JKMSCL

JAMMU AND KASHMIR MEDICAL SUPPLIES CORPORATION LTD.

(Public Sector Undertaking of the Government of Jammu and Kashmir)
Corporate Head Office: **Corporate Head Office**: Plot No. 58, Friends Colony Satyam Road Trikuta Nagar Jammu
Corporate Office: Kashmir, Near Haj House, Bemina 190018, Srinagar
email: jkmscljepm@gmail.com; **website**: www.jkmsclbuisness.com

CORRIGENDUM

In light of the representation(s) submitted by the prospective bidder(s) thereof, for the finalization of Rate Contract for the **"Procurement of 3 Tesla MRI Machine under Group Machinery & Equipment" uploaded vide No. Mach/2024/628 dated 21.10.2024** the amendments in the technical bid as recommended by the technical experts from GMC Jammu are annexed as **Annexure (20 Pages).** The critical dates are extended with the approval of tender inviting authority.

The critical dates are as under:

1. Last date and time for submission of online bids: 23.12.2024 upto 1600 hrs
2. Date and time for online opening of technical bids: 24.12.2024 at 1100 hrs

Please Note:

1. *Those firms/bidders who have already uploaded their bids are required to re-upload their bids as per amendments and corrigendum issued thereof.*
2. All the bidders are requested to keep themselves updated & submit their e-bids through e-portal as per specifications & BOQs. The amendments/modifications shall be available on e-Portal and www.jkmsclbusiness.com.

10.12.24

(Mohd. Ashraf Choudhary) JKAS
General Manager (Adm), JKMSCL

No.: JKMSCL/Corg/2024/8953-54 Dated: 10.12.2024.

Copy for information to the:-

1. General Manager-(P&S), JKMSCL.
2. P.A to Managing Director, JKMSCL for the information of Managing Director.
3. File

DR Vipan Magotra
MBBS, MD
Professor & Head

PG Department of Radio-diagnosis
& Imaging GMC Hospital Jammu

To

The Managing Director
JKMSCL
Plot No. 58, Friends Colony Satyam Road, Trikuta Nagar,
Jammu.

No: Rad/2024/928 Dated: 09.12.2024

Subject: Tender Specification for 3 Tesla MRI 32 Channel Tender No. NIT/JKMSCL/ME/2024.

Sir,

Kindly find enclosed Tender Specifications for 3 Tesla MRI (32 Channel) along with accessories and other requirements including turnkey and attached annexures 1 to 3 (total 20 Pages) formulated by the Technical Experts from the department of Radiodiagnosis GMC Jammu.

(Dr. Vipan Magotra)
Professor & Head
Deptt. of Radiodiagnosis & Imaging
GMCH Jammu

Technical Specifications:

Technical Specifications for 3 Tesla-Magnetic Resonance Imaging (MRI) System:

Technical Specifications.

The manufacturer/bidder must quote the latest state of the art 3 Tesla MR System or better as per the specifications below.

- The quoted model must be launched year 2020 onwards.
- The offered model should be USFDA approved (authentic and legible certificate for the same to be annexed).
- Also, the vendor will guarantee that the system supplied is not refurbished and The MR system quoted is the latest best available model in the segment (3T MR Scanner with 70 cm or more bore) quoted, at the time of delivery and should submit an undertaken in this regard.

S.No.	Features	Essential Specifications
1.	Magnet	3.0 Tesla (superconducting) magnet with approximately 70 cm or more bore diameter. The magnet should have display for information on coil connectivity, physiological curves, start scan. Switching off alarms, automatic transfer from different positions.
	a) Field Strength	Helium only 3.0 T (superconducting) magnet along with facility for quick shutdown of the magnet in case of emergency.
	b) Field Stability over time	1) Should have active shielding, external interference shielding with good field stability. 2) Mention the RF frequency of operation and the field drift.
	c) Homogeneity	1) Guaranteed homogeneity of magnet by VRMS method 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 quote scanner. 2) Should be very good for single voxel and CSI spectroscopy, specify values.
	d) Magnet Bore	1) 70 cm or more magnets bore diameter, after positioning of gradient, shim and RF cons.
	e) Active Shielding Fringe field	1) Quote values for 5 Gauss and 1 Gauss line.
	f) Ext. Shielding	Ext. interference shield (sufficient to house the magnet, Anaesthesia and physiological monitors should be provided.
	g) Magnet Cooling System	1) The magnet should be having zero boil off rate. 2) Devices for helium level monitoring in the magnet should be supplied. 3) Liquid helium should be supplied during warranty period and comprehensive AMC. 4) The vendor should include the cold head maintenance and replacement during warranty period and also during comprehensive AMC.
	h) Shim System	1) High performance and highly stable shim system with global and localised manual and auto shimming for high homogeneity magnetic field required for imaging. (MRI/MRI), single voxel spectroscopy (MRS), and spectroscopic imaging (MRSI). 3D shimming for volume imaging and CSI.

Dr Vikrant Gupta
Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Dr Manik Mahajan
Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College

Dr Ishan
Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College

Associate Professo
Deptt. of Radio Diagn
Govt. Medical Colle
Jammu

		2) Auto shim (global and voxel shim) should take minimum time to shim the magnet with patient in position (specify the time). 3) 2nd order/High order shim should be offered as standard & specify number of shim coils including high order.
2.	Patient Table	1) Computer controlled subject table movement in vertical and horizontal direction. 2) The vendor should supply fully motorized computer controlled table, with movements in vertical and horizontal directions for the main MRT patient table. 3) Subject table should be able to take at least 140 kg load. 4) Emergency manual transaction of the subject from the magnet.
	Patient monitoring	1) Patient monitoring devices for ECG, Respiratory, pulse rate, oxygen saturation, ETCO2 at the console etc. A comprehensive solution at patient side and at main console capable of gating the sequence protocols with respect to patients heart (ECG) and respiratory rates.
	Patient comfort features	1) Two-way patient communication with headphone, microphone and necessary accessories. 2) Patient audio alarm 3) Lightning 4) MR compatible Music System (complete) should be able to play inside the gantry 5) One MR compatible patient trolley (to transfer patient to the magnet table) 6) One MR compatible wheel chair 7) Closed circuit TV and CCD video camera for patient monitoring 8) Provide other standard patient comfort devices, with quoted system (please specify)
3.	Gradient System a) General	1) Actively shielded gradient system in X,Y,Z planes. 2) Gradient strength should be actual 44Mt/M or more along each axis and an actual slew rate of 200 T/M/s in each axis. Both Slew rate and peak amplitude should be achieved simultaneously. The system should have 32 independent RF receiver channels/channel independent (which can be demonstrated). 3) Quote the slew rate at the maximum gradient strength. 4) Specify the linearity of the Gradient at full FOV. 5) 100% duty cycle for full FOV.
	b) Resolution Parameters	1) Specify the minimum and maximum FOV achievable for the quoted MR system foreseeable to have 10-500mm. FOV. 2) Specify min. Slice thickness in 2D & 3D modes at 128×128. 256×256. 512×512 1024×1024 matrices. 3) The system should be capable of performing single shot EPI (in 64×64, 128×128, & 256×256 matrices) including conventional and fluoroscopic imaging in the three orthogonal and also oblique planes.

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		4) 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	The vendor should quote the latest RF transmit technology available with them globally, as per the datasheet.
	a) RF Transmitter	1) A fully digital RF system capable of transmitting enough power (please quote the value) (as per FDA guidelines), and the operating frequency should cover 1H, & 31P nuclei (for multinuclear spectroscopy of 1 H/31P). 2) Specify max. Transmitter RF power available (at 50 ohm impedance).
	b) RF Receiver	1) Optical/Digital RF receiver system with/high efficient RF Receiver system/or its equivalent located on the magnet inside the shielded active room.
		RF Receiver 1) System should have 32 independent RF receiver channels/Channel Independent (which can be demonstrated) 2) Specify the RF receiver bandwidth for each channel 3) The system should have necessary hardware to support Quadrature phased array and flex coils.
	c) RF Transmit Technology	1) Latest RF transmit system (like Multi-transmit/Multi Drive transmit system/True form with at least 2 independent output channels/ports should be offered to improve B1 uniformity and signal homogeneity and to reduce patient induced in homogeneities.
	d) SAR Limits	1) SAR Limits should be as per FDA guidelines for all protocols, including neuro/abdominal imaging.
	e) Coils	1) 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 to 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. RF Transmitter, Receiver coils 2) Head coil (32 channels or more for high resolution brain, brachial plexus, nerve imaging, EPI/DTI applications, compatible with FMRI projection device quoted with the system. 3) Separate coil for head neck at least 32 channels or more for routine brain/Neurovascular exams should also be quoted as standard. A built in shim system in the head coil for improved imaging would be preferred. 4) Spine array coil (32 channel or more)

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		5) Body array coil/phased Array coil with at least 32 channel imaging for Z-axis FOV of at least 45 cms in combination with spine and single or combination of anterior coils. 6) Dedicated shoulder array coil (16 channel); If a dedicated coil is not available with the vendor, then the vendor has to quote equivalent coil (for eg. If flex coil is offered, then the number should be in addition to the previously quoted coil) 7) Dedicated wrist coil (16 channel) 8) Dedicated knee imaging Transmit/Receive (16 channel or more) 9) Peripheral coil or whole body coil (32 or more channel) with a coverage of at least 80 cms (with a combination of 2 or more coils) 10) Breast coil (16 channel or more) 11 Flex coil (minimum 2) for extremity imaging (one coil at least 4 channel and one coil at least 8 channel) 12 Dedicated foot/ankle coil, minimum 8 channels or more.
	f) Coil Technology	1) Integrated coil technology, latest as available with the vendor to be quoted: Equivalent of TIM/GEM/DStream or equivalent to be offered.
	g) Table Technology	1) Bolus chasing with automatic/continuous moving table should be offered and should be available with fluro triggered MR angiography for manual and fast switchover in less than 1 sec for CE-MRA/ 2) Latest table technology available with the vendor (globally) should be offered.
5.	Computer control system	1) The vendor should supply the latest computer system along with the MR system, to handle all the latest applications available on the MR system. 2) During the warranty period and CMC, any software updates that are launched globally should be supplied and installed free of cost with necessary hardware if required.
	a) Host computers and array processors	1) Latest state-of-art computer system with sufficient RAM (32 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. 2) Necessary image processor with sufficiently large RAM 3) (4 GB or more) for ultra-fast image reconstruction, capable of performing real time image reconstruction. 4) Total hard disk memory capable of storing a minimum of 2,00,000 (two lakh) images. 5) Monitor 19" or more Medical grade monitor (3MP) with enhanced graphics accelerator. 6) One measurement (Main) console capable of data acquisition and all online calculations (as required for all sequences in the tender, section 6) and post

Assistant Professor
Dept. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Dept. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Dept. of Radio Diagnosis
Govt. Medical College
Jammu

		processing (as requireed for all applications in the tender, section 7) 7) Licenses for acquisition (As required for all sequences in the tender, section 6). Post processing and for special packages should be given explicitly (as require for all applications in the tender, section 7), listening all the capabilities of the vendors quoted product basic standard package, premium packages, etc. 8) 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 necessary for such applications (like laptop with system interface solution). Appropriate procedures like (research agreement) should be finalized before the installations of the equipment, So that there is delay in operation of any requirements.
	b) Additional workstation	**A client – server architecture based solution, minimum 40,000 concurrent slices, 5 (five) concurrent user licenses for all applications. DICOM 3.0 compatibility and interfacing with other modalities must be possible.** **LICENSES: 5 (five) no's** **Concurrent license here implies the capabilities to process all the loaded software (basic review & advance application) to be accessible and usable on all the clients/nodes simultaneously without any processing delay. The software should also include reputed antivirus software of a perpetual type or renewed by the supplier.** **HARDWARE (SERVER): The server (single/dual configuration) should have image storage capacity of at least 2.5 Terabytes minimum 40,000 concurrent slice processing power and at least 128 GB RAM and Octa Core 2.5 Ghz CPU or more (latest).** **HARDWARE (Client/Node): CPU unit, minimum 32 GB RAM, 512 SSD & 1TB HDD storage, Medical grade, monitor of 2 MP resolution & size 21" or more, mouse, keyboard, & Separate UPS.**
	c) CD/DVD archival	1) 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. 2) Provision for archival of K space data and raw (unprocessed) images.
	d) Networking	1) The vendor should provide level 3 network switch (with 32 nodes) or latest to integrate the network. 2) Protocols Ethernet TCP/IP standards based image transfer with DICOM 3.0 Over standard Ethernet IEEE 903 (DICOM send, receive and DICOM QUERY modes). 3) The vendor should provide the connectivity with PACS, with the user departments, as mentioned in item no. 10 of this tender.

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio-Diagnosis
Govt. Medical College
Jammu

		4) The network speed and cables should match the latest industry standards (eg. 10 BaseT/1GB) 5) System should be configured with different IP series, so as Not to clash with different equipment already existing in different departments. 6) The vendor should provide necessary networking and configuration assistance with existing PACS, HIS, RIS.
	e) Film Documentation	DICOM interface to hook DICOM compatible, dock able, latest state of art Dry Laser Camera with more than 500 dpi, capable of storing/printing images of 1024×1024 (or higher, if available) matrix size in various matrix formats (including 16 format) without loss of digital resolution (Agfa/Fuji/Kodak) with three online tray system.
6.	A) Data Acquisition	1) The system should be capable of 2D & 3D acquisition 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. 2) 2D multi slice imaging should be possible in all planes (axial, sagittal, coronal, oblique and double oblique. 3) Upto to 1024×1024 Matrix acquisitions preferred for all applications. Wherever 2048 matrix available, please mention. 4) Half Fourier or other techniques to reduce scan acquisition time while maintaining adequate SNR. 5) 3D volume, multiple contiguous slabs, multiple interleaved and multiple overlapping slabs. 6) Slice thickness in 2D and partition in 3D to be freely selectable. 7) Dynamic acquisition (serial imaging) with capability to initiate scan sequences either from the magnet panel or from the console. 8) Dynamic acquisition: No. of repeat scans with delay time either identical time interval or selectable. 9) Auto slices positioning from the localizer images. 10) Maximum off centre positioning both anterior posterior and lateral direction and should be selectable. 11) Gating: Physiological signals like ECG, Pulse, respiratory, External signal triggering (interlace for triggering input pulse from external source). The provision should be available at the console also (for FMRI, EEG etc.) 12) Simultaneously acquisition, processing and display of image date in 2D multi-slice mode. 13) Selection of voxels from oblique slices should be possible while doing spectroscopy. 14) Artifact reduction/imaging enhancement/image filtering/Image subtraction/addition/multiplication/division techniques.

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		15) Flow: Ist & 2nd order flow artefact compensation. 16) Presentation slabs: a number of relocatable saturation bands to be placed either inside or outside the region of interest. 17) Graphic prescription. 18) Fat saturation techniques: frequency selective RF pulses to supress fat signals in the measured image FOV.ROI selective (regional) fat suppression should also be given. 19) Magnetization transfer saturation: off resonance RF pulses to suppress signals from stationary tissue in FOV. 20) Phase contrast capability in 2D & 3D modes. 21) Image intensity correction. 22) Breath hold acquisition. 23) EPI mode. 24) DTI with MDDW or equivalent with a minimum of 12 & selectable up to 128 direction encoding. 25) Data acquisition in all three standard planes (axial, sagittal, coronal) and oblique and double oblique planes or more oblique planes. 26) 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. 27) The vendor should offer multicoil acquisition in order to optimize throughout increase and increased effective FOV individual acquisition elements of every coil should be mentioned.
	B) Imaging Pulse Sequences	1) All standard and special pulse sequences available at the time of quote/delivery should be offered and quoted in the bid as per tender document. If the vendor does not have any particular sequences but offers a work in progress (WIP) sequences, 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. 2) The system should be capable of selecting TR & TEs as per requirement in majority of the pulse sequences. 3) 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. 4) Inversion recovery (IR): including short TI modified IRSE, FLAIR, DIR (Double Inversion Recovery). 5) Gradient echo (GE): with transverse gradient/RF spoiling, & transverse gradient re phasing, e.g. GRASE or equivalent etc.3 D G Gradient.
	Fast sequences	1) Fast spin echo and GE sequences in 2D & 3D mode with T1, T2 & 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. 2) Half Fourier acquisition capabilities should be available with/without diffusion gradients and in

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		combination with/fast spin echo. 3) Fast inversion recovery with spin echo. 4) 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. 5) Fast gradient echo sequence should incorporate RF spoiling and other technique to acquire images in Ultra-fast 2D and 3D modes. 6) Fat and water suppressed imaging sequences. 7) EPI optimized sequences (with and without fat suppression) 8) For T1,T2, PD Imaging, perfusion, regular diffusion values (at least 5b, 3 directions) EPI FLAIR, EP-1-IR. EPI FLAIR diffusion tensor, and 128 directions) and diffusion studies. Suitable artefact/fat suppression techniques to be incorporated in the sequence to have optimum image quality. 9) There should be capability of calculating ADC map (isotropic and anisotropy from the regular diffusion and tensor data). 10) Optimized sequences for special applications. 11) Multi-band EPI: Simultaneous Multi Slice Accelerate Advance applications for neuro & body (optimal, price to be quoted separately)
	Optimized sequence packages	Mention all available packages.
	C) Neuro	1) All T1 (2D,3D),IR(2D,3D), Dual IR(2D,3D) sequences. 2) Sequence for internal ear imaging for visualization of line structures like cranial nerves (appropriate sequences like CISS, etc. or equivalent. Mention the sequences provided. 3) 3D sequences for internal auditory canal imaging. 4) Dynamic imaging of pituitary using appropriate sequences. 5) Whole spine T1,T2,IR sequences. 6) Whole neuro examination with automatic planning. Scanning and post processing, with single localizer positioning, without changing the coils/repositioning. 7) 2D/3D ASL
	D) Angiography	1) 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. 2) For Peripheral moving table angiography should he offered covering hip to limbs to be examined in one go with high resolution and high SNR. 3) Bolus tracking software package. 4) Sequences for breath hold angiography with contrast enhancement. 5) Sequences for time resolved angiography with contrast kinetics. 6) ECG triggered non contrast angiography

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		7) Contrast bolus tracking (including single shot whole body MRA, interactive and automatic tracking, etc.). 8) Perfusion study in organ system like kidney, brain, etc. with T1 perfusion with permeability maps and quantitation of rCBF/rCBV,MTT, etc.., with colour maps.
	F) Diffusion/DTI	1) Sequence package for diffusion including DTI Tractography) study in organs like brain, kidney, muscle, heart, spine, breast, etc. 2) There should be capability of calculating ADC map (isotropic) and anisotropic from the regular diffusion and tensor data). 3) MR diffusion tensor imaging package with tractography 4) Mr neuro functional imaging sequence package (incl. Mosaic, etc.) 5) Zoom IT/resolve or equivalent, application for high resolution for small FOV diffusion imaging.
	G) Body Imaging	1) Flow quantification in vessels and CSF, hepatobiliary system. 2) Fly through facility with flow analysis including display of various velocity values. 3) Optimized breath hold sequences for abdominal studies including angiogram. 4) MR cholangiography and pancreatography: specialized sequences and processing to perform MRCP. 5) Pulmonary 2D/3D MRA sequence, including single breath hold sequence. 6) MR ventriculography, cisternography, myelography. 7) 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 photography/T1 quantitative analyses. 8) 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. 9) Flow quantification packages for CSF with dynamic CSF flow imaging, aqueduct, and spinal canal. 10) Radial/Spiral pulse sequences for ultrafast imaging. 11) Suitable artefact/fat suppression techniques to be incorporated in all the sequences to have optimum image quality. 12) A sequence for differentiation of fluid and cartilage in ortho applications (sequences like DESS or equivalent) 13) Susceptibility artefact correction techniques to be incorporated in all the sequences to have optimum image quality.
	H) SWI	1) Sequences for susceptibility imaging.
	I) Prostate Imaging	1) Sequences for imaging of prostate
	J) Whole body	DWIBS or equivalent, whole body imaging t

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Profe.
Deptt. of Radio Dia
Govt. Medical Co.
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

	diffusion and STIR, Angiography	inversion recovery sequence, whole body MR angiography.
	l) M-Dixon	1) Provide sequences like m-Dixon for all applicable sequences, m-Dixon-HD or equivalent.
	m) Relaxometry	T1 mapping and T2 mapping with necessary post-processing's/w/.
	n) Motion correction	1) Sequences for in-line motion correction for uncooperative patients/children (with software and acquisition sequences like BLADE,PROPELLAR, Multivane or equivalent. 2) Sequences with ultrashort TE 3) Sequences for nullifying CSF pulsation artifacts 4) Whole body imaging (using body coil and surface coils) 5) Whole body diffusion weighted imaging (using body coils) 6) Automated fusion and composing for the above two (without any artrifacts). 7) Volume acquisitions for Neuro applications.
	o) MR Spectroscopy	1) System should have capability to perform multi planar proton 2) Proton MRS Sequence for single-voxel acquisition, with selectable fat/lipid saturation (eg. VAPOR, CHRSS, etc) with all post-processing software. 3) 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. 4) If separate coils are needed for carrying out MRS, it should be provided. 5) RF sequences for prostate, liver musculoskeletal and brain (if there are any specialized/optimized sequence available, the same should be offered)-with all post processing software. 6) Water and lipid suppression in automated sequences.
7	Post Processing and evaluation	1) License of all the post processing and evaluation packages should be provided for the main and additional console/workstation. 2) 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.	1) The vendor must provide their specialized and optimized imaging sequences in the main Acquisition console; Post processing packages in the main acquisition console and additional workstation. **System should be able to perform multi dynamic multi echo sequence (MDME)/SynTac/MAGIC and supporting software to calculate multiple contrast from above asked sequence, quantification such as brain, volume, myelin for paediatric and other neurogenerative disease like MS.** a) Neuro (Smart exam/Ready suite/Smart Brain etc.) b) Body

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		c) Oncology d) Angio (including DSA approach, capturing arterial, capillary and venous phases in a single acquisition with a single bolus) e) Ortho and MSK, Metal artefact reduction software should be provided as standard for imaging of joints with prosthesis. f) Liver (including 3D T1 fat sat for dynamic liver imaging. g) Paediatric h) Breast i) Prostate j) Necessary composing software for whole body applications. Smart Exam/Smart Brain/Ready suite/Brain Dot Engine/Equivalent techniques should be quoted in all available imaging packages.
	i)MPR	1) Multi Planar reconstruction (MPR) in any arbitrary plane including curved planes with freely selectable slice thickness and slice increments. 2) Surface Reconstruction and evaluation on reconstructed images with minimum time. 3) MIP in displaying in cine mode 2D & 3D mode, Targeted/Segmented MIP in any orthogonal axis with minimum processing lime and capable of displaying in cine mode.
	j) ADC, Perfusion etc	1) Evaluation and display of diffusion images, ADC map, FMRI in reference of EPI-Optimized sequence. 2) Perfusion image evaluation with time intensity graph and other statistical parameters. 3) Evaluation package for calculating rCBV, rCBF, MTT, perfusion map, corrected CBV calculations: Fusion of perfusion map with contrast enhanced 3DT1 images etc. Mention the package/software offered with brochure. 4) Flow quantification and evaluation far vascular (high & low) CSG, bladder outlet and cine display.
	Arterial Spin Labeling	2D/3D ASL processing and quantification package in main console/additional workstation.
	Liver Segmentation	Automatic liver segmentation and volumetric analysis.
	K) Bold analysis	1) Evaluation of functional images of brain with appropriate statistical algorithms, colour display and overlay on base anatomical images. 2) Software for evaluation of functional mapping (BOLDEvaluation and Neuro-metabolite mapping.
	L) Tractography	Post-processing package for DTI and Tractography, estimation of ADC, FA (Lambda Parallel, perpendicular separately and combined), Fibre tracking, fibre statics, and display of fibre tracts on anatomical images.
	M) Image Statistical	1) Measurement of distance, area, volume, angle, mean, SD, image addition, subtraction, multiplication, division, interpolation, segmentation, threshold, histogram. 2) Image filtering and image fusion software. 3) Software for co registering MRI/FMRI/MRS/Metabolite mapping images with

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Profes
Deptt. of Radio Dia
Govt. Medical Co

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		images from CT, PET, and SPECT. 4) Evaluation features like zoom, rotation, scroll, roaming, Image synthesis, multi point T1 and T2 calculation (More than 8) window stretching, text dialogues graphics, sorting, searchmfl, archiving, recalling etc.
	N) Spectroscopy	1) Full post-processing for single-voxel MRS, CS1 (Multi voxel MRS), Metabolite mapping with colour coding (metabolic images etc, for brain prostate and for other applications. 2) 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.
	O) Advance organ Specific Imaging (not in other tendor)	Any advanced organ specific imaging with automatic planning; scanning and post-processing applications should be quoted.
	P) Silent MRI	Silent MRI for neuro protocols including T1W,T2W imaging without any loss of image quality on all sequences (like Neuro Silent/silenz, or equivalent), with noise less than 80Db. The quiet scanning should be without loss of SNR.
	Q) Advanced Compress Sensing imaging	System should have the advanced compressed sensing imaging for high speed image acquisition for brain, body, MSK. Also offer simultaneously multi-slab acquisition for diffusion and FMRI of the brain.
		1) Functional imaging with package for BOLD imaging and processing package (capable real time processing and display of colour-overlay (in real time) using Head coil being supplied with the system.
		2) Complete (MRI) solution including audio visual projection (8Dcapable) system, with headphones with very good noise suppression(>30Db) (Preferable to have LCD/LED monitor projection.
		3) The system should be integrated with stimulus presentation/paradigm generator software, along with permanent license (like super lab, Nordicaktiva) 4) The paradigm presentation should be synchronized with the scanner (fur starling along with measurements).
8	Functional MRI Accessories and post processing	1) 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.
		2) Complete (MRI solution including audio visual projection (3D capable) system, with headphones with very good noise suppression (>30dB) preferable to have LCD/LED monitor projection).
		3) The system should be integrated with stimulus presentation/paradigm generator software, along with permanent license (like super lab, Nordicaktiva, Sensevue-in vivo presentation, etc)

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		tele med
		4) The paradigm presentation should be synchronized with the scanner (fur starling along with measurements).
9	Quality assurance and phantoms	1) Phantoms for routine quality assurance for all coils (including body coil)
10	Standard MRI Accessories	1) Rechargeable hand held metal detectors (2 Nos.)
		2) Walk through metal detector with multiple sensor and Multiple location LED (Zone III TYPE)-01 no
		3) MR compatible patient monitor (Annexure 1) and MR compatible infusion pump (annexure 2) (specifications are mentioned separately)
		4) High standard Ferro Guard should be installed at entrance of mr room to detect/alert ferromagnetic Articles
		5) (unit price of lines and tubing's to be quoted separately for Additional requirement)
		6) a.) MR compatible Dual Pressure Injector (minimum 2000 Gauss line) b.) Please quote the price of the consumables for the quoted MR compatible pressure injector (for 1000 syringes and 1000 patient tubing's), valid for a period for 5 years. This has to be supplied in a staggered manner, after consultants with the user. This is to be quoted separately.
		7) Unit price of syringe and tubing's to be quoted separately for additional requirements.
		8) MR compatible anaesthesia machine (specifications are mentioned separately: Annexure 3)
		9) Two quantity: Non-Magnetic IV stand
		10) Two quantity: Digital Patient weighing scale (in the range between 0 to 200 kg)
		11) MR compatible storage carts and wall mounted cabinets.
		12) Coil cabinets to be provided
		13) Network cable and other require materials for the complete installations to be provided by the supplier.
		14) MR compatible crash cart 1 no.
		15) MR compatible instruments trolley-1 no.
		16) MR compatible patient trolley (to transfer patient to the magnet table) with both vertical and horizontal movements with hydraulic operation and should take a minimum load of 150 kg in both vertical and horizontal motion (Model: Adjustable Height Trolley: MRS501 of War dray Premise Ltd. U.K or Adjustable Height Trolley, Femo, UK or equivalent)-1 no.
		17) MR compatible wheelchair (War dray/equivalent model) with cushion, back-rest and anti rest)-1 no.
11	Antivirus s/w and updates	1) 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 years
		2) The vendor should provide antivirus updates for 5

Assistant Professor
Dept. of Radio Diagnosis
Govt. Medical College
Jammu

		years and make sure of the updated antivirus every week (using automatic updates with internet facility by the vendor)
		3) The vendor should ensure that all the above modalities include necessary connection, I mage and work list send/receive, image and data storage, scheduling, patient registration, and synchronization functions as per DICOM standards for smooth and effective integration to RIS/PACS
13.	Accessories	1) Ten chairs with arm rest with medium back without casters (Godrej/Gee ken make)
		2) Table for the MRI console, MRI additional console/workstation. FMRI workstation.
		3) Necessary Desk, chair and Rack for the PACS Server & workstation to be provided by the supplier.
		4) All the necessary interconnecting interfaces, cables, modules and other hardware and software to fully integrate the system for full operational status.
		5) Uninterrupted power supply (UPS) with sufficient capacity '(appropriate rating as required for MRI and chiller) for 30 minutes backup of the full load MR system and its accessories during Patient MR Imaging.
		6) Suitable Diesel Generator with silent enclosure. for proper functioning of the MRI and all accessories (Standard) (at least 250 KVA capacity or more)
		7) 2 quantity MR compatible oxygen cylinders (for the anaesthesia system)
		8) Good quality air curtain at MRI entrance (for patient entry), To filter the dust and prevent the leakage of a/c.
		9) One high quality LED projector for conference room of reputed brand like Sony or equivalent.
		10) Desktop specifications: 7 (seven) in nos. **Processor: Intel Core i9 (latest generation) or AMD Ryzen 9 (latest generation)** **RAM: 32 GB RAM DDR4.** **Storage: 512 SSD & 1TB HDD storage or a combination of SSD and HDD for additional storage.** **Graphics: Integrated graphics like Intel UHD or AMD Radeon Vega (sufficient for basic tasks and graphic requirements).** **Operating System: Windows 11 (latest)** **Connectivity: USB 3.0 and 3.1 ports, HDMI Ethernet, WI-FI and Bluetooth.** **Power Supply: Efficient power supply units, preferably with an 80+ certification. UPS** **Laptop Specifications: (5 five in nos)** **Processor: Intel Core i9/latest generation) or AMD Ryzen 9/latest generation)** **RAM: 8GB to 16GB DDR4.** **Storage: 256GB to 512GB SSD.** **Graphics: Integrated graphics like intel Iris Xe or AMD Radeon.** **Display: Full HD (1920×1080) resolution, with**

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical C...

		larger screens (15.6 inches) preferred for better visibility. **Operating System: Windows 11 (latest)** **Battery life: At least 6-8 hours of battery life.** **Connectivity: Multiple USB ports, HDMI, Wi-Fi, Bluetooth, and often a built-in webcam.** **Laser printer (B&W)- 7 (seven) nos. Latest generation B&W laser printer.** **Colour laser printer- 3(three) in nos. latest generation colour laser printer.**
	Image Storage Solution (not in other)	**x) Image Storage Solution: The existing system need to be augmented by a PACS system capable of storing DICOM data from DICOM modalities, 100 TB image storage systems to enhance the workflow and be ready for 100% redundancy to provide 100% backup for existing stored data. The system should allow high speed transmission and viewing of Data with adequate security measures against viruses, unauthorized access, and encryption to prevent misuse.** **It will be the responsibility of the vendor to demonstrate capabilities/functions Quoted as well as complete seamless integration of their solution with the existing system to the technical evaluation committee onsite.**
13	Training	Advanced training to be provided by the vendor at the site for faculty, Residents, students and Radiographers so as to benefits the latest applications available on the system. The training should be minimum period of 12 weeks. staggered.
14	Installation on site	1) The system should be installed and handed over in working condition.
		2) All the necessary interconnecting interfaces, cables, modules and other hardware and software to fully integrate the system for full operational status.
		3) Installation and integration of the uninterrupted power supply (UPS), as quoted in 1 3(v) and (vi).
		4) Generator(to be quoted as standard) with sufficient capacity for operator of MRI (Including powerful gradient sequence), accessories, air conditioning, etc (at least 250 KVA capacity or more)), The necessary cable from main supply of hospital to generator and from generator to MRI machine and the Electric panel required is to provide by vendor. UPS of equivalent capacity to run the MRI machine has also to be provided by the vendor provided.
		5) The UPS, Generator and other local items have to be quoted in Indian rupees only.
		6) Water/Air Chiller should be of good quality.
	Air conditioning works	2) Air conditioning that is required for the MRI equipment, examination room, and console areas have to be carried out by the vendor with a new unit. Proper duelling and other necessary work have to be carried out without damaging existing structure. The vendor should discuss with the engineering section and the department before quoting for site modification.
		3) Necessary adequate air-conditioning units. The vendor should discuss with the engineering section and the department before quoting for site-

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

		Modification.
		4) The installation of the MR system should be complete with all accessories.
16	Special Condition	Please see Annexure for special conditions, including warranty and CMC.
	1.	Original Product Datasheet of main unit and all accessories, including third party items to be provided.
		All agreements should be binding on principal. The principals should be responsible for any lacuna or deficit in service or supply.
	2.	All items in the supply order should be supplied during the time of installations. No exception will be allowed.
	3.	Items under Research Agreements should be finalized well in advance after receipt of supply order), so that there is no delay in delivery of software or coil or any other accessories.
	4.	Software upgrades/updates like new pulse sequence, new applications package etc, and necessary hardware (if required) should be provided within one month after release worldwide (any country, viz North America/Europe/Germany, etc.) wherever feasible. In case, the same is not provided in time, the parent company should undertake the responsibility to implement the same. This is to make sure that the machine Stays updated with similar products for at least 5 years.
	Warranty Period	
	5.	The warranty period (5 years) of the 3TMRI System commences from the date of handing over (from the date of issue of inspection Note) the fully functional unit of all coils and the accessories supplied (such as UPS including batteries replacement as when required, AC, Generator etc.) including third party items such as MR compatible infusion pump, patient monitor with probes, MR compatible anaesthesia machine and Ferro guard to the institute, against manufacturing defects of material and workmanship. The Helium supply and cold head repairs (including replacement, if needed) should be included in the warranty period.
	6.	Note: any liquid Helium Filling, due to quenching or due to any other caused during the warranty period shall be borne by the firm, (except purchaser's fault).
	7.	If a particular coil is not working for more than 5 days and due to which patient work suffers, the firm will be asked to pay penalty of half-a-day beyond 5 days for each day that it is not working.
	Post Guarantee Annual Comprehensive Maintenance Contract (CMC):	
	8.	The post warranty (after 5 years) CMC should be comprehensive and should include helium and cold head (repair and/or replacement) + Labour + Spares for the complete system which includes all the accessories supplied such as UPS, Generator, AC, etc. (including all consumables like batteries for UPS, and maintenance for another 5 years. This CAMC should be quoted in Indian rupees.
	9.	Note any liquid Helium Filling due to quenching or due to any other causes during the CMC period shall

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Profes
Deptt. of Radio Dia
Govt. Medical Co
Jammu

		be borne by the firm.
	10.	If a particular coil is not working for more than 5 days and due to which patient work suffers, the firm will be asked to pay penalty of half-a-day beyond 5 days for each day that it is not working.
	8 AIR CONDITIONING: minimum 16 TR (10 TR working + 6 TR standby) (The vendor to verify that the capacity is adequate)	
	1.	Duct-able split air conditioners and splits AC units may be used according to room requirement and suitability. Humidity control should be effective to eliminate moisture condensation on equipment surface. The air conditioning should be designed with standby Provision to function 24 hours a day.
	2.	The outdoor units of AC should be located as approved by the institute and should have full coverings to prevent theft and damage.
	3.	Copper pipes and valve panel to be used for the chiller to the MRI.
	4.	Environment Specifications:
	a)	Humidity range: Relative humidity 60% and 80% in all areas in all areas except equipment room which shall be as per requirement of the equipment.
	b)	Temperature ranges: 22+2"C in all areas except equipment room which shall be as per requirement of the equipment.
	c)	Air conditioning load: The heat load calculations and maintaining tie desired temperature and humidity shall be the responsibility of the bidder.
	9 Furniture:	
	1.	Revolving chairs height adjustable, medium back with hand-rest in the control room, Radiologist room and viewing area, 12 Nos.
	2.	Cupboard with laminate door shutters for storage of spare parts and accessories and records as per requirement-5 Nos.
	3.	Drug trolleys for patient preparation area-1 Nos.
	4.	Name boards for all rooms.
	5.	Tables for workstation and Radiologist in reporting room. 4 Nos.
	6.	All furniture items should be of standard make as mentioned in the table below.
	10 Miscellaneous:	
	1.	LED X ray film viewer with adjustable brightness; capable of holding 3 films of 14"×17" size, 2 Nos.
	2.	Cabling of network (LAN) connectivity for camera system, console system, workstation, servers arid computers etc.
	3.	Cabling for broadband connection: for REMOTE SERVICE OF MRI SYSTEM.
	4.	MR compatible piping and outlets (4 lines) for Medical Air, Oxygen, Vacuum and N20. To be provided in the Gantry room. The Hospital gas lines will be terminated outside the MRI area.
	11 CIVIL & ELECTRIC WORK	
		Civil and electric work if required will be forwarded to vendors after finalization of drawing with engineering department for their evaluation and costing.

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Annexure 1

Specifications for MR safe dual Channel/Syringe/Volumetric Pump (Infusion Pump)

1. The MR safe pump should be adaptable both as a syringe pump as well as a volumetric pump.
2. It should be designed for use in MR environment and not adopted for the purpose (should not be a non-MR pump in an RF cage).
3. It should have a non-magnetic ultrasonic motor to provide accurate fluid delivery from infants to adults with capability of delivering two drugs simultaneously.
4. It should come with a 10 digit keypad entry system for ease of programming.
5. It should be 10000 Gauss compliant so that it can be placed anywhere in the MR room.
6. It should have a large LCD display providing high visibility.
7. Expanded delivery range of the pump should be 0.1-1400ml/hr.
8. It should have a long – life lithium polymer battery pack for more than 10 hours back up once fully charged.
9. The syringe set should be self-vented type with a very low priming volume.
10. The system should be field upgraded to pulse oximeter monitoring.
11. The downstream occlusion pressure should be adjustable from 1-10 psi to suit various cannula sizes and viscosity of the drug to be infused.
12. There should be an air line ultrasonic bubble detector.
13. It should have a 360° visible green/red bright flashing alarm light indication sufficiently big to be observed from control room itself in event of any alarm situation or for regular drug delivery confirmation.
14. Optionally and MR safe free standing IV Pole & a wireless remote control which can control the pump in a seamless bidirectional manner using 2.4 Ghz spectrum should also be quoted along with the main system.
15. It should be CE marked and FDA approved.
16. All the accessories including batteries should be provided for 10 years.
17. It should be approved by major magnet manufacturer like siemens/Philips/GE for use up to their 3T magnets.

Annexure 2

Specifications for MR safe portable Multi-parameter Vital Sign Monitor.

1. It should be a fully Non-Magnet multi parameter portable patient monitoring solution. designed to be small, easy to use and lightweight.
2. MRI vital signs monitor able to travel with the patient.
3. It should be 30000 Gauss complaint so that it can be placed anywhere in the MR room (upto 3 Tesla MRI)
4. It should help in increased staff efficiency by simplifying inter-department transfer and faster emergency response with the monitor docked to the patient's bed.
5. The unit should come with wireless vital signs 3 or 5 lead ECG with trusted artefact free sp02 technology.

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

Associate Professor
Deptt. of Radio Diagnosis
Govt. Medical College
Jammu

6. The unit should come with wireless control room light weight monitor with base station having backup charging dock.
7. Clinical Features: Standard
   - Sp02 with perfusion Indicator: Wireless.
   - ECG: 3/5 Lead: Wireless
   - Non-Invasive blood pressure
   - Dynamic trend indicators.
   - Tri-colored alarm light
   - Full gas module with ETC02 sidestream
   - Invasive blood pressure
   - Accessories, Mr Compatible Laryngoscope
   - Vendor should provide the paediatric & Adult SP02-03 each.
   - Vendor should provide the Paediatric & Adult BP Cuff -03 each.
   - Vendor should also quote the price for SP02 probe and BP Cuff (pediatric & Adult) separately for the further purchase if required.

Should be European CE marked/FDA marked

Annexure3

MR Compatible Anaesthesia Machine

S.No.	Description
	The system should be compatible with 3T MRI systems (minimum 400 Gauss line) since it will be used with other MRI systems in case of need/emergency. Should be antistatic, heavy frame & base with good quality castors with front brakers, with following features:
1.	Three gas model viz Oxygen, Nitrous oxide and Air.
2.	Should be compact, ergonomic, easy to use and easy to maintain.
3.	Should have separate fresh gas outlet for use in open circuit.
4.	Machine should have flow meters for oxygen, nitrous oxide and air. Emergency Oxygen flush should be available. There should be facility to select oxygen-air or oxygen-nitrous oxide with the help of a separate switch or knob.
5.	Flow sensing capability/pneumatic ventilator at inhalation and exhalation ports.
6.	Should have paramagnetic/galvanic cell oxygen sensors. In case of galvanic cell sensors, the firm should supply free sensors for the entire warranty period of 5 years. In case of Paramagnetic sensors, the firm shall ensure that there is no down time during repair of these sensors (if necessary) and provide a standby alternative.
7.	Shall have back-up Oxygen control which provides an independent fresh gas source and flow meter control in case of failure.
8.	Pressure regulators shall be of modular design.
9.	Should have oxygen fail safe device & an auxiliary built in oxygen flow meter.
10.	Electronic or Mechanical Hypoxic Guard to ensure minimum 25% Oxygen across all 02N20 mixtures.
11.	Oxygen failure warning by audible alarm should be provided.
12.	The consumables like appropriate length of circuit, tubings, lines, etc. should be provided for adults, paediatric and neonates for a period of one year.
1.	Facility of mounting minimum 2 vaporizers, latest technology, key filler, selectatec type, tool free installations, meaning any vaporizer of our choice can be mounted at will with interlocking facility. It should be preferably of the same make as that of machine.
2.	Temperature, pressure and flow compensated with high accuracy of delivered concentration of volatile Aesthetic agent. Should be maintenance free.
3.	Vaporizers should be supplied (Sevoflurane).2 vaporizers will be preferred if available.
1.	The machine should have an integrated Anaesthesia Ventilator system, Facility

Associate Profess
Deptt. of Radio Diagn
Govt. Medical Colle
Jammu

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College

Assistant Professor
Deptt. of Radio Diagnosis
Govt. Medical College

	respiratory parameters and should be able to ventilate adult and paediatric patients including infants.
2.	Ventilator/ pneumatically controlled time cycled ventilator should have controlled Manual, spontaneous modes.
3.	Tidal Volume (inspired and expired respiratory rate, 1:E ratio ,minute volume Airway Pressure &Fi02.
4.	Should have Tidal volume and fresh gas compensation mechanism.
5.	Tidal volume (VT) 20-150Oml (Volume Control), Rate at least 4-80 BPM.
6.	Inspiratory/Expiratory ratio(1:E)2:1 tol:6& peak flow-100 to 120L/min.
7.	Ventilator should have at least 30 min rechargeable battery backup for Ventilator.
8.	Machine should have an integrated breathing circuit with circle absorber of good quality, easy to clean, autoclavable, fewer parts to reduce leaks.
9.	Machine should have mounting capability of one 02 and one N20 pin-indexed cylinder
10.	Adult autoclavable (2sets) breathing circuits & one paediatric circuit to be Provided.
11.	The machine should be equipped with AGSS.
12.	All Accessories should be covered under Warranty and CMC.
13.	Anaesthesia workstation should be USFDA approved.