes or more oblique planes.
	(xxvi)	Higher matrix acquisition capability in single shot EPI. Acquisition time, TR, TE and slice thickness should be clearly mentioned and supported by data sheet reference.
	(xxvii)	The vendor should offer multi coil acquisition in order to optimize throughput increase and increased effective FOV. Individual acquisition elements of every coil should be mentioned.
	(i)	All standard and special pulse sequences available at the time of quote/ delivery should be offered and quoted in the bid. If the vendor does not have any particular sequence/s but offers a work in progress (WIP) sequence/s, then it should be provided without any pre-condition like asking the Institute to sign any agreement for this purpose. This also applies to any post- processing software that is offered which is WIP.
	(ii)	The system should be capable of selecting TR and TEs as per requirement in majority of the pulse sequences.
	(iii)	Spin echo (SE): multi-slice single echo, multi-slice multi-echo (8 echo or more), SE with symmetrical and asymmetrical echo intervals and fast spin echo. MT-SE imaging sequence.
b) Imaging Pulse sequences		

  
19/8/14

	(iv) Inversion recovery (IR): including short TI modified IRSE, FLAIR, DIR (Double Inversion Recovery).
	(v) Gradient echo (GE): with transverse gradient/RF spoiling, and transverse gradient re-phasing, e.g., GRASE or equivalent etc. 3D gradient echo with shortest TR and TE, free choice of flip angle selection, while maintaining SNR.
Fast sequences	(i) Fast spin echo and GE sequences in 2D and 3D mode with T1, T2 and PD contrast capable of acquiring maximum number of slices with a given TR a minimum TE, echo train should be at least 128 or more in fast spin echo mode
	(ii) Half Fourier acquisition capabilities should be available with/without diffusion gradients and in combination with fast spin echo
	(iii) Fast inversion recovery with spin echo
	(iv) Fast gradient spin echo IR multi-slice multi-echo mode with maximum ETL. Sequences should incorporate RF focusing to acquire ultra-fast gradient spin echo.
	(v) Fast gradient echo sequence should incorporate RF spoiling and other technique to acquire images in ultra-fast 2D and 3D modes.
	(vi) Fat and water suppressed imaging sequences.
	(vii) EPI optimized sequences (with and without fat suppression)
	(viii) For T1, T2, PD imaging, perfusion, regular diffusion values (at least 5b, 3 directions) EPI-FLAIR, EPI-IR, EPI-FLAIR diffusion tensor, EPI-MT-FLAIR, tensor diffusion (at least 16 b values, and 128 directions) and diffusion studies. Suitable artefact/ fat suppression techniques to be incorporated in the sequence to have optimum image quality.
	(ix) There should be capability of calculating ADC map (isotropic and anisotropy from the regular diffusion and tensor data).
	(x) Optimized sequences for special applications.

  
 19/8/14

Optimized sequence Packages	Mention all available packages
c) Neuro	<ul style="list-style-type: none"> <li>(i) All T1 (2D, 3D), T2 (2D, 3D), IR (2D, 3D), Dual IR (2D, 3D) sequences</li> <li>(ii) Sequence for internal ear imaging for visualization of fine structures like cranial nerves (appropriate sequences like CISS, etc or equivalent). Mention the sequences provided.</li> <li>(iii) 3D sequences for internal auditory canal imaging</li> <li>(iv) Dynamic imaging of pituitary using appropriate sequence</li> <li>(v) Whole spine T1, T2, IR sequences</li> <li>(vi) Whole neuro examination with automatic planning, scanning and post-processing, with single localizer positioning, without changing the coils/ repositioning</li> </ul>
d) Angiography	<ul style="list-style-type: none"> <li>(i) MR angiography: 2D/3D TOF, 2D/3D Phase contrast (with and without gating) and magnetization transfer saturation, black blood angiography for cerebral, pulmonary, abdominal and peripheral vessels.</li> <li>(ii) For peripheral moving table angiography should be offered covering hip to limbs to be examined in one go with high resolution and high SNR.</li> <li>(iii) Bolus tracking software package.</li> <li>(iv) Sequences for breath hold angiography with contrast enhancement.</li> <li>(v) Sequences for time resolved angiography with contrast kinetics.</li> <li>(vi) ECG triggered non-contrast angiography</li> <li>(vii) Contrast bolus tracking (including single shot whole body MRA, interactive and automatic tracking, etc.).</li> <li>(viii) Perfusion study in organ systems like kidney, brain, heart etc. with T1 perfusion with permeability maps, and quantitation of rCBF/rCBV, MTT, etc, with color maps, quantitation of rCBF/ rCBV, MTT, etc, with color maps.</li> </ul>
e) Cardiac package	<ul style="list-style-type: none"> <li>(i) Full comprehensive cardiac sequences which includes, MR cardiology package for evaluation of heart in long and short axis with black blood cardiac imaging,</li> <li>(ii) Package for coronary artery imaging including sequences for motion compensation - prospective and retrospective gating, etc.</li> </ul>

CS  
19/8/14

	(iii) EPI based sequence for stress perfusion MRI including ability to adjust the cardiac phases required with increasing HR
	(iv) Myocardial tagging sequence
	(v) 2D and 3D Sequences enabled with delayed Enhancement
	(vi) 3D sequence of cine (bright blood & dark blood options)
	(vii) Rapid acquisition of heart using acceleration techniques
	(viii) STIR sequence for cardiac use
	(ix) 3D whole heart sequence (with & without contrast for coronary imaging)
	(x) Ability to acquire multiple arterial and venous phases on CE MRA.
	(xi) Quantitative flow analysis software
	(xii) 3D acquisition of whole heart in one breath-hold
	(xiii) 4D TRAK/ TRICKS-XV/ TWIST/ equivalent (with maximum FOV)
	(xiv) Provision for timing /Stop watch (MR compatible) for timing drug infusion
f) Diffusion/DTI	(i) Sequence package for diffusion including DTI (tractography) study in organs like brain, kidney, muscle, heart, spine, breast, prostate, etc.
	(ii) There should be capability of calculating ADC map (isotropic and anisotropic from the regular diffusion and tensor data).
	(iii) MR diffusion tensor imaging package with tractography
	(iv) MR neuro functional imaging sequence package (incl. Mosaic, etc)
g) Body imaging	(i) Flow quantification in vessels and CSF, hepatobiliary System
	(ii) Fly-through facility with Flow analysis including display of various velocity values.
	(iii) Optimized breath hold sequences for abdominal studies including angiogram.
	(iv) MR Cholangiography and Pancreatography: Specialized sequences and processing to perform MRCP.

CA  
19/8/14

		(v) Pulmonary 2D/3D MRA sequence, including single breath hold sequence.
		(vi) MR ventriculography, cisternography, myelography.
		(vii) Single sequence to acquire four different contrast (in-phase, out-of-phase water only, fat only). The same technique should be used in other sequences, for dynamic angiography/ T1 quantitative analyses.
		(viii) Parallel acquisition techniques including new sequences. Specify the technique used and the factor by which the acquisition time is reduced for similar acquisition with and without parallel imaging technique. Mention the sequences.
		(ix) Flow quantification packages for CSF with dynamic CSF flow imaging, aqueduct and spinal canal.
		(x) Radial/Spiral pulse sequences for ultrafast imaging.
		(xi) Suitable artefact/fat suppression techniques to be incorporated in all the sequences to have optimum image quality.
		(xii) A sequence for differentiation of fluid and cartilage in ortho applications (sequence like DESS or equivalent)
		(xiii) Susceptibility artefact correction techniques to be incorporated in all the sequences to have optimum image quality.
	h) SWI	(i) Sequences for susceptibility imaging
	i) Prostate imaging	(i) Sequences for imaging of prostate
	j) Breast imaging	(i) Sequences for imaging of breast (including sagittal bilateral breast imaging in a single acquisition)
	k) Motion correction	(i) Sequence for in-line motion correction for uncooperative patients/ children (with software and acquisition - sequences like BLADE, PROPELLAR, Multivane or equivalent)
		(ii) Sequence with ultra short TE
		(iii) Sequence for nullifying CSF pulsation artifacts
		(iv) Sequence enabling prospective motion correction in quick time and in real time during fMRI.
		(v) Sequence employing arterial spin labelling (ASL) Technique

CA  
19/8/14

		(vi) Whole body imaging (using body coil and surface coils)
		(vii) Whole body diffusion weighted imaging (using body coil and surface coils)
		(viii) Automated fusion and composing for the above two (without any artefacts)
		(ix) Volume acquisitions for neuro applications
	1) MR Spectroscopy	(i) System should have capability to perform multiplanar proton and phosphorous spectroscopy (31P)
		(ii) Proton MRS Sequence for single-voxel acquisition, with selectable fat/lipid saturation bands, options of water saturation (eg. VAPOR, CHESS, etc) with all post-processing software
		(iii) Proton Multi-voxel CSI [2-D and 3-D] acquisition and metabolite mapping with all necessary RF sequences (and post-processing algorithms) with all post-processing software
		(iv) If separate coils are needed for carrying out MRS, it should be provided.
		(v) Sequences for phosphorous single voxel and multi-voxel spectroscopy should be provided, with all post-processing software
		(vi) RF sequences for cardiac, prostate, breast, liver, musculoskeletal and brain (if there are any specialised/optimized sequence available, the same should be offered)- with all post-processing software
		(vii) Water and lipid suppression in automated sequences.
		(viii) The pulse sequences for 31P MRS and 1H MRS for liver, cardiac spectroscopy, etc. should have external gating provision with triggering bases on ECG/ Respiratory, with all post-processing software
		(ix) Please give details of spectroscopic packages offered and not offered (but available with the vendor).
7	Post Processing and evaluation	(i) Licences of all the post processing and evaluation packages should be provided for the main and additional console/ workstation

CA  
19/8/14

		(ii) Specify clearly number wise the algorithms that need licenses and a statement whether these have been provided in both the main console and the additional workstation (satellite console/ extended workspace).
Special Application Packages	(i) The vendor must provide their specialized and optimized imaging sequences with post-processing packages for a) Neuro (Smart exam/Ready Suite/ Smart Brain/ etc.), Body, Oncology, Cardiac (detailed in (j)), b) Cardio (including DSA approach, capturing arterial, capillary and venous phases in a single acquisition with a single bolus), c) Ortho and MSK, d) Liver (including 3D T1-Fatsat for dynamic liver imaging) e) Pediatric f) Breast g) Prostate h) Prostate i) Prostate j) Prostate	Smart Exam/ Smart Brain/ Ready Suite/equivalent technique should be quoted in all available imaging packages. Please list other applications available with the Vendor, which are part of standard or basic package.
i) MPR	(i) Multi-planar reconstruction (MPR) in any arbitrary plane including curved planes with freely selectable slice thickness and slice increments.	
	(ii) Surface Reconstruction and evaluation on reconstructed images with minimum time.	
	(iii) MIP in displaying in cine mode 2D and 3D mode, targeted / segmented MIP in any orthogonal axis with minimum processing time and capable of displaying in cine mode.	

CA  
14/8/14

j) Cardiac evaluation package	<p>(i) Full cardiac evaluation: Operator selective or automatic contour mapping and calculation of cardiac parameters like wall thickness, stroke volume, Ejection Fraction, filling rate, myocardial wall motion including display of data in table, graph and in cine mode, blood flow quantitation, velocity mapping, pressure gradient quantitation, shunt quantitation, regurgitation calculation, stenosis, blood flow, etc. These should be usable on main as well as on additional workstation/ satellite console.</p> <p>(ii) Semi- and fully quantitative analysis of myocardial Perfusion</p> <p>(iii) Quantification of myocardial scar vs total myocardium volume / mass on DE imaging</p> <p>(iv) Analysis of both RC and LV volumes mass and ejection fraction to be available separately; should be possible to do manually and in fully automated manner</p> <p>(v) Non contrast coronary angiography with single vessel approach/whole heart approach</p> <p>(vi) Sequences and post-processing for T1, T2 mapping</p> <p>(vii) T2* imaging with quantification</p>
k) ADC, perfusion, etc	<p>(i) Evaluation and display of diffusion images, ADC map, fMRI in reference of EPI optimized sequence.</p> <p>(ii) Perfusion image evaluation with time intensity graph and other statistical parameters</p>
	<p>(iii) Evaluation package for calculating rCBV, rCBF, MTT, perfusion map, corrected CBV calculation; Fusion of perfusion map with Contrast enhanced 3D T1 images etc. Mention the package/software offered with brochure.</p>
	<p>(iv) Flow quantification and evaluation for vascular (high &amp; low) CSF, bladder outlet and cine display.</p>
l) BOLD analysis	<p>(i) Evaluation of functional images of brain with appropriate statistical algorithms, colour display and overlay on base anatomical images.</p> <p>(ii) Software for evaluation of functional mapping [BOLD evaluation] and neuro-metabolite mapping.</p>

  
19/8/14



	m) VBM	(i) Voxel-based morphometry for segmentation and quantification
	n) Tractography	(i) Post-processing package for DTI and Tractography, estimation of ADC, FA (Lambda-parallel, perpendicular separately and combined), Fiber tracking, fiber statistics, and display of fiber tracks on anatomical image(s).
	o) Co-registration	(i) Superimposition on Neurotractography geometry and tensor diffusion field on both functional BOLD mapping and neurometabolite (CSI) mapping.
	p) Image statistics	(i) Measurement of distance, area, volume, angle, mean, SD, image addition, subtraction, multiplication, division, interpolation, segmentation, threshold, histogram.
		(ii) Image filtering and Image fusion software.
		(iii) Software for co-registering MRI/fMRI/MRS/Metabolite mapping images with images from CT, PET, and SPECT.
		(iv) Evaluation features like zoom, rotation, scroll, roaming, image synthesis, multi point T1 and T2 calculation (more than 8) window stretching, text dialogues graphics, sorting, searching, archiving, recalling etc.
	q) Spectroscopy	(i) Full post-processing for single-voxel MRS, CSI (multi-voxel MRS), metabolite mapping with colour coding (metabolic images), 31P MRS post-processing, etc., for brain, breast, prostate and for other applications.
		(ii) Post processing should include FFT, base line correction, curve optimization, automatic phase correction, metabolite imaging, spectral mapping, magnetic resonance spectroscopic imaging (molecular imaging) with naming and peak integral values for all in-vivo metabolites
8	Functional MRI accessories and post-processing	(i) Functional Imaging with package for BOLD imaging and processing package (capable of real-time processing and display of colour overlay (in real time) using 32-channel Head coil being supplied with the system.

19/8/14



		(xii) The entire fMRI hardware package should be from a single vendor for complete integrated solution (Vendors known to the users are: Esys - In Vivo, M/s. Philips, Nordic Neurolab Norway, Resonance Technology Inc. USA, or better).
		(xiii) Brain voyager post-processing software (along with permanent license)
<b>9</b>	<b>Quality assurance and Phantoms</b>	<p>(i) Phantoms for routine quality assurance for all coils (including body coil)</p> <p>(ii) Chemicals for spectroscopy phantoms for important short echo time neuro metabolites (NAA, Cho, Cr), breast (Cho, Cr) and prostate (Cho, Cr, Citrate, polyamines) with appropriate MR compatible phantom containers.</p> <p>(iii) Quality assurance as per AAMP standard for SNR for different coils and nuclei, spatial resolution, magnetic field inhomogeneity, eddy current compensation, RF power and inhomogeneity measurement. Specify the details of the QA package. It should be possible to provide the QA report quarterly to the Faculty-in-charge, MRI for records.</p>
<b>10</b>	<b>MRI PACS</b>	<p>(i) Picture storage and archival system, to store and retrieve MRI, fMRI and spectroscopic images and raw data. This should be from the same manufacturer as the quoted MRI system. It is mandatory for the vendor to submit a valid FDA approved DICOM compliance statement for supporting storage of all MRI SOP classes. The vendor should also submit DICOM conformance statement, as per the NEMA standards.</p> <p>(ii) The system should have DICOM 3.0 compliant interface and enabled for networking connectivity to Linux/ Windows based servers/ clients with Patient ID labelling and integration to generic Hospital Information System/ PACS.</p> <p>(i) The system should provide an access control mechanism that enables assignment of unique access privileges to individual users and user-groups to access or alter system resources and data.</p> <p>(ii) Retrieval of MRI data (along with header information) including the animal MR images</p>
	<b>b) Retrieval</b>	

CS  
19/8/14

	(iii) Retrieval of spectroscopic data from the PACS for processing using Vendor provided software in Console
	(iv) Integrity of the raw spectroscopic data (single voxel, multi-voxel CSI data) should be preserved, so that after retrieval of spectroscopic data from the PACS, processing should be possible using LC Model and jMRUI software
	(v) System should be possible to export images to removable media in a variety of formats (e.g., TIFF, GIF, DICOM, JPEG, other)
	(vi) Should support MR Spectroscopy Images storage as SOP class for raw data format
	(vii) Should support enhance MR color image storage
	(viii) Should have DVD writer facility for copying specific patient data on DVD/CD.
c) Networking (please read in conjunction with 5 (d))	(i) Vendor will make necessary modifications to connect to the existing 1.5 T and the new 3 Tesla MRI system (of the present tender) for the DICOM archival and Storage of MR Images and spectroscopic data
d) PACS Workstation hardware & features	(i) Workstation hardware and software should be industry standards, and should be the latest with the vendors, as per their globally launched product catalogue.
	(ii) The workstation should support the display of multiple images from one exam on one or more displays and possible to make flexible layout and compare layouts
	(iii) The workstation should provide a function that displays the status of image printers on the network, including the print queue
	(iv) The system should support the DICOM Print Service Class as a Service Class User (SCU)
	(v) Workstations support the DICOM query and retrieve SCU
	(vi) Workstation should retrieve MR Spectroscopy Images

CA  
19/8/14

		(vii) Should enhance MR color image storage
	e) Security & Reliability	(i) Should provide uptime guarantee of 95% or more. Necessary antivirus during the warrantee and CMC period should be provided, with regular updates.
	f) Radiology Information System	(i) Should offer three RIS software / Licenses for Registration, DICOM Worklist, integrated with offered PACS, with registration, sticker printing, scheduling and appointment modules, and corresponding hardware for RIS also should be included
	g) Scheduling & Appointment for Patient	(i) Module for scheduling and managing (ii) Modality, Exam Date and Time will be fixed during Scheduling the Exam (iii) Appointment letter with Patient instructions will be printed from RIS and given to Patient for OPD patients, Ward patients, Critical patients and VVIPs
		(iv) DWL licenses to plan, perform, and document examinations
		(v) Statistics of Exams, etc
	h) PACS Client	(i) Web Client concurrent Licenses - 5 (minimum) for access to the data from remote systems
11	Standard MRI Accessories	(i) Hand held metal detectors (2 Nos.) (ii) MR compatible (minimum 2000 Gauss line) cardiac and physiological monitor (ECG, NIBP, SPO2,) for neonates/ infants and adults (with all accessories for five years) (MedRad/In-vivo/better models) (iii) MR compatible (minimum 1000 Gauss line) syringe/infusion pump. (MedRad/MRidium/better models) (iv) MR Compatible Dual Pressure injector (minimum 2000 Gauss line) (MedRad/better models) (v) MR compatible anaesthesia machine (for Paediatric and adults use) with dual vaporisers (for isoflurane, halothane), and other accessories (minimum 1000 Gauss line). (Penlon/Leon/better models)

19/8/14

		(vi) Provision for external trigger (of the sequence) near the Console
		(vii) Provision for serial ports and DB15 ports in the penetration panel for routing SVGA/EEG connections (one each for customer use).
		(viii) Two quantity: Non-magnetic IV stand
		(ix) Two quantity: Digital Patient Weighing Scale (in the range between 0 to 200 kg)
		(x) MR compatible storage carts and wall mounted cabinets.
		(xi) Coil cabinets to be provided.
		(xii) Network cable and other required materials for the complete installation to be provided by the supplier
12	Antivirus s/w and Web updates	(i) All the Servers and Workstations in the network (MRI console, additional workstation, PACS workstation, fMRI workstation, etc) that is supplied by the vendor should be provided with antivirus software (periodically updated) for five years.
		(ii) The vendor should provide antivirus updates for five years and make sure of the updated antivirus every week (using automatic updates with internet facility by the vendor)
		(iii) The vendor should ensure that all the above modalities include necessary connection, image & work list send/receive, image & data storage, scheduling, patient registration, and synchronization functions as per DICOM standards for smooth and effective integration to RIS/PACS
13	Other accessories	(i) Ten Revolving chairs (Godrej Make) with ergonomic support
		(ii) Table for the MRI console, MRI additional console/workstation, fMRI workstation.
		(iii) Necessary Desk, chair and Rack for the PACS Server & Workstation to be provided by the supplier
		(iv) All the necessary interconnecting interfaces, cables, modules and other hardware and software to fully integrate the system for full operational status.

CS  
19/8/14

		(v) Uninterrupted power supply (UPS) with sufficient capacity (appropriate rating as required with a minimum of 200 KVA or more UPS) for 30 minutes back up of the full load MR system and its accessories during patient MR imaging.
		(vi) PACS system should be connected to the UPS (if a separate UPS is required for this purpose, this should be provided)
		(vii) Two (quantity) MR compatible oxygen cylinders (for the anaesthesia system)
		(viii) Good quality air curtain at MRI entrance (for patient entry), to filter the dust and prevent the leakage of a/c.
14	Training	(i) Advanced training to be provided by the vendor at the site for (ii) Training of two radiologists Faculty, Residents, students and Radiographers, so as to benefit (faculty members) in a reputed the latest applications available on the system. The training centre in India for two weeks.
15	Turn Key Installation	(i) The system should be installed and handed over in working condition, with all the necessary electrical, air-conditioning and civil works undertaken by the vendor in consultation with the user department. Some re-arrangement of the existing place including relocation of staff place may have to be carried out. (ii) All the necessary interconnecting interfaces, cables, modules and other hardware and software to fully integrate the system for full operational status. (iii) Installation and integration of the uninterrupted power supply (UPS), as quoted in 13(v) and (vi). (iv) Generator with sufficient capacity for operation of MRI (including powerful gradient sequence), accessories, air- conditioning, etc (minimum capacity should be 250 KVA), should be offered under buy-back (v) The turnkey items, UPS, Generator and other local items have to be quoted in Indian rupees only. (vi) Water/ Air chiller should be of good quality, with performance guaranteed during summer months also.

  
19/8/14

Civil works	(vii) Fire alarm (along with new/existing panel) should be provided in all rooms, wherever modification is being carried out, and in the rooms (in the MRI section), where there is no fire alarm. The vendor should discuss with the engineering section and the department before quoting for turn-key
	(ii) Ferromagnetic object detector and alarm (No door frame required), at the entry of MRI suite (Ferroguard/ Metrasens (United Kingdom) or equivalent)
Table technology	(iv) If the vendor has advanced table technology (like TIM-CT, etc), the same should be quoted as an option.
Data Acquisition and pulse sequences	(v) Any other special sequences that are available as a product (other than those mentioned in this section) should be offered as an option.
Optimized sequence Packages	(vi) If any optimised packages is not included in main bid, but available with the vendor, the same application packages should be quoted as Optional. Please list all available packages with the vendor.
	(vii) Please list of application packages that are available with the vendor, which are optional/premium/ advanced/ application suite/etc. If these are not listed in the tender, please quote the cost of each package separately (two-bid system).
	(viii) Any advanced organ specific imaging with automatic planning, scanning and post-processing application should be quoted.
	(ix) Rapid acquisition of heart using acceleration techniques

**Air Conditioning Works- Necessary adequate air conditioning units to be provided for proper functioning of MR.**  
**Computer for Report generation- Latest available CPU 2GB RAM, 100GB Hard disc**  
**19" high resolution Monitor—1no.**

**Laser Printer- Black & White**

**Medical Illuminator for viewing atleast four films of 17"X14" size- 4nos.**  
**Warranty for five years & CMC for five years after the expiry of warranty.**  
**Turn Key- Site preparation**





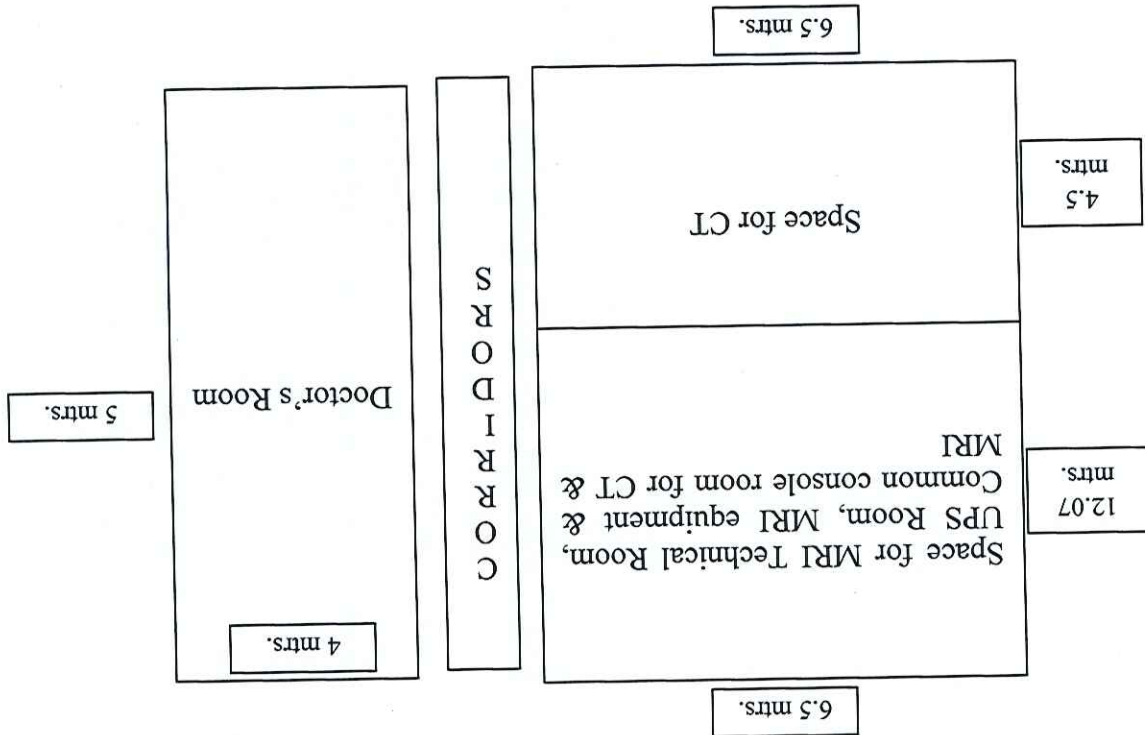
19/8/14

Note : - For details & any clarification please contact Professor & H.O.D, Department of Radiology, RIMS, Ranchi

- Doctor's Room
- Four desks ten chairs
- Two Desks
- CT Console – Four chair for CT console
- Two Desks
- MRI Console – Four Chair for MRI console

Furniture for Console Room

- Flooring
- Vitrified Tiles
- False Ceiling
- Aluminium channel with perforated boards
- Wall paints
- Acrylic paints



Layout of the rooms

TURNKEY PROJECT FOR MRI ROOM & DOCTOR'S ROOM

**Item No. 4 (b) Specification of Multi Slice CT scan : (128 Slice)**

1.1 The system should be lasted state of the art having independent 64 rows of detector with minimum acquisition of 128 slices per rotation with iterative Reconstruction Technique for Ultra Low Dose Imaging capable of integrating with any PACS/HIS DICOM Ready with true isotropic volume acquisition and sub millimeter resolution (Details of detector to be used must be mentioned)

**System should be AERB approved with CE Certification/USA FDA approval**

1.2	<b>GANTRY</b>	APETURE : 70 cms or more FOC : 50 cms or more Tilt : +/- 30 Deg. (30 degree)
2.2	<b>X-RAY GENERATOR</b>	High Frequency type Power out : 70 KW or higher KV Range : 90 KV or less – 130 KV or more mA range maximum 500mA or more at 120 KV
2.3	<b>X-RAY TUBE</b>	Tube Voltage : 90 KV or less – 130 KV or more Anode heat Storage Capacity of 7 MHU or more Mention head <u>dissipation</u>
2.4	<b>PATIENT TABLE</b>	Load carrying capacity minimum 150 Kg with 1mm positioning accuracy of less Horizontal table speed at least 100mm/sec Metal free scannable ragne of 150 cm or more Facility of positioning aid horizontal isocentric positioning of the patient Carbon Fibre Table Top
2.5	<b>SPRAL CT</b>	Scan time should be 0.4 second or less (Less scan time will be preferred) for full 360 degree rotation. Min slice thickness should be 0.625 mm or less

19/8/14

19/8/14

- C Slice increment – specify scan and selectable slice thickness
- D Mention pitch factor
- E Single continuous spiral scan time should be at least 100 sec or more
- F Bolus triggered or bolus chase spiral acquisition should be possible
- G ECG gating triggered
- 2.6 Real time CE fluoroscopy : at 6 to 8 frames per second with 18" color TFT/LCD monitor
- 2.7 IMAGE QUALITY
  - A Low contrast resolution – specify LC detectability at 3mm. Mention dose using 20cm CATPHAN phantom.
  - B High contrast resolution should be at least 21 lp/cm for axial and spiral at cut off.
- 2.8 DATA ACQUISITION SYSTEM
  - A Detector – capable of acquiring 128 slice per 360 degree of rotation.
  - B Minimum 64 rows of physically independent detector is required.
  - C Inbuilt pediatric protocols. Based on infant weight.
  - D Detector shall cover 40 mm per rotation for Standard & cardiac scan in 1:1 pitch.
- 2.9 IMAGE RECONSTRUCTION
  - A Real time construction speed specify
  - B Display Matrix : 1024 x 1024 or better
  - C Reconstructed slice thickness : 1mm-10mm freely selectable
  - D Scan field and reconstructed field : specify
- 2.10 MONITORS
  - 2 Nos of high resolution. TFT/LCD color monitors of 18" or more
- 2.11 OPERATOR CONSOLE
  - A Should perform registration. Scheduling, protocol selection, volume rendering volume measurements, multiplanar Reconstruction, and standard evolution application wand all available post processing functions, without the help of the satellite workstation.
  - B Raw data storage with at least 250 GB hard disc having image storing capacity of 4,00,000 or more in 512 x 512 format.

19/8/14

- A 2-D including image zoom and pan, image manipulation, including averaging, reversal of grey-scale values, and mirroring, image filter functions, including advanced smoothing algorithm and advanced bone correction.
- B Real-time multi-planar reconstruction (MPR) or secondary views, with viewing perspectives in all planes including curved and orthogonal MPR.

2.14 POST PROCESSING TOOLS

- i. Cardiac review with analysis functions such as ventricular motion, short axis/long axis view, central stenosis analysis, regional wall motion studies.
- ii. Coronary angio
- iii. Coronary tree extraction
- iv. One touch volume rendering of the whole heart.
- v. ECG gated dose modulation
- vi. Calcium and coronary angio reporting
- vii. Prospective ECG Getting cardiac scan

- G. Complete cardiac package with ECG gated studies (prospective and retrospective tagging) with
- F. Calcium Scoring software for coronary arteries

- E. MIP, Volume MIP, CT Angio software with quantitative vessel analysis, Virtual endoscopy software for visualization of vessels and air filled structures and Colonography software for virtual endoscopic, colon study, dental planning software and panoramic, Lung Nodule Assessment, Lung Nodule CAD, Colono CAD, Liver Analysis Software JOB SCAN/Shuttle scan for perfusion, Automatic Bone Removal, AVA analysis software.

- D. It shall be a high speed CUP with a speed of 3.0 GHz or better and with and independent Hard Disk storage capacity of 500 GM or more.
- C. The computer shall be the latest state of art Pentium processor working on Windows base platform or case of use
- B. It shall be independent fully and be DICOM 3.0 complaint for multi modality study review.

- A This should be a Remote Workstation with 2 nos of 18" LCT monitors for post processing, filming.
- 2.13 Workstation (From the Principal Vendor or from Tara Recon)

- 2.12 Company's own workstation shall be a high speed CPU with a speed of 3.0 GHz or better (with dual processor the combined speed will be counted) and with an independent Hard disc storage capacity of 500 GB or more, capable of simultaneous viewing of all post processing functions and filming independently without the help of main console. Memory of the workstation should be independent of the console. It should be 16 GB or more. Two way data transfer between the operator console and the satellite workstation should be standard.

19/8/14

- 2.21 System must be PACS interface ready without any new hardware or software.
- 2.20 Software of remote diagnostics service over a telephone line.
- C Option of viewing these discs on any PC without DICOM viewer should be available.
- B Archiving : CD / DVD & USP writer should be provided for archive. Provide 2000 CDRWS or 1000 DVDRWS.
- A Filming parallel to other activities, including independent scanning, documentation and post – processing and configurable image text.
- 2.19 ARCHIVAL**
- B Laser printer – Black & White
- A Latest available CPU with 2GB RAM, 100 GB Hard disk, 19" high resolution monitor & high resolution graphics card
- 2.18 COMPUTER FOR REPORT GENERATION**
- C More than 20 ppm
- B Resolution – at least 1200 x 1200 dpi
- A DICOM compliant
- 2.17 LASER COLOR PRINTER (PAPER)**
- C DICOM Compatible (attach conformance statement)
- B Support multiple film size : one of which must be 17" x 14"
- A Resolution 16 bits / 500 dpi or more.
- 2.16 DRY LASER IMAGER**
- An integrated intercom and automated patient instruction system (API) should be provided.
- 2.15 PATIENT COMMUNICATION SYSTEM**
- F Fusion of morphological data obtained on CT, MR of DSA
- E volume measurements
- D Spatial alignment and visualization of two different data sets of one patient generated on different modalities or with different acquisition time should be displayed on the workstation.
- C CT Angiography, MIP, Minp, SSD, VRT and other advanced 3D applications and color coding for different tissues.

19/8/14

The device should be mobile to be used only when needed for procedures.  
 System should assist the clinicians to deliver local anaesthesia to the patient before the procedure.  
 System should help the clinicians to plan and achieve required Trajectory and insertion depth to reach the target lesion.  
 System should also have the ability to limit patient movement while performing procedures.  
 System should also have to ability to limit patient movement while performing procedures.  
 System should have ability to assist the clinicians to tracking movements related to breathing while performing procedures.  
 System should deliver consistent accuracy to perform procedures on lesions at various depth, with angulated approach.  
 System should enable such procedures to be performed on the CT table.  
 The Device should be used without need for continuous radiation.  
 System should be useful to perform Diagnostic procedures Like Biopsy, FNAC and Therapeutic procedures like Ablations, Pain management under CT scanner guidance.  
 The Device should be used with any of the DICOM compatible CT scanners and should work as an offline device without need for continuous radiation.

**Specifications :**

**ROBOTIC TOOL FOR CT GUIDED INTERVENTIONAL PROCEDURE**

Optional Item

- 2.25 **DUAL HEAD PRESSURE INJECTOR** provide 200 nos. of 200 ml disposable sterile syringe sets.
- 2.24 **GENERAL ANESTHESIA MACHINE** with circle absorber, vaporizer for halothane & isoflurane and ventilator to provide.
- D Should have external peacemaker facility.
- C Disposable defibrillator pads – 10 Nos. with each machine should be provided.
- B The charging time of highest energy level should be less than 7 seconds.
- A Biphasic, latest model. With auto and manual mode. Minimum 50 manual selection upto 200 Joules.
- 2.23 **DEFIBRILLATOR**
- Portable and light weight non – invasive monitor preferably less than 10Kg. modular with 10.4 inch multi color TFT display, for monitoring parameters like ECG, respiration, NIBP, SaO2 and temperature with digital and 6 waves / traces display and 30 minutes or more battery backup.
- 2.22 **NON INVASIVE MONITOR**

19/8/14

1. Civil works includes Flooring, False ceiling etc.
2. Electrical Work includes all power points, lightings, earthings etc. as per the requirement of the total system.
3. AC requirement as per the total system.

**Scope of Turnkey Works : Area approximately 600 sq.ft.**

6. Training of Two Radiologist for Cardiac Application in a reputed Center in India for two weeks.
5. Comprehensive maintenance contract for five years shall cover all the accessories including CT Tube.
4. WARRANTY : 60 months from the date of satisfactory installation and handing over to the department. The warranty shall cover all the accessories including CT tube (No exception) as well as turnkey work.
- 3.7 Medical illuminator for viewing atleast four films of 17 x 14 sizes – 4 nos.
- Suitable servo controlled stabilizer / CVT as applicable.
- 3.6 Online UPS for suitable rating should be supplied for the complete system including Gantry, computer, system, anaesthesia delivery system, monitor and defibrillators with at least 30min backup
- 3.5 Lead Glass 100 cm x 150 cm of 2mm lead equivalence
- 3.4 Thyroid Guard
- 3.3 Light weight vinyl lead aprons of 0.5 mm lead equivalence – 05 nos.
- 3.2 Standard patient positioning accessories and restraining devices – 02 nos.
- 3.1 Collapsible wheel chair with rubberized swivel wheels – 02 nos.

**3 SYSTEM CONFIGURATION ACCESSORIES, SPARES AND CONSUMABLES**

The device should be compatible with any of the available biopsy/FNAC needles in the market and ablation electrodes – Thickness from 11G to 20G

The system should work in wide range of power (110V to 230V, 50 Hz), Temperature – 20 to 50 Deg and Humidity – 50 to 95 ph.

The device should have all required in built safety mechanisms for patient safety and address Sterility requirement.

Provision should be available to perform post procedure check scans with the needle/ Tools in place.

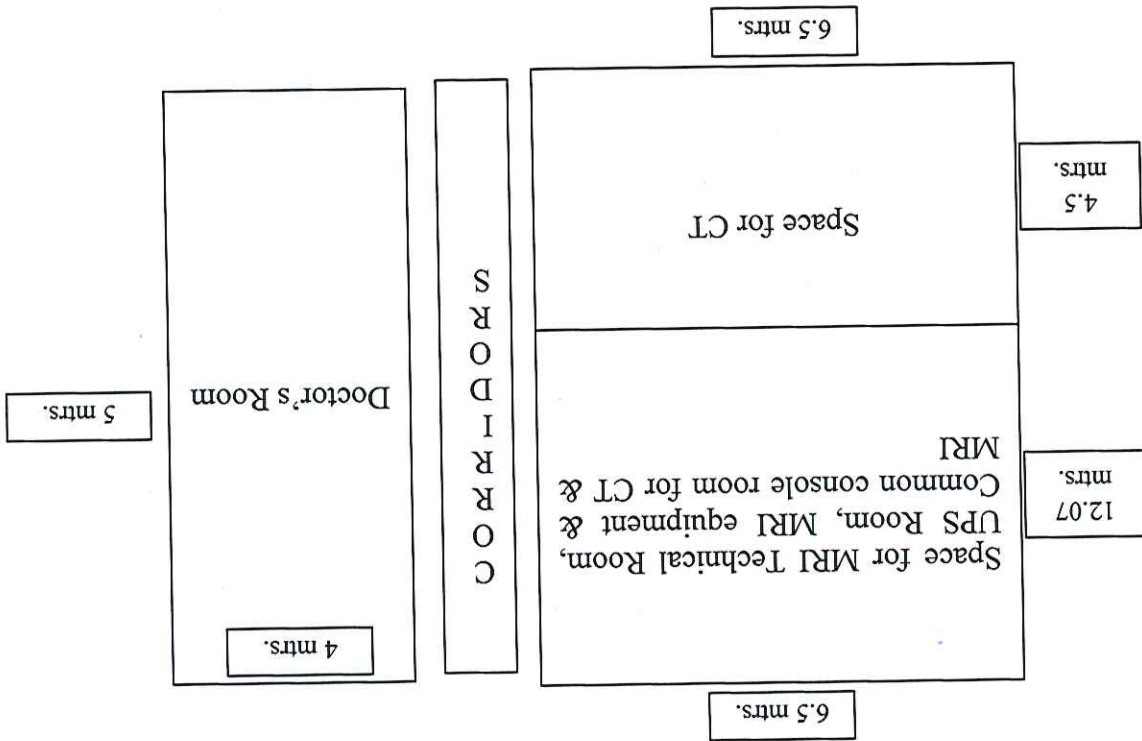
System should comply with the standards like CE

Procedure planning should be simple and PC based application

Planning software should be capable of displaying the planned tool path/ Trajectory before procedure for clinician's confirmation.

**TURNKEY PROJECT  
CT ROOM INCLUDING LEAD VIEWING GLASS IN COMMON CONSOLE ROOM**

**Layout of the rooms**



- Flooring - Vitrified Tiles
- False Ceiling - Aluminium channel with perforated boards
- Wall paints - Acrylic paints

**Furniture for Console Room**

- Two Desks - MRI Console – Four Chair for MRI console
- Two Desks - CT Console – Four chair for CT console
- Doctor's Room - Four desks ten chairs

Note : - For details & any clarification please contact Professor & H.O.D, Department of Radiology., RIMS, Ranchi

19/8/14



19/8/14

Processing Server and workstation with 2 nos 21" Monitor for Centralized patient Study Management with facility of processing raw image data of the CR Digitizer / reader

ii. Should have hospital information system (HIS) connectivity.

i. Window leveling, printer, rotating, flipping, panning, Zooming, Image post contrast

Remote for viewing of the images and should be separate module having following features

A) Viewing / Previewing with 21" Monitor CRT – 2 nos.

Patient cassette identification should be a separate module for being able to be kept at sdistance sway from Digitilazier /CR reader for identifying the IP cassette.

Patient cassette identification & terminals

- Cassette release time : please specify
- Storage size of image information : please specify

- Image plate resolution :
  - minimum 5 pixel / mm standard
  - upto 10 pixel/mm High resolution
  - 20 pixel / mm for mammography

- 35 x 43 cm (14 x 17") - 6
- 24 x 30 cm (14 x 11") - 6
- 18 x 24 cm (10 x 12") - 6
- 8 x 10" - 6

- Imaging plates/hour min. 70 (35 x 43) Cassette with imaging plates

## 2. Cassette reader unit

Automatic compensation of the under and overexposure – direct printing as well as printing digital communication of images possible dose indication included with images

## 1. General

State of the Art Latest Generation CR System for high resolution Radiography

Specification for CR System

Other feature should include image gray scale reversal, imaging flipping and rotating, image zooming, edge enhancement, Lattitude reduction, image noise reduction, gray scale saturation feedback.

#### **Main dry imager (for film Printing)**

The system should be supplied with Dry Imager/ DICOM imager with a spatial resolution of 500 PPI / DPI or more. It should have contrast resolution of 12 bits/pixel or more, it should have minimum three online film printing facility (selectable from following film sizes of 8" x 10" and 10" x 12", 11 x 14", 14" x 17") There should be no involvement of wet chemicals and should have standard multiple film sorter at the out put for sorting the films based on patient name and modality connected.

#### **Interconnectivity :**

Interconnectivity between various CR modules should be Ethernet based that is RJ45 connection (10/100 Base T)

#### **Scalability :**

The CR system should have scope of adding advanced quality control viewers, workstation, connectivity to any DICOM archive OR image management system (PACS)

#### **UPS :**

The equipment should be supplied with UPS of the required rating with at least 30 minutes back up for the whole system

#### **Airconditioner :**

Suitable adequate Air-conditioner to be supplied.

#### **Warranty :**

The warranty should be for a period of two years from the date of installation of equipment and cassette/ imaging plates. Imaging plates should have warranty of minimum 30000 exposures.  
Please also submit CMC charges for a period of 8 years after expiry of warranty.

#### **Training :**

Company has to provide on site operational training for radiographers and radiologist for at least seven days.

19/8/14

**Specification of High End Color Doppler System**

1.	The system must be top-of-the line, latest and state of the art with fully digital technology to incorporate the facility of 2D, M-Mode, M-mode, color Doppler, 2D/Doppler optimization, Adaptive Doppler/Color, Color power Angio and directional CPA, contrast imaging, PW Doppler, CW Doppler, Real time 3D (4D imaging), 2D Fetal echo, Elastography imaging, panoramic imaging
2.	System must have convex and cardiology transducer with either single crystal technology or purewave technology or matrix for excellent grayscale image quality on difficult to image patients.
3.	System should have dedicated presets for application- Abdominal, Obstetrics & Gynaecology, vascular, paediatric, small parts, MSK, fetal Echo, urology, TDC, interventional radiology
4.	System must be offered with a minimum 19 inch High resolution flat panel Medical grade display monitor with nearly infinite position adjustments.
5.	System must be offered with 4D imaging with quantification software for general imaging, and obstetrics & gynaecology applications
6.	System should have tomographic Ultrasound imaging quantification to analyze multiple parallel slice of a volume data set, Review of 3D/4D, color 3D data sets
7.	System should have at-least three imaging universal active probe ports with electronic switching facility.
8.	System should support multi-frequency/ broad band probes spanning a frequency of 2-16 MHz or even better.
9.	B mode & color mode should be available simultaneously side by side real time display. Digital zoom facility for region of interest in real time and frozen.
10.	Image storage facility on in build hard disc or CD/DVD-RW facility should be available. In built hard disk with capacity of 500 GB. System should have extensive image management capability including thumb nail review, Cineloop editing etc.
11.	Auto trace & automatic Doppler calculations should be available in Live & frozen images.
12.	Should have the state of the art Transmit Real time Compound Imaging Technology with Multiple transmitted lines of sight, wherein Multiple Coplanar images from different viewing angles are obtained and combined into a single compound image at real-time frame rates for improved visualization.
13.	System must be offered with speckle Reduction imaging technology to remove speckles and clutter artifacts

19/8/14

19/8/14

14.	System should be capable of scanning depth of 25cm
15.	System must be offered with a 2D frame rate of at-least 800 frames/second. Acquisition frame rate should be clearly mentioned in the technical quote.
16.	System must be offered with user friendly high resolution user interface touch panel (optional) or intuitive keyboard. User friendliness will be given priority.
17.	System should have THI & should be able to work in combined mode of harmonic imaging and real time compound imaging to get excellent image quality
18.	The system should be upgradable to Fusion imaging where CT/MRI/PET images can be fused in real time ultrasound images.
19.	The system should be quoted along Elastography imaging with quantification as standard. Vendors have to mention elastography technology detail (eSie touch/ARFI/strain/equivalent/ ASQ) in the technical quote.
20.	The system should be DICOM ready. System should be connect to the dry chemistry printer available in the department (CR/DR system). Should provide advanced DICOM connectivity to an enterprise data management system or PACS with advance DICOM features : DICOM store, Modality work list, Performed Procedure step and structured Reporting. Please specify the advance DICOM features available on the quoted system
21.	System should have inbuilt thermal printer
22.	Following probes to be quoted as standard
22.A	1-5 MHz Convex Transducer with $\pm 1$ MHz variation accepted for General Imaging, Renal, OB/GYN, abdominal imaging with capabilities of CEUS. Must have Tissue Harmonic Imaging. Transducer element technology to be mentioned (Hanfy lens/Matrix array/Single crystal/Pure Wave etc.)
22.B	4-12 MHz Linear Array Transducer with $\pm 1$ MHz variation for entirely covering frequency range accepted ; for Vascular, breast, Musculoskeletal, small parts, elastography imaging.
22.C	2-6 MHz Broadband Mechanical / motorized volume transducer with $\pm 1$ MHz variation accepted for General Imaging, Abdomen, Renal, OB/GYN imaging.
22.D	End fire sector, endo – cavitary transducer of 4 to 10 MHz extended operating frequency range with $\pm 1$ MHz variation accepted, single probe solution for trans – rectal and trans – vaginal application.
23	2 KVA online UPS with 15 minutes back-up from reputed manufacturer to be supplied along system

**Specification of 800mA X-ray R/F System with IITV (High frequency X-ray machine 800 mA R/F system with IITV)**

The X-ray equipment shall be the latest state-of-art Hi-frequency technology High-end Radio, fluoroscopy system capable of multipurpose diagnostic procedures like GI procedure, ERCP, Endoscopies, Novascular IVR, Urological and Orthopaedics examinations and all extremities. The system should consist of Patient table with X-ray system to IITV, SFT, over couch X-ray tube, control operation from remove control room as well as from table side etc. as an integrated configured system

**X-ray Table :**

Remote Controlled R/F X-ray table with full auto SFD

The Patient should be accessible from back and front of the table.

Motorized tilting facility +90/-30 degrees.

Motorized table elevation (up & down movement) of at least 25 cm vertical coverage.

Full coverage of patient anatomy should be possible without repositioning the patient

Imaging unit should travel at least 90 cm

Table should bear at least 130 kg weight

Mention tabletop lateral travel range

Table X-ray absorption should be low

Tube swing out 180 degrees should be three for Chest Radiography etc.

Motorized remote driven Compression cone to be there in the table.

**Spot Film Device**

Spot film device should be electronically controlled auto-sensing and displaying the cassette format and operation.

Grid ratio 12"1 with 60 lines / inch

Cassette format should be possible from 8" x 10" to 14" x 14", (8" x 10" to 14" x 17" format will be preferred) along with sub-divisional (upto 4 divisions) spot Radiography.

**X-ray Generator**

X-ray generator should be capable of handling minimum 65KW with automatic exposure of high contrast level of image quality.

It should be latest technology High-frequency inverter type with at least 50 KHz or more

Generator output voltage from 40 KV to 150 KV

Radiography mA – 800 mA or more and as low as 10 mA

14/8/14

Minimum time Radiography exposure should be 1m Sec. and maximum upto 10 sec  
Pulse fluoroscopy facility for X-ray dose reduction at least 15 fps  
Continuous fluoroscopy time up to 10 minutes with alarming buzzer

Fluoroscopy KV range should be up to 125 KV

Anatomical Program (ARP) setting and selection of minimum 50 numbers

### X-ray Tube

400 KHV tube is preferred

Tube leakage radiation should be low

Tube should be dual focus

AHU and focal sizes to be mentioned

### II and TV System

Minimum 9" CCD based Image Intensifier in under table position

Minimum 14" monitor for live and reference image viewing

Operator and Patient microphone communication with built-in Monitor speaker for operator.

System (offered model) must have CE certification / US FDA approval.

System must be AERB approved.

Features must be mentioned in the Catalogue of the offered model

Warranty for Five year (Non Exclusion) and CMC for Five years after expiry warranty

Company should have local service support.

### Scope of Turnkey

1. Preparation of operating console area

2. Air conditioning as per requirement of system & room size

19/8/14

**Specification for Mobile DR X-RAY System**

The Mobile Digital Radiography system should be Capable of taking All Emergency, Trauma care, Bed Side Digital X-Rays with Minimum Time Spent on Positioning and on Flat Panel Device.

**System Configuration:**

1. 32 kW Generator or better
2. Multi Leaf collimator
3. Mobile unit Capable of taking X-Ray Without 3 phase Power – Battery operated
4. Wireless 17"X14" cassette size FPD
5. PC with original Microsoft Software & DICOM Print/Store

- A. X-ray High Voltage Generator
- 32kW High voltage generator with inverter frequency of not less than 50 kHz.
  - Maximum output: 32kW or better
  - Radiographic kV range : 40 – 125 kV at 1kV step
  - Radiographic mA range: Not less than 400 mA@80KV
  - Radiographic mAs range: 0.32 - 320mAs at 12.5% steps
  - Anatomical program memory – user programmable at least 100programs

- B. Mobile Unit ( Battery Operated )
- LED readout for parameter display.
  - Microprocessor controlled
  - Error Code / Unit Status Display for safety of the unit

- C. Flat Panel Detector
- Should have a vertical Coverage of 200 cm or more
  - Arm Coverage of 100 cm or more on entire vertical coverage
  - Multi leaf collimator with a maximum field size of 43 x 43 cm at 100 cm SID.
  - Light switch with automatic switch off function
  - Positioning of Entire Mobile unit from Collimator side should be possible
  - X Ray tube rotation on horizontal axis  $\pm 180$  deg
  - The Arm should be capable of positioning +/- 270 degrees around the vertical Axis without Rotating the Unit ( Telescopic System only )
  - The Unit Height should be less than 6.5 feet
  - Width of the unit should be less than 65cm
  - Length of the unit including the Projections like tube if any should be less than 130cm
  - Should have provisions for keeping FPD Cassettes-size 14X17 inch.
  - Should have Detachable Grid 8:1, 51lines/cm
  - Should have provision for Hanging Lead Apron
  - Exposure Hand Switch and 15 inch Touch-screen LCD Display are needed

- D. X-Ray Tube
- Pixel resolution – 125 microns or better
  - Pixels – Not less than 2000 x 3000
  - Image size - automatic sizing up to 14 x 17"
  - 14 bit Acquisition
  - Preview image to be displayed in less than 4 sec after exposure
  - System software and image processing software should be included
  - Dicom Print and Dicom store should be included.
  - The digital system should be able to communicate with the X Ray Generator
  - Renowned brand PC – Pentium IV with 1 GB RAM (DDR), 80 GB HDD & CD-R/DVD combo drive, & Windows XP Pro O/S.

- E. Others
- Rotating anode tube
  - Anode heat capacity – not less than 150 KHU
  - Focal spot size – 0.7 or less / 1.5mm
  - System should have AERB approval
  - CE/FDA
  - Supply to Govt. Institution more than One unit in last 5 Years

19/8/14