Amendment No. 2

10-01-2018

Sub: Amendment to the Bidding Document

Ref.: Notice Inviting Bid ref. HITES/PCD/NCI-AIIMS/07/17-18 dated 28.11.2017 read with its Amendment no. 1 dated 26.12.2017

The following changes have been authorised and are being incorporated in the above referred Bidding Document.

SECTION - VII

TECHNICAL SPECIFICATION AND GENERAL POINTS

A. TECHNICAL SPECIFICATION:

Item sl. no. 01 (Rfx no. 3000002448)

State of Art Linear Accelerator

The existing specification of the tendered item is amended as under:

I	**HIGH-ENERGY LINEAR ACCELERATOR WITH IGRT AND FACILITY SITE-MODIFICATION**
	Sealed tenders (sealed separately as the "Technical Bid & the Price Bid-in duplicate) are invited directly from the manufacturers/principles for the supply of two state-of the-art clinical Radiotherapy Linear Accelerator capable of producing 6 MV, 10 MV and 15 MV photon energy for the routine and specialized treatment techniques. Linear Accelerator must have the latest technology and should be fully computer controlled system. The Medical Linear accelerator system includes Linear accelerator, Treatment Planning System, Oncology Information System, Dosimetry and quality assurance equipment and systems and Patient Immobilization devices. It should be capable of integrating with standard networking and PACS systems available in the market. Vendor should provide the time-line schedule for shipping, beam modelling, on-site training and clinical implementation and first patient treatment after LC opening. The offered equipment should have the following technical features.
1	**LINEAR ACCELERATOR**
	An Advanced, latest model of high-energy medical linear accelerator should be equipped with a multi-leaf collimator (MLC) and an electronic portal imaging device (EPID) and kV-cone-beam CT (CBCT) to perform conformal treatment techniques such as three dimensional conformal radiotherapy (3D-CRT), intensity modulated radiation therapy (IMRT) and image-guided radiotherapy (IGRT) volumetric Modulated Arc therapy, stereotactic radiosurgery and radiotherapy (SRS/SRT), stereotactic body radiotherapy (SBRT) 4D-

	Radiotherapy (4D-RT) and Adaptive Radiotherapy (ART) with Flattening Filter Free (FFF) beam technology based linear accelerator.
2	**Photon Beam Characteristics**
2.1	**Beam Energies:** The accelerator shall be capable of producing three clinically useful photon beams with energies of 6MV, 10MV and 15 MV (flattened). In addition, two energies of 6MV and 10MV capable of producing in Flattening Filter Free (unflattened) photon mode should be offered.
2.2	**Dose Rate and Beam Stability**
2.2.1	The maximum dose rate for routine clinical applications shall equal at least 500 monitor units (MU)/min or more for a 10 x 10 cm field at the depth of maximum build up dose at a TSD of 100 cm for all the three photon beams.
2.2.2	The dose rate for in flattening filter free photon beams should have at least 1000 or more MU/min for 6MV and 2000 MU/min or more for 10MV.
2.2.3	Specify the maximum dose rate and number of intermediate dose rate available in the offered LINAC model.
2.2.4	Specify the beam stability time in milliseconds.
2.3	**Field Size Specifications**: The field size is defined as the distance along the radial and transverse axes between the points of 50% density on an x-ray film taken at 100 cm TSD with minimum build-up. The digital display, light field size and mechanical display should be accurate to within + 2 mm.
2.3.1	The accelerator shall provide a continuously variable rectangular, unclipped field size from 1 x 1 cm to 35 x 35 cm at 100 cm SSD. The maximum clipped field size should equal or exceed 40 x 40 cm at 100 cm SSD. Clipped corners are unacceptable for fields smaller than 35 x 35 cm.
2.3.2	A detachable block holder should be provided to accommodate 2 trays simultaneously for wedges and block trays. The size of the blocking trays should be at least 5 cm larger than the maximum field size at the lower position. Specify location and size of blocking trays.
2.3.3	Asymmetrical collimation for two sets of jaws shall be provided. One set of jaws shall be capable of crossing the center line by at least 10 cm as projected at 100 cm TSD. The collimators shall re-center automatically when the symmetrical mode of operation is re-selected.
2.4	**Beam Profile Specification**
2.4.1	**Field Flatness:** Variation of x-ray intensity relative to the central axis shall not exceed + 4% at 100 cm SSD and 10 cm depth over the central 80% of the field for the longitudinal and transverse axes of all field sizes from 10 x 10 cm to 40 x 40 cm. State the maximum variations for the above field sizes at each energy.
2.4.2	**Field Symmetry:** The maximum percent differences of average doses shall not exceed + 3.0% for the longitudinal and transverse halves of the field at 100 cm TSD and 10 cm depth, at gantry angles of 0, 90, 180 and 270 degrees. Field sizes shall be specified as 10 x 10 cm and 40 x 40 cm. Average dose is defined as the arithmetic average of minimum and maximum doses within the central 80% of the field for both axes.

2.4.3	**Radiation Field Penumbra:** The width between the 20% and the 80% isodose lines measured for 10 X 10 cm2 at depth of 10 cm at 100 cm SSD should not be more than 10mm. Specify the penumbra width.
2.5	**Beam Quality Index:** The ratio of ionization measured at 20 cm and 10cm depth for a field size 10 X 10 cm2 at the detector level and with constant detector source distance = 100cm should be as given below:
2.5.1	**Photon beam energy (MV) Quality Index (QI)**
2.5.1.a	6 MV : Specify
2.5.1.a	10 MV : Specify
2.5.1.a	15 MV : Specify
2.6	**Radiation Leakage :** Radiation leakage limits shall be within appropriate regulatory agency guidelines as follows:
2.6.1	**Photon leakage.** The photon leakage rate at any point one meter from the target outside the cone defined by the primary x-ray collimator shall be less than 0.1% of the absorbed dose at the isocentre.
2.6.2	**Collimator transmission**. The movable collimators shall not permit transmission of radiation exceeding 0.5% of the central axis dose at Dmax measured in air for both photon energies.
2.6.3	**Neutron leakage**. The neutron leakage rate should not exceed 0.2% expressed in neutron dose equivalent (Sivert) when added to the photon leakage for a 10 x 10 cm field at the isocentre at any point one meter from the target when the jaws are closed.
2.6.4	In addition to meeting above specifications for radiation leakage, the LINAC should also meet all the mandatory safety and radiation leakage regulations as specified by Atomic Energy Regulatory Board (AERB), Mumbai, India for a medical linear accelerator.
2.7	**Rotational/ Arc Therapy**
2.7.1	The LINAC must have photon arc therapy feature with gantry rotation in clockwise and counter clockwise directions.
2.7.2	The dose rate/range of dose rate should be specified MU per degree. The MU/degree shall automatically be computed.
2.7.3	A range of continuously variable dose rate should be available. A unit able to deliver high dose per degree will be preferred.
2.8	**Maximal Dose** : For TBI procedures, maximum dose should be specified for a single field
2.9	**Congruence Between Optical and Radiation Field:** The congruence between optical and radiation fields for 5x5 cm2, 10 cm x10 cm at 0, 90,180 and 270 degree gantry angles with SSD = 100 cm should be within 2 mm along X,Y axes.
2.1	Vendor should provide the beam matching between two linear accelerators.
3	**Electron Beam Characteristics**
3.1	**Electron Beam Energies**
	Five clinically useful electron beam energies shall be provided. The lowest

	energy shall be 4 or 6 MeV and the highest energy shall be 15 MeV or above. Energy shall be specified as the most probable energy (Ep) of the electron energy spectrum at 100 cm from the accelerator exit window.
3.2	**Dose Rate:** The dose rate at the isocentre shall not be less than 600 MU/minute for each electron energy.
3.3	**Field Size**
3.3.1	The electron beam size is defined by the inside dimensions of the electron beam applicators projected geometrically to a plane surface at 100 cm SSD. A range of field sizes from 4 x 4 cm to 25 x 25 cm is required. A method to obtain irregular field shapes shall be provided.
3.3.2	It shall be possible to visualize both the field defining light and the optical distance indicator with an electron applicator in place.
3.4	**Beam Profile Specification**
3.4.1	**Field Flatness:** The maximum percent variation of the electron intensity at 100 cm SSD at Dmax shall not exceed 5% (within the central 80% of the longitudinal and transverse axes relative to the central axis) for field sizes from 10 x 10 cm to 25 x 25 cm and for all the electron beam energies.
3.4.2	**Beam Symmetry**
3.4.2.1	The maximum percent variation in the average electron intensity to the longitudinal and transverse halves of the electron field at Dmax for a 10 x 10 and 25 x 25 cm field at 100 cm SSD shall not exceed + 2% at gantry angles of 0, 90, 180 and 270 degrees.
3.4.2.2	The average electron intensity is the average of the maximum and minimum points within the central 80% of the field for each of the axes.
3.5	**X-ray Contamination**
3.5.1	The x-ray contamination of the electron beam shall be less than 5% of the maximum dose for all energies specified previously.
3.6	**Total Skin Electron Therapy**
3.6.1	A high dose rate electron mode for total skin electron therapy must be provided with a minimum dose rate of 900 MU/min or above for the 4 or 6 MeV electron beam.
4	**Accelerator System**
4.1	The system must provide with either Magnetron or Klystron as the radiofrequency (RF) micro power source. The warranty should be at least for 5years. (Pro-rata guarantee is not acceptable).
4.2	Standing or travelling type of wave-guide along with the bending magnet, target assembly, vacuum ion-pump should be offered a warranty of 5 years. (Pro-rata guarantee is not acceptable).
4.3	Specify the target type and materials and also flattening filter materials in details
4.4	Electron gun should have warranty of minimum 5 years and the beam focal spot should be within 3 mm diameter.
5	**Dose Monitoring System**

5.1	Sealed/unsealed type of dose monitoring chambers must be provided and should operate independent of ambient temperature and pressure. All dosimetry, patient and unit safety related interlocks must be sensed and controlled by hardware and software.
5.2	The equipment shall provide two independent dose monitoring systems for primary and secondary dose monitoring as well dose distribution monitoring
5.3	The dose monitoring systems shall monitor the beam energy and shall terminate irradiation when the change of beam energy greater than ±3% of the nominal energy.
5.4	Provision of a controlling timer to protect against failure of dose monitoring systems shall comply with the requirements in accordance with respective IEC norms.
5.5	The reproducibility tolerance for the dose monitoring system shall be better than 1% or 1 MU.
5.6	The linearity tolerance of accumulated doses from 10 to 1000 MU for the dose monitoring system shall be ± 1% or 1 MU. Specify the linearity tolerance for less than 10MU in view of IMRT
5.7	The reproducibility tolerance at any gantry angles for the dose monitoring system shall be better than ± 1% or 1 MU.
6	**Mechanical Features Specification**
6.1	**Gantry**
6.1.1	Gantry shall be motorized by local and remote controls. Automatic setup facility and in-room display of treatment parameters shall be provided.
6.1.2	The total range of gantry rotation shall not be less than 360°
6.1.3	Resolution and accuracy of digital readout shall be 0.1° and ± 0.5° or better
6.1.4	Resolution and accuracy of analog readout shall be 1° and ± 1° or better
6.2	**Collimator**
6.2.1	Collimator shall be motorized by local and remote controls
6.2.2	The cross-wire wander (rotation) shall not exceed 1mm diameter
6.2.3	The total range of collimator rotation shall not be less than ± 165°
6.2.4	Resolution and accuracy of digital readout shall be 0.1° and ± 0.5° or better
6.2.5	Resolution and accuracy of analog readout shall be 1° and ± 1° or better
6.3	**Diaphragm (Jaws)**
6.3.1	Each diaphragm shall be independently motorized by local and remote controls
6.3.2	One pair of diaphragm shall be travelled up to at least -10cm crossover the central axis in order to simulate the asymmetrical and offset fields.
6.3.3	Resolution and accuracy of digital readout shall be 1 mm and ± 1mm or better
6.3.4	Maximum angular deviation between the axes of opposing diaphragms shall be stated.
6.4	**Multi-Leaf Collimator**
6.4.1	Number of multi-leaf collimator (MLC) leaves shall be at least 60 pairs or more to provide maximum field size of 40x40 cm2.
6.4.2	MLC leaf width projected at 100 cm TSD shall be 5 mm uniform or combination

	of 5mm and 10mm.
6.4.3	Multi-leaf collimator speed together with maximum possible dose rate for dynamic radiotherapy shall be stated.
6.4.4	Maximum range of leaf speed and extension between leaves shall be stated.
6.4.5	Accuracy and repeatability of leaf position shall be within ± 1mm or better. Accuracy of leaf alignment perpendicular to leaf movement about isocentre shall be within 1mm or better.
6.4.6	Radiation parameters such as leaf penumbra, leaf transmission, inter-leaf transmission and coincidence of radiation field vs optical field shall be stated.
6.4.7	The MLC system shall incorporate a fast and efficient QA tools (compliance of AAPM-TG-50 guidelines) for checking and monitoring all leaves position in real time. Deviations from leaves position calibration shall be interlocked to prevent treatment.
6.4.8	Clearance from bottom of collimator to isocentre shall be specified.
6.4.9	Provision of treatment verification and record system with the necessary interface for static and dynamic operation of MLC prior to treatment delivery.
6.5	**Treatment Table/Couch**
6.5.1	Vendor shall provide the treatment couch and accessories used for accurate image guided radiation therapy and it should have 6-degree-of-freedom (6DOF) in translational and rotational movement capability.
6.5.2	Indexed carbon fibre tabletop shall be provided.
6.5.3	The tabletop shall comply with the deflection requirement of IEC norm.
6.5.4	Lifting capacity shall be at least 200kg
6.5.5	IEC scale convention shall be provided.
6.5.6	Treatment tabletop shall be capable of free manual movement in both lateral & longitudinal directions
6.5.7	Lateral & longitudinal couch displacement shall not exceed 1mm under braked condition
6.5.8	Range of vertical, longitudinal and lateral movement and pitch, yaw and roll shall be stated
6.5.9	Range and accuracy of isocentric rotation shall be stated.
6.5.10	Vendor shall specify the accuracy of isocentric rotation angle.
6.5.11	Mechanical isocentre accuracy for couch rotation shall not 1 mm radius sphere
6.5.12	Vendor shall specify the accuracy of couch rotation isocentre
6.5.13	Vendor shall specify the coincidence of couch isocentre with gantry and collimator isocentre.
6.5.14	Vendor shall provide any auto-setup / remote control couch motions capability
6.5.15	Precision of digital couch rotation readout +/- 0° or accuracy of digital couch rotation readout +/- 1 ° or better.
6.5.16	Precision of digital couch vertical, longitudinal and lateral position readout shall be +/- 1mm or better, accuracy of digital couch vertical, longitudinal and lateral position +/- 2mm or better.

6.5.17	Vendor is required to facilitate with all available accessories, inter-changeable table top materials, removable parts for treatment. Provision of patient immobilization accessories, preferably with indexing capability compatible with the couch. Detailed list of all accessories shall be stated and provided.
6.5.18	Emergency down drive shall be provided to remove the patient in the case of power failure.
6.6	**Electronic Portal Imaging System**
6.6.1	The imager shall utilize amorphous silicon (a-Si) with higher resolution shall be provided
6.6.2	Vendor shall specify the maximum image field size at isocentre and at other distance achievable with a single exposure for the detector panel.
6.6.3	Specify details of all movements and positional accuracy of the imager.
6.6.4	Specify the details of pixel depth pitch of the imager.
6.6.5	Maximum image acquisition rate and minimum MU for full image resolution shall be stated
6.6.6	Spatial resolution (lp/mm) shall be stated if test object position is at isocentre and at detector
6.6.7	Accuracy of imager centre to beam isocentre shall be stated.
6.6.8	The system shall provide a suitable means to import & export images for verification and display on the same workstations; to acquire & transfer images through the existing oncology network; and to be capable of registration
6.6.9	Vendor shall provide features on image processing, image display, image analysis, image storage, image print and image enlargement. Details shall be stated.
6.6.10	Avoidance of irradiation of area outside sensitive detector panel and anti-collision device, vendor shall state and provide details including the usable life span of the EPID.
6.6.11	Vendor shall provide all accessories including necessary QA tools, maintenance tools etc. for EPID.
6.6.12	Provision of facilities for storage I archival of electronic portal images.
6.6.13	Portal images can be exported to external facilities in a recognized format including BMP and TIFF.
6.6.14	Vendor should provide IMRT and VMAT portal dosimetry verification system of EPID for all available energies including FFF beams.
6.7	**Patient Alignment system**
6.7.1	Vendor is required to supply and install One set of 4-green laser alignment systems. A separate back pointer laser alignment system shall be provided and installed onto the linear accelerator on offer. All laser products shall comply with respective code of IEC safety of laser products.
6.7.2	Each laser beam shall be precisely adjustable vertically and horizontally by remote control to indicate the isocentre position within 1 mm and protected against accidental displacement

6.7.3	System should have 0.5mm line thickness at isocentre for patient alignment and set-up
6.8	**Control Console and Treatment room display features**
6.8.1	**Main control console:** A computerized control console shall be located outside the treatment room. This console shall provide controls that must be activated in order for the accelerator to become operational in any of its various modes of operation and also provide displays of accelerator parameters. The following shall be present:
6.8.1.1	**Power Off:** Turns off all electrical power, including power to the computer, except for that power needed to maintain the accelerator in a "Stand By" condition
6.8.1.2	**Power On:** Turns on electric power to the accelerator
6.8.1.3	**Total Dose:** Sets the desired total dose for patient's treatment
6.8.1.4	**Time:** Sets time for patient's treatment. Time shall be used as a back-up in case of failure of total dose interlock. Backup time shall be calculated automatically with provision for manual reset.
6.8.1.5	**MU/Degrees:** Sets the desired MU/degree for rotational therapy. MU/degree shall be calculated automatically with provision for manual reset.
6.8.1.6	**Mode Selection:** Selects x-rays or electrons for treatment
6.8.1.7	**X-Ray Energy**: Selects photon beam energy
6.8.1.8	**Radiation On:** Turns on accelerator and radiation is produced
6.8.1.9	**Interrupt:** Immediately stops treatment.
6.8.1.10	**Treatment Complete:** Indicates that desired dose has been delivered. In addition, the operator should be alerted if radiation terminates for any reason other than reaching the set integrated dose. In such cases, the dose remaining to be given shall be indicated
6.8.1.11	**Arc Therapy:** Enables the accelerator to perform arc therapy
6.8.1.12	**Wedge**: Requires that the presence, identification and orientation of a wedge must be confirmed at the control console.
6.8.1.13	**Port Film:** Opens jaws completely or partially, as selected by the operator, and limits the amount of radiation to be delivered to less than or equal to 20 cGy. This shall be operational in both the photon and electron modes but allow only the production of low energy photons. Once the port film has been completed, it should be possible to return the collimators to their original setting automatically.
6.8.1.14	**Special Procedures:** Prohibits accidental selection of procedures such as electron arcs or high dose rate electron irradiation by providing an "extra step" in selection procedure
6.8.2	**Control Console Display / Monitors**: The following monitors and displays should be available at the control console, and with the exception of a back-up dose counter, it should be possible continuously to visually observe the value being registered on these counters and displays from the position of the operator.
6.8.2.1	**Dose Rate Indicator:** Indicates the dose rate at maximum build-up for a 10 x

	10 cm field at 100 cm SSD.
6.8.2.2	**Dose Counters**: Two counters that count integral dose detected by each of the two dosimeters
6.8.2.3	**Total Time Counter:** Counts total treatment time in 0.01-minute increments up to 9.99 minutes.
6.8.2.4	Angle: Indicates position of gantry in degrees with precision of ± 0.5 degrees
6.8.2.5	**Symmetry:** Indicates beam symmetry in both major axes
6.8.3	It should be possible to adjust the parameters at or near the control console:
6.8.4	**Accelerator Parameter Checks**: It shall be possible to monitor different accelerator parameters via an oscilloscope at or near the control console.
6.8.5	**Treatment room pendent:** Hand pendants shall be provided. The hand pendent must have the control of gantry rotation, collimator rotation, collimator jaw settings, treatment couch motions (vertical lateral, longitudinal and turntable rotation around isocentre and room light control. To prevent possible malfunctioning, when hand pendant is in operation, the computer system must prevent conflicting signals from being sent to the same mechanical device.
6.9	**Essential Accessories**
6.9.1	**SSD indicator:** A optical distance indicator (ODI) of SSD from 80cm to 130 cm with accuracy of ±1 mm at isocentre should be provided.
6.9.2	**Front and Side pointers** :A mechanical front pointer to locate isocentre of the unit within ±2mm and to apply to any orientation of the machine shall be provided
6.9.3	**A closed-circuit color TV system** with TV monitors and two cameras in the LINAC treatment room shall be supplied.
6.9.4	**Field Illuminating light**: A field illuminating system should be provided for both photon and electron modes.
6.9.5	**Motion-based skylight**: Vendor should provide the motion-based skylight with interior of treatment room wall decoration for all linear accelerators.
6.1	**Wedge Systems**
6.10.1	Provision of EITHER a set of standard physical wedge filters with wedge angles 15°, 30°, 45° and 60°
	Provision of virtual or dynamic programmable wedge fields of generating wedge angles. All available range of wedge angles (15 deg to 60 deg) to be provided.
	The programmable wedge fields shall provide a range of wedged fields starting at least 4cm up to 30 cm at 100 cm TSD
	Provision of a statistics log for tracking the accuracy of the programmable wedge fields' profiles
	OR
6.10.2	Provision for automatic, motorized, universal wedge system for variable wedge angles from 0° up to 60.
7	**Intensity Modulated Radiation Therapy & Volumetric Modulated Radiation Therapy System**

7.1	The linear accelerator system shall be capable of delivering Intensity (fluence) modulated photon beam within and across the given field apertures in order to produce highly conforming dose distribution as per the physician prescription.
7.2	Inverse treatment planning system shall be capable of doing IMRT and VMAT Planning of the linear accelerator offered.
7.3	Support for “step and shoot” IMRT and/or dynamic sliding window” IMRT delivery
7.4	Specify the LINAC performance for small MU delivery
7.5	Capable of delivering high quality intensity modulated fields using fractions of MU (please state minimum MU per segment)
7.6	Extended intensity modulated field size shall be at least 30 cm x 30 cm
7.7	Capable of automated delivery of multiple co-planar fields in sequence from the console with remote control of gantry, collimator and jaws motions between co-planar treatment fields.
7.8	Capable of verifying every parameter of segments downloaded from treatment planning systems through network for IMRT treatment
7.9	The latest technology for faster implementation of IMRT such as Volumetric Intensity Modulated Arc Therapy (VIMAT) or its equivalent should be provided.
8	**Image-Guided Radiotherapy System**
8.1	Kilovoltage-based 3D-Image-Guided Radiotherapy (kV-IGRT) shall be provided and it should have FDA clearance. The system shall have the capability of producing 2D radiography, 2D fluoroscopy and 3D cone beam CT (3DCBCT) and 4D cone beam CT (4DCBCT) imaging modalities to account for patient’s interfraction and intrafraction daily setup verification and respiratory motion.
8.2	A 3D volume CT image data is reconstructed from a series of 2D projection images acquired as the linear accelerator gantry is rotated. This image data can be used for verification of patient position and target motion. This shall have flexibility in providing full or partial gantry rotations.
8.3	The cone-beam CT technology should be of amorphous silicon (a-Si) based flat panel detector technology.
8.4	The system should be able to acquire and display on-board 2D and 3D volume images of the patient immediately prior to treatment. The images should be in DICOM 3 and DICOM RT format. The network provided should be able to transfer images to (from) EPID/CBCT from (to) TPS and simulator and additional workstations.
8.5	The quality of image, especially axial CT images from the CBCT should be sufficient to delineate target and critical structure volumes.
8.6	All Advanced image registration software commercially available should be supplied and should be able to overlay original reference images from the TPS to the on-board images and calculate offset values based on user defined reference points and structures. The software should be able to move the table as per the offset values in 3D and 6D.
8.7	Based on the comparison of initial planning images and on-board images, change in treatment plan should be possible.

8.8	The system should have latest configuration of hardware (CPU, hard drive, RAM, min 21" square TFT monitor, colour LASER printer)
8.9	There shall be a geometric calibration phantom for kV to MV isocentre alignment and other calibration.
8.10.	Image quality phantom to determine the low contrast and spatial resolution shall be provided.
8.11.	IGRT daily QA phantom for kV and MV projection imaging and kV CBCT checks and dynamic thorax phantom for validation of 4DCBCT imaging along with mechanically independent of platform motion and programmable through motion control software and all other necessary IGRT QA tools shall be provided.
9	**Stereotactic Radiosurgery and Radiotherapy of Intracranial and Extracranial Treatment System**
9.1	The frameless stereotactic treatment systems for both intracranial radiosurgery/radiotherapy (SRS/SRT) and also extracranial stereotactic body radiotherapy (SBRT) should be provided.
9.2	The vendor should offer necessary immobilization systems and other gadgets to perform frameless intracranial and frameless extracranial stereotactic treatment of brain, lung, liver and spine tumours for each 20 patients.
10	**Four-Dimensional and Adaptive Radiation Therapy Systems**
10.1	The vendor should provide advanced and latest model of optical surface tracking and gating solutions for entire four-dimensional (4D) treatment chain from imaging (4DCT) to (4D) treatment delivery. The system should consist of Advanced Laser based-optical Scanning, 4DCT acquisition and Gating Systems with following features;
10.1.a	The system should be of non-invasive, marker-free i.e no markers or devices will need to be placed on the patient or on the couch.
10.1.b	The system should support for patient positioning/surface mapping, intrafraction motion tracking/monitoring and respiratory gating of complete workflow.
10.1.c	The system should facilitate the 4D treatment of thoracic and abdominal tumours.
10.1.d	The system should have advanced algorithms for non-rigid and deformable models to enable real-time assessment of patient positioning errors before and during treatment delivery.
10.1.e	The system should check the patient position more than once every second with sub millimetre accuracy.
10.1.f	The system should have provision for audio-visual coaching apparatus to detect the deviation outside the set tolerance which also helps the patient to follow optimal breathing pattern.
10.1.g	The optical scanning system should support for 4D CT imaging acquisition and should be installed both in the CT room and also treatment room.
10.1.h	The gating system should be capable of prospectively gated and retrospectively gated imaging and treatment delivery.

10.1.i	All necessary phantoms and QA systems/tools/gadgets required for Commissioning and validation tests for clinical implementation of above systems should be provided.
10.2	**Stand-alone deformable image registration system** : The vendor should provide latest model of the stand-alone deformable image registration system with following features;
10.2.a	System should be capable of performing deformable image registration using CT/MRI/PET/SPECT images and should be provided with all commercially available deformable algorithms.
10.2.b	System should be capable of performing Auto contouring and Atlas based segmentation for Adaptive re-planning.
10.2.c	System should be capable of Adaptive re-planning interfraction Dose Accumulation.
10.2.d	System should support for DICOM /DICOM RT Import: CT, CBCT, PET CT, PET, MR, SPECT and diffusion weighted MRI (DWI), including cine/4D modes for all relevant imaging types.
10.2.e	System should support for DICOM / DICOM RT export: all meta-data and imaging data (including structure sets, treatment plans with doses) must be exportable in a DICOM-readable format along with deformations, either as deformable vector fields (DVF) or as resample deformed DICOM images.
10.2.f	System should have tools to generate maximum intensity projection, minimum intensity projection, average projection, mid-ventilation position reconstruction from 4D-scans.
10.2.g	System should be capable of performing 4D dose accumulations over all phases of respiration for evaluating the actual dose delivered to moving target.
10.2.h	Should have tools to reduce artifacts/noise from the images, e.g. attenuation correction, HU replacement in a user contoured or automatically defined area.
10.2.i	It should have Biological modelling solutions (EUD or TCP or NTCP etc.).
10.2.j	It should have external beam and brachytherapy dose accumulation.
10.3	**CBCT Electron density and image quality phantom:** The vendor should provide CBCT Electron density and image quality phantom specifically designed for CBCT with increased HU value for adaptive radiotherapy commissioning and QA of CBCT image quality.
11	**Utility Requirements**
11.1	**Power Supply**
11.1.1	Power conditioner shall be installed to provide precise voltage regulation and protection for the linear accelerator on offer.
11.1.2	Should work on three phase 400-440 V / 50 Hz Power
11.1.3	UPS of suitable rating with voltage regulation and spike protection for 60 minutes back up for whole linear accelerator systems (including associated TPS, server etc.) should be provided.
11.1.4	Resettable over current breaker shall be fitted for protection.
11.2	**Water Chiller System**
11.2.1	The chiller system provided shall **conform to international class / standards**.

11.2.2	The chiller system shall incorporate an automatic back-up facilities, remote control and alarm panel with warning facilities
11.2.3	Vendor should provide a fully automatic water chiller system for sufficient cooling of the linear accelerator
11.3	**Air conditioning and ventilation**: To be provided. Specify temperature, relative humidity and air changes.
11.4	**Safety Systems**: Patient, staff and machines safety interlocks, emergency switches and beam off interlocks to be provided.
11.5	**Machine space:** Details about the physical dimensions and weights of the machine and its accessories including control console to be provided.
II	**ADVANCED TREATMENT PLANNING SYSTEM**
	Inviting tender for supplying Advanced Radiation Treatment Planning System (TPS) capable of performing Conformal 3D-Planning, Inverse Treatment Planning for IMRT and VMAT, 4D-Treatment Planning and Adaptive Treatment Planning for clinical application of standard and advanced techniques in radiotherapy treatment for cancer. The offered system should have the following requirements and technical specifications.
1	**General Requirements**
1.1	The system should be integrated and connected to CT-Simulator, MR/PET and linear accelerators capable of dynamic sliding window IMRT and VMAT.
1.2	System should be capable of integrating with standard record-and-verify and networking and PACS systems commercially available.
1.3	The system should have latest technology of hardware and software features commercially available. Any advanced version which is released within 6 months period after LC opening should provide/upgrade for free of charge.
1.4	2 nos of TPS server with 128 GB RAM memory with Five treatment planning workstations with calculation licenses for 3D conformal planning and IMRT and VMAT planning capability and additional Five workstations for enabling contouring and virtual simulation with individual licenses should be provided. There shall be at least 10 TB storage for plan storage in addition to OIS storage. Vendor should provide the each unit price of both TPS and workstations offered.
1.5	The TPS system should have the capability of integration with CT-Simulators/MR/PET scanners and linear accelerator of any vendor. Virtual simulation software and licenses for virtual simulation features including for controlling moving laser shall be provided.
1.6	The system shall be linked to linear accelerator console through record and verification system and required port/Hub/connectors for network connection should be provided.
1.7	The offered system should be capable of performing both 3D conformal and IMRT and VMAT planning in the same single system.
1.8	Vendor should provide the time-line schedule for shipping, beam modelling, on-site training and clinical implementation and first patient treatment after LC

	opening.
1.9.	**Networking of all the systems of Radiation Oncology department like CT simulator, Brachytherapy machine, LINAC and TPS must be done by the Main LINAC Vendor.**
1.10.	**LINAC vendor also have to do the networking of various diagnostic equipment of the imaging department like PET CT, PET MR & MR to the radiotherapy system.**
2	**Three-dimensional (3D) conformal Planning:**
2.1	It should support 3D-Conformal radiotherapy planning (3DCRT) with LINAC and MLC of any make. It should include non-coplanar, asymmetric, arc and blocked irregular beams.
2.2	Advanced tools for automatic and manual contouring/segmentation of normal structures and target volumes on arbitrary axial, coronal and sagittal planes. Non-uniform automatic and manual margining for CTV and PTV in 3D with exclusion barriers should be possible.
2.3	Manual and fully automatic image registration using mutual information modes for image fusion among CT, MRI and PET should be provided. The fusion results should be qualitatively and quantitatively verifiable with checker board and in vertical and horizontal split screens spyglass and image overlaying options.
2.4	3D visualization of anatomical structures, beams eye view (BEV), rooms eye view (REV) and dose distributions shown in 2D and 3D solid, wired and transparent multi-planar views including colour wash mode.
2.5	Multiplan viewing for comparing dose distribution of at least three rival plans including interactive DVH (qualitative and quantitative) comparison. Summation and subtraction of dose plans should also be possible.
2.6	Creation of DRRs in any desired plane including the beam cross-sectional plane should be possible for export to EPID and virtual simulation console.
2.7	EUD or TCP and NTCP calculations should be provided
2.8	Compatibility with any reputed international class RFA system for beam data transfer. Necessary software and support for beam modelling into the TPS should be provided.
2.9	It should support full DICOM connectivity for import and export of data with query/retrieve support, DICOM CT, MR, PET image support, and DICOM RT structures, set, RT plan and RT dose support.
3	**Patient anatomical imaging and data transfer:**
3.1	The patient data must be transferred from CT, MRI, PET via DICOM, CD and DVD's.
3.2	Image data from CT/MRI slices must be transferred direct using DICOM from CT/MRI scanners, Simulators, RFA system and patient-specific QA system.
3.3	The system should select at least 150 images per patient and to do real-time multi-planer reconstructions from original CT/MRI image data sets.
4	**Image handling**

4.1	Should support the prone or supine, and head-first or feet-first patient orientation.
4.2	Image processing tools should include mean filter, median filter, threshold, and adaptive histogram.
4.3	Window/level facilities for grey scale images should be possible
4.4	Image utilities should include distance, area and volume measurements and statistical calculation of CT values within a user-defined region.
4.5	Zooming of high-resolution image and screen dumps to a colour printer should be possible in any stage of the planning program.
4.6	Each image should contain information of the imaging equipment (scaling, orientation); the images should be in arbitrary order and arbitrarily spaced.
5	**Contouring**
5.1	System should support contouring templates that list structures of interest and define structure display properties.
5.2	Automatic contouring of patient outlines and internal structures through all CT images.
5.3	Post-processing tools that smooth, reshape, connect, disconnect structures should be possible.
5.4	3-D auto-margin functions (e.g. CTV to PTV) with independent margins in 6 directions.
5.5	3-D manual contouring tools that work in the transversal, sagittal and frontal images.
5.6	Interpolation of contours
5.7	Manual contour entry and editing
5.8	Display of frontal and sagittal images for reference should be possible
6	**Dose Planning**
6.1	System should support planning library that define field orientation, name, margins, isocenter location, and dose prescription
6.2	The field should be centered automatically to the center of any volume
6.3	Different energies (photons and electrons) to combine in a single plan should be possible
6.4	Each field should have separate isocentre
6.5	Import of image, isocentre and plan data from CT scanner
6.6	Entire group of fields should be moved together
6.7	Auto-blocking with a user-defined margin around target volume
6.8	Block outlines should be modified graphically
6.9	Ability to copy, move and mirror blocks
6.10.	Auto-MLC with a user-defined margin around target volume
6.11.	MLC aperture should be modified graphically
6.12.	Ability to copy and mirror MLC settings
6.13.	User-defined density for bolus
6.14.	User-defined CT numbers within specified regions (remove contrast medium) in any plane

7	**Dose Calculation should support for:**
7.1	Photon energy range from 6MV to 15 MV X-rays and multiple electrons.
7.2	3-D dose calculations with coplanar and non-coplanar photon and electron beams
7.3	Calculation of Monitor Units for any vendors of linear accelerators
7.4	3-D dose calculations should be performed simultaneously with multiple patients planning
7.5	Normalization of dose distributions to minimum, maximum, any arbitrary % value or to any dose point value
7.6	User-definable transmission factors for blocks etc.
7.7	Beam hardening in metallic wedges should include in the calculation
7.8	Isocentre and fixed SSD fields
7.9	Photons, electrons beams
7.10.	Irregular fields
7.11.	Coplanar and non-coplanar fields
7.12.	Asymmetrical collimators with field central axis over-travel
7.13.	Shielding blocks (number should be specified)
7.14.	Standard physical wedges
7.15.	Motorized universal physical wedge
7.16.	Enhanced Dynamic Wedges/Virtual wedge
7.17.	Bolus
8	**Dose Calculation Algorithms**
8.1	**TPS should include any of the following algorithms:** **Electron beam: Monte Carlo or equivalent.** **Photon beam: Monte Carlo or equivalent (ACUROS-XB) calculations algorithms and AAA/CCC/ or equivalent should be provided.**
8.2	Specify the Inhomogeneity calculations algorithms available.
9	**Plan Analysis and Evaluation**
9.1	Side-by-side plan comparisons such that images are linked to display the same image planes (frontal, sagittal and transversal) simultaneously should be possible.
9.2	DVH for any multiple structure volumes in one plot
9.3	DVH for multiple plans in one plot
9.4	Differential or cumulative dose volume histogram
9.5	Absolute or relative scale for the structure volume axis of DVH plot
9.6	Export of DVH data into other formats (ASCII file/Excel file, etc.)
9.7	Printout of DVH graphs on paper
9.8	Point dose display
9.9	Display and plotting of any arbitrary dose line profiles
9.10.	Multiple plan summation and store summed plans should be possible.
10	**Inverse Treatment Planning for IMRT and VMAT**: Inverse planning optimization should be used to determine fluence pattern or beamlet intensities/aperture shape for each field and translate it to delivery

	instructions. Inverse planning algorithms should be specified in the offered TPS for IMRT and VMAT Planning with the following capabilities:
10.1	System should be capable of handling unlimited target and normal structure volume objectives and dose-volume constraints.
10.2	The dose optimization should be fast and interactive. Optimization algorithms either deterministic or stochastic should be provided. Both physical and biological optimization algorithms should be provided.
10.3	The system should support planning for both step-and-shoot and dynamic sliding window IMRT delivery and also for VMAT.
10.4	MLC leaf sequencing algorithms for beamlet-based/direct aperture-based/direct machine parameters-based should be provided.
10.5	System should be capable of modelling/incorporating MLC head scatter, penumbra, physical limitation of MLC motion, rounded leaf ends and tongue- and groove effects.
10.6	Specify all dose calculation algorithms used in the offered inverse planning.
10.7	The dose grid should be finer than the size of the beamlet or incidence fluence
10.8	System should be capable of calculating doses in the build-up region using bolus
10.9	System should be capable of calculating doses in the region of flash and also in the mobile target like breast target.
10.10.	Advanced inverse planning features should be included to follow ICRU-83 nomenclature of volume definitions and dose reporting and recording the treatment.
10.11.	Comparison of planning images with images received via network from EPID system for necessary changes in treatment plan should be possible
10.12.	Vendor should provide the necessary QA tools/gadgets for commissioning of the inverse planning system for dosimetric accuracy.
11	**Four-dimensional (4D) Planning** : The system should be capable of performing 4D-treatment planning and adaptive re-planning, having features such as auto-segmentation, deformable imaging registration for target delineation and other necessary tool/gadgets and systems.
11.1	System should be capable of doing both rigid and deformable image registration with all imaging modalities (CT/MRI/PET/CBCT) used in radiotherapy planning.
11.2	Should be capable of automatically register images, such as MIP, Min-IP, Average-IP,or free-breathing images with 3D/4D images.
11.3	Specialized contouring tools should offer to make dose planning in 4D.
11.4	System should be capable of 4D-viewing, assessment, and contouring in 4-D movie loops and 4-D blinding images.
11.5	System should be capable of shaping fields on moving DRR feature.
11.6	System should be capable of automatically re-contours subjects for re-planning post-or mid-way through treatment.
12	**Quality Assurance Software Systems** for testing the performance of Image registration and fusion, auto-segmentation, deformable image registration for

	4D dose calculations and adaptive planning of interfraction dose accumulation capability should be provided.
13	**Plan Output**
13.1	The plans should be exported directly after approval to linear accelerator for dose delivery.
13.2	User-definable print layouts
13.3	On-screen graphics should be dumped to a colour graphics printer
13.4	Plotting of plan in a user selected scale on A3, A4, letter or tabloid size paper
13.5	Printouts should include patient administration data, time stamp, field parameters (treatment unit, gantry, collimator and couch rotations, field position coordinates, field size, wedge, weight, Monitor Units), dose parameters (target maximum, minimum and mean, maximum dose), patient orientation and plotting scale.
13.6	DRR should print with cross-hairs to identify isocentre
13.7	DRR should print with graticules to identify scale
13.8	DRR should print with structure outline projections
13.9	Should be scaleable DRR printouts
13.10.	Plotting of BEV image at any distance.
13.11.	Block outlines should be plotted in a user-defined scale with internal structures and field edges
14	**Network Connectivity and Import/Export licenses**: All licenses required for above mentioned planning capabilities should be included, even if it is not listed now, but which are necessary and obvious.
14.1	Multiple 3D workstations should be connected to TPS network.
14.2	Multiple 3D workstations should import image and plan data
14.3	Should support for different image modalities (CT, MR and PET) for target and critical organ delineation.
14.4	Should support DICOM-RT import/export of:
14.5	At least DICOM 3.0 images.
14.6	Radiotherapy Images (CT, MRI, PET, Simulator image, EPID, CBCT etc.)
14.7	Radiotherapy Structures
14.8	Radiotherapy Plans
14.9	Radiotherapy Dose Matrix
14.10.	Radiotherapy Dose points
14.11.	Radiotherapy Fluence
14.12.	Radiotherapy dMLC for IMRT
14.13.	Radiotherapy Blocks.
15	**Hardware System Specifications**: The latest configuration of the computer/PC available at the time of shipping should be the basic platform for the TPS.
15.1	The CPU shall perform 64 bit instructions
15.2	There should be at least quad core processors with speed of each exceeding 2.8GHz

15.3	The system should have minimum 28GB RAM capacity.
15.4	Disk space for patient data should be of RAID type with a capacity of 2 TB
15.5	Internal Read/Write CD/DVD on the TPS computer must be included for archiving
15.6	21' Flat panel screen with a resolution of at least 1280 x 1024 pixels should be provided.
III	**ONCOLOGY INFORMATION & RECORD AND VERIFY SYSTEM**
	The oncology information for recording and verifying communication between treatment planning systems and treatment delivery system. The system should have latest model/version of hardware and software features commercially available.
1	The vendor shall provide a comprehensive oncology information & image management and treatment record & verify system. The system shall assist in the integration of radiotherapy patient data throughout the entire department which includes treatment planning systems, linear accelerators, CT-Simulator, imaging units in the institute. It shall also record and verify treatment parameters of patients undergoing treatment on LINAC(s). The system shall be based on one comprehensive database, thereby eliminating the need for redundant entry of data used in different applications.
2	The system shall provide the following functions: Record and Review Patient Diagnoses; capable of recording the diagnosis as per the ICD C and ICD 10 system and complete ICD C and ICD 10 codes should be available in the system without requiring extra input, Plan a course of treatment in advance so that treatments are readily delivered when the patient arrives; Write RT prescriptions that detail treatment techniques, fractions, and dose; Define treatment fields; Link setup fields and notes to treatment fields; Setup notes should include photos that show how to set up the patient; Track dose to specific sites; Define site breakpoints with instructions that appear when the breakpoint will be exceeded; Store treatment plan information to avoid redundant and time-consuming data entry. **Vendor should provide the each unit price of OIS workstation offered.**
3	MLC user operation shall be accomplished entirely through the Oncology Information System (OIS), thereby eliminating the need for a separate control station for the MLC. Planned leaf shapes shall be incorporated directly into a patient's planned treatment field(s) in the electronic Chart.
4	The MLC shape shall automatically appear on the OIS treatment screen during the setup and treatment of any patient with a planned MLC shape. The shape shall be displayed simultaneously with all other pertinent treatment parameters.
5	The system shall have the capability of storing patient photos facilitating correct treatment. The digital patient photographs should upload to the database. After treatment of the first field, all subsequent fields shall be automatically and sequentially downloaded to start auto-setup of the next field without requiring operator interaction at either the OIS console or In-Room

	Monitor.
6	Port Films shall be capable of being planned ahead for appropriate treatment sessions, completed with prompting from the system, and automatically recorded in the electronic chart. Port Film dose shall be capable of being accumulated, if desired. The system shall permit override of individual treatment parameters (couch longitudinal for example) and require a password and appropriate user rights to successfully complete the override.
7	The record and verification station shall accept and store demographic data, notes or comments and diagnostic information for each radiotherapy patient. When the patient proceeds with tumor localization, treatment planning and simulation, the treatment parameters will also be entered into the patient's file automatically or manually.
8	A daily patient schedule and time management schedule must be capable of being displayed on the computer monitor at the record and verify workstation. This schedule shall include, at a minimum, the scheduled treatment time for each patient, the patient's identification number and the patient's name. The schedule shall be used to select a patient for treatment on the accelerator.
9	The system shall be capable of maintaining a record of field-specific and treatment-specific daily and cumulative doses for the target site and additional sites of interest. It shall be possible to specify a prescribed dose for each treatment site for every patient. The system shall prevent treatment if this dose will be exceeded upon completion of the treatment. A manual override shall be provided. Overriding prescribed dose limits by unauthorized personnel shall not be permitted. After the daily irradiation of a patient, the therapy history will be updated and the given target doses, or doses calculated to other sites, shall be accumulated.
10	The Operating System shall provide a convenient and efficient means for the user to generate and to print hard copy reports of information contained in the database.
11	The scheduler of the OIS should be capable of maintaining schedules for multiple departments and scheduling any resource desired by the site. It should have a graphical user interface for ease of customizing schedule views, changing appointment times and minimizing keystrokes.
12	The OIS shall provide the capability to integrate simulation, CT, MRI, PET and electronic portal imaging system images into the OIS database to provide a readily available reference during the patient’s course of treatment. Reviewing images immediately after acquisition from a remote location shall be permitted.
13	The Hardware should consist of the following: **One integrated server for data management and image management with back up with 8 TB or more capacity** to handle busy department workload. Additional 10 Image Workstations for Review and Approval; a networked colour image DICOM laser printer; capability for high speed internet connectivity for Online Service support. Vendor should provide licenses in order to use ten user simultaneously.

14	The vendor should provide the storage server for backup of patient databases.
15	**Equipment Warranty and Service Facilities**
15.1	Five years warranty to be commenced from first patient treated as per AERB norms.
15.2	CMC year-wise for quoted machine, UPS, Battery and other accessories for next 5 years after warranty period.
15.3	Spare parts should be available for minimum of 10 years.
15.4	During the warranty period, all the software updates should be provided for free of charge.
15.5	Quote the rates of necessary consumables valid for 5 years block of CMC period
15.6	Factory trained service engineer/Application specialist should be available in Delhi to look after the installation and maintenance of the system without patient treatment interruption.
16	**Safety Standards and Training**
16.1	Equipment standard and safety should comply with the national regulatory AERB requirements.
16.2	System offered should be of USA-FDA and European CE certified product.
16.3	On-site application training should be provided for minimum two weeks for all concerned staff members in the department.
17	**General Terms & Conditions**
17.1	The vendor shall list the number of their offered TPS installation/user in India.
17.2	All claims regarding meeting the specification should be duly supported by appropriate, latest technical catalogues/brochures from the manufacturer.
18	**National Regulatory Body and Radiation Safety and Protection Requirement**: The vendors should visit the site and user department to get the Plan Layout and should facilitate and coordinate with user department in communicating with AERB in providing all required information pertaining to radiation safety compliance of the concerned equipment till the clinical commissioning process of first patient treatment commencement.
IV	**SCOPE OF WORK FOR FACILITY SITE MODIFICATION:**
1	The Supplier should inspect the proposed site offered by the Consignee, wherein the LINAC has to be installed. They are required to submit the plan for the project. The scope of work includes complete Electrical, Wall finishing, Air-conditioning, Flooring for the proper functioning of the LINAC. The supplier shall assist the user by providing necessary documentations/technical data for regulatory clearances and approvals from AERB. (The site plan is attached herewith as Annexure I).
2	The cost of the facility site modification work should be quoted separately and this cost will be considered for L1 calculation.
3	Vendor will have to quote Unit Rates of the following components of Site Modification work.
3.1	Electrical work
3.2	Air conditioning (HVAC)

3.3	Flooring
3.4	Wall Finishing & Painting
3.5	False Ceiling
4	The payment for site modification work shall be based on the Unit Price quoted by the supplier applied to the actual measurement of Site Modification work executed at the supplier at the site.
5	Bidder should clearly mention break up price of each component of Site Modification work separately.
6	The system should be installed and handed over in working condition with all necessary electrical, wall finishing, air conditioning, flooring and plumbing work undertaken by the vendor in consultation with the user dept.
7	Rate quoted for Site modification work, Furniture like desks, chairs, shelves etc; and the price quoted for 30 TR HVAC is included for L1 calculation of the bids.
8	**The LINAC CENTRE shall consist of the following rooms:**
8.1	LINAC Treatment Room
8.2	Console Room
8.3	UPS & batteries Room
8.4	Equipment / Electrical Room
9	The supplier shall be required to specify the total load requirements for the LINAC centre including the load of air conditioning , room lighting and for the accessories if any. The supply line will be provided by the Institute up to one point within the LINAC centre. The mains panel and distribution panel for LINAC, HVAC, and LIGHTING should be provided by the supplier. Few lights in LINAC, CONSOLE ROOMS, UPS ROOM shall be connected to the UPS to provide emergency lighting.
10	The bidder may quote the unit rates of any other site modification work activity which is not mentioned in the list below.
11	**THE ELECTRICAL WORKs:**
11.1	Wiring – All interior electrical wiring with main distribution panel board, necessary MCBs, DB, joint box, switch box etc. the wires shall be of copper of different capacity as per the load and should be renowned make as listed below.
11.2	All necessary cabling like LAN, DICOM & PACS for data interface between TPS and LINAC; CT-SIMULATOR & LINAC should be provided with adequate number of terminals.
11.3	All the internal wiring including that of telephone, LAN, DICOM & PACS etc) will be concealed variety.
11.4	Earthing: Double earthing with copper plate shall be provided for the LINAC and all accessories like UPS and Chiller. The earthing for the AC should also be done by the suppliers. The earthing cable/wire shall be routed end-to-end through an insulated conduit.
11.5	Switches light and power points should be of modular type and of standard make as listed below.

11.6	General lights – Ceiling mounted LED lighting panels, recessed 600 x 600mm should be provided. Light dimming facility should be provided wherever it is necessary.
11.7	All wires used must be FRLS (Fire Retardant with low smoke) type only.
12	**AIR CONDITIONING WORKS : (15 TR + 15 TR backup : Total 30 TR HVAC)**
12.1	The area marked for Site Modification work needs to be air-conditioned. Package Air Conditioners may be used according to room requirement and suitability. Humidity control should be provided to effectively eliminate moisture condensation on the equipment. The Air conditioning system should be designed with standby unit(s) to provide uniform air-conditioning 24 x 7.
12.2	In the case of LINAC-CHILLER is placed indoors; the Air-conditioning system should be able to provide adequate ventilation and heat exchange for the same.
12.3	The outdoor units of AC should have grill coverings to prevent theft and damage.
12.4	Stand-alone Room Dehumidifiers of adequate capacity to be provided for LINAC Room, Console Room and TPS Room to ensure condensation- free atmosphere for the high value equipment.
12.5	The Air conditioning of the LINAC treatment room shall have minimum 6 air changes per hour.
12.6	Environment specifications:
12.6.1	Humidity range: Relative humidity 60% and 80% in all areas except equipment room which shall be as per requirement of the equipment.
12.6.2	Temperature ranges: 22 ± 2° C in all areas throughout the year, except equipment room which shall be as per requirement of the equipment.
12.6.3	Air conditioning load: The heat load calculations and maintaining the desired temperature and humidity shall be the responsibility of the supplier.
13	**FLOORING WORKs:**
13.1	600x600 mm vitrified tiles with 100mm matching tile skirting in LINAC Room & Console Room. Note: Providing and laying approved quality, colour, design and shade fully homogeneous 600 x 600 mm (thickness to be specified by the manufacturer)Vitrified tile flooring (Marbonite or Granamite, confirming to IS code 15622 with water absorption less than 0.08%)flooring in pattern as detailed in drawing or as directed by the institute and grouted with matching colour approved quality readymade grout, curing, cleaning etc to required line level etc. all complete at all leads, lifts and heights to the entire satisfaction of the institute. Providing and fixing 2-3mm thick POP protection over polythene covering sheet to flooring areas till handed over and cleaning, etc all complete as per drawings & Specification.
13.2	50 mm thick cement concrete flooring with 3mm Vinyl flooring in UPS Room / Equipment Room
13.3	Floor levelling if required to be done by supplier. All installation related floor modification non-structural) like Turntable pit, trench etc. to be done by supplier.

13.4	The LINAC room, Console Room & UPS Room will be made rodent /pest proof.
13.5	Mode of measurement (finished surface area of the tiles shall be measured and paid. Rate shall be inclusive of providing and laying levelling course, PVC spacers, providing and applying epoxy grout and no additional payment shall be made for wastage.
14	**WALL FINISHING & PAINTING**
14.1	Two coats Plastic Emulsion Paint over 2 coats of wall putty including primer in all areas not covered by wall tiles. Colour to be approved by institute.
14.2	Wall Tiles-High quality density Vitrified Tiles clad on the side walls up to a uniform height of 1200 mm in all rooms; except UPS & equipment rooms. Colour to be approved by institute. Note: Providing all tools, tackles, materials, manpower for applying plastic enamel paint over
14.3	Coats of wall putty including primer in all areas, of approved brand and manufacture and approved shade finished with roller to wall & ceilings surfaces, in 2 coats over a coat of approved quality primer on the plastered/POP surface, POP board/Gypsum board surfaces including scaffolding, preparation of surface, sanding, light sanding, work platform, painting equipment/apparatus etc. required to complete interior grade finish etc. at all heights & levels complete as per drawings & Specifications.
15	**FALSE CEILING**
15.1	Acoustical tile for ceiling with light weight insulating material of high quality supported on grid or finished seamless with support above ceiling. To be finished with white paint or powder coated with white paint, if metallic. The false ceiling panels should be of reputed brands.
16	**MISCELLANEOUS:**
16.1	The LINAC room shall be provided with wall-mounted storage cupboards within LINAC room; to store: Dosimetry & QA Items, LINAC accessories.
16.2	Sufficient number of Open Racks of high Quality vendors should be provided to house the immobilization materials; within LINAC room
16.3	TPS room should be provided with LED X-ray film viewer with adjustable brightness; capable of holding 3 films of 14"x17" size-2 nos.
16.4	The CONSOLE room shall be provided with Wall mounted Storage cupboards with MDF laminate shutters; to be fixed on the wall above the workstation (approx 1800mm length; 750 mm height; 300 mm depth).
17	**FURNITURE:**
17.1	Revolving chairs height adjustable, medium-back with hand-rest for Control room, TPS room - 12 Nos.
17.2	Workstation/Tables for Console room & TPS room: The Console room and TPS room should be provided with suitable workstations(s) of reputed brand, to accommodate the various Terminals in Console Room, TPS Room. The Workstation shall be providing with enough power sockets, LAN sockets etc. to enable smooth functioning of the LINAC and TPS.
17.3	Bookshelves: Four-door bookcase with glass doors, height approx. 1700mm; to store manuals; CD/DVDs, spares etc-4 Nos.

17.4	Shoes Rack - 2 Nos.
18	**LIST OF ITEMS AND SUGGESTED MANUFACTURERS.**
	A. ELECTRICAL
	1. CABLES - Gloster, Universal, Polycab
	2. WIRES - Finolex, Havells, V-Guard, RR Kabel, Gloster, Anchor
	3. SWITCHES - Legrand, L&T, Crabtree , Roma, MK, Crabtree
	4. DISTRIBUTION BOX , MCB - Legrand, L&T, Siemens, Havels
	5. LIGHT FITTINGS - Philips / Crompton / Kesselec-Schreder / Wipro.
	B. AIR CONDITIONING -Daikin, Hitachi, Blue Star, Voltas
	C. FURNITURE -Hermen Miller, Godrej, Featherlite, Wipro
	D. FALSE CEILING - Armstrong, Saint Gobain, Luxalon.
V	**RADIOTHERAPY DOSIMETRY EQUIPMENT**
	The following dosimetry equipment and systems that are required for the dosimetry and quality assurance for safety and quality of the radiotherapy treatment shall be provided by the vendors **(One set for Two nos. of Linear Accelerator)**.
	DOSIMETRY AND QUALITY ASSURANCE EQUIPMENT AND SYSTEMS
1.	**RADIATION BEAM THERAPY ANALYSER** Require a full-fledged three dimensional rectangular Water Phantom & Dosimetry System and therapy beam analyser for performing Off-axis profiles, PDD, point dose measurement, beam symmetry tuning, Dose rate constancy check, vector scan and TG51 lead foil measurement for low and high energy Photon, electrons. All the measurements should be computer controlled and user friendly.
1.1	All components comply with national and international regulations and safety rules. All components of the system; all available options are controlled by the same software that runs under Microsoft Windows of latest version of Windows 2000 and Windows XP. The system should suitable to measure pulsed radiation with fluctuation dose rate Ion Chamber:
1.2	Necessary thimble ionization chamber should be there for measurement of field and reference signal plane parallel chamber should be there for electron measurement. The necessary holding devices extension cables for the above chambers must be included. The chamber specification should be quoted. The position accuracy should be better than ±0.1mm. The chambers should be properly calibrated and given necessary calibration certificate. Brass build up caps needs to be provided.
1.3	The positioning tool should be there to allow easy and exact positioning of the chamber's geometric centre in the central beam and at the water surface. Apart from this the exact position of the chamber the radiation beam should be possible via software.
1.4	The detector unit should be driven by stepper motor and step length should be adjustable in steps of mm. The scanning speed should be adjustable between 5mm/s and 50mm/s in 5mm/s small steps. Further the delay times for each step should also be adjustable by the user. The acceleration of the step

	movement should also be changed as and when required.
1.5	The system should allow simultaneous movement in available direction for any vector scan and shall be a latest system with water levelling sensor in order to do a quick setup where water levelling delays can be avoided.
1.6	The zero point, reference point and limit of the different detector units should be stored separately and permanently in the control unit.
1.7	The control pendant should display the actual position of the chamber position at any given measuring time.
2	**Water Phantom/ Radiation Field Analyzer:**
2.1	The scanning volume should be large enough to scan and should not be less than 48x40x48 cm To avoid bending of the tank's walls by water pressure and water absorption of the acrylic material 1 wall thickness should be not less than 2.0 cm
2.2	The motor of the moving mechanism should not touch not touch nor dip to the water to avoid mechanical stress to the acrylic tank.
2.3	The reproducibility of a position should be ±0.1 mm throughout the whole phantom
2.4	The digitally driven stepper motors should provide hysteresis free movements (stick and slip free).
2.5	The lift table should be electrically as well as manually operable.
2.6	The velocity of the vertical motion should be quoted and preferably should have two vertical velocities. The Water Tank must be rotatable into positions 0 degree, ± 45 degree and ±90 degree.
2.7	A highly accurate Positioning device directly supplied by the principals must be included.
3.	**Water reservoir**
3.1	The water reservoir should be large enough to store the water and can be pump and drain to the water phantom as quick as possible. The water Reservoir must be able to hold the entire weight of the water without any change
3.2	The weight of the whole assembly can be push or pull though the wheel with polyethylene or equivalent. The lifting carriage should be electromechanical/elevating screw mechanism that keeps the height absolutely accurate
3.3	The Lifting carriage and Water Reservoir must be imported and directly from the suppliers and must complete with all facilities including TPR and TMR measurements. Completely Integrated Lifting Carriage and Water Reservoir.
3.4	The Water Reservoir must be compatible for TPR measurements and hence for TPR measurements 1 pump of the reservoir should drive automatically and electromagnetic valves makes sure that no water can flow the phantom tank to the reservoir during automatic TPR measurement.
3.5	The water reservoir should have a safety circuit that avoids the dry pump running Control Unit/Electrometer:
3.6	A separate control unit for controlling the movement of the detector in any three directions should possible.

3.7	A separate electrometer to collect the ions/dose from the chamber/detector should be there The voltage to the chamber should be adjusted in the electrometer in steps of 50 V. The polarity of the chamber should be toggled between +/-. The electrometer should also be able to measure absolute doses for low and high energy photon and electron.
3.8	The gain of the electrometer should be automatic depending upon the signal collected by the field and reference detector. Further the user should also be given an option to change the gain to field an reference separately.
3.9	Necessary software to use the electrometer for absolute measurements should be provided.
3.10	The time constant should allow 10ms measurement times.
3.11	The external dosimeter should also be connecting to the water phantom.
3.12	The control unit should permanently store zero point, reference point and limit points for water phantom, air scanner and mechanical film densitometer separately.
3.13	These different sets of limits , zero and reference points can be retrieved independently.
3.14	The co-ordinates of the probe should display for all directions, simultaneously on a control pendant.
3.15	The control pendant can be attached either to the water tank or to the control unit.
3.16	The communication between the control unit and the computer should performed by a standard RS23; interface.
3.17	The high voltage for the probe should be switchable independently for each decreased in different voltage and sign of the measuring signal can be reversed.
3.18	A solid, water equivalent phantom made up of slabs of different thicknesses shall be provided by the vendor for external beam teletherapy dosimetry. It shall be possible to use this phantom for both photon and electron beam dosimetry. The phantom shall be free of contaminants and air bubbles. The slab shall be of 30x30 cm or more size totalling a thickness of 30 cm.
4	**Control Computer:**
4.1	The latest version of windows computer should have all the latest features with colour monitor and with printer/plotter (colour) and branded UPS (45 min. back-up).
4.2	The software:
4.3	Measurements can be done against time, against a monitor signal or against reference chamber
4.4	Within the moving range arbitrary points can be measured.
4.5	An arbitrary vector scan measurement should be possible.
4.6	Point dose measurement, Beam symmetry tuning and TG5I foil measurement should also be possible
4.7	2D planes can be measured at any solid angle

4.8	Isodose can be displayed and plotted that can constructed out of profiles and depth dose curves or measured matrices. The Isodose level should be freely closable Warning before unsaved date in the RAM should be overwritten.
4.9	The Isodose levels can be chosen after the measurement and without the necessity to have the water phantom connected.
4.10	Multiple closed Isodose lines and hot spots should be detected automatically.
4.11	Single measuring points, complete curves and parts of curves should be re-measured from a user definable point.
4.12	During the measurement the measuring curve should be display graphically and online on the screen.
4.13	A special measuring program allows a dose rate constancy check including a statistical evaluation.
4.14	Any kind of open, regular shaped, blocked or wedged field can be measured.
4.15	Fields from asymmetric collimators can easily be measured.
4.16	A special measuring routine for service purposes allows to easily checking the beam with respect to symmetry, flatness, homogeneity and energy.
4.17	Implemented routines allow the measurement, formatting and transferring of basic date to all-important therapy planning systems.
5	**ABSOLUTE DOSIMETRY**
5.1	Secondary standard Dosimeter with appropriate thimble chamber and parallel plate chambers with latest calibrations to be provided. Including pin point chamber for small field dosimetry with phantoms and required calibration
5.2	Solid equivalent slab water phantom with adapters for the above mentioned chambers should be provided.
6	Suitable Film Scanner along with Film Dosimetric software should be provided for treatment verification Administrative Data:
6.1	Comprehensive documentation of the measured data by automatic saving of the used measuring environment should simplify the interpretation of data even a long time.
6.2	The used measuring routine data can be reused either unchanged or with some of the parameter changed Data can be printed and plotted in numerical and graphical form on all printers and plotters that art supported by windows.
6.3	The administrative data can be changed after saving the measuring data. All measuring data should furnished automatically with their administrative information and comprehensive filter function allows the easily selection of specific data.
6.4	The necessary software to network the 3D TBA system with the 3D TPS in the department of Radiotherapy must be offered.
6.5	**Data analysis:**
	Various normalization should possible viz. normalization to maximum for depth dose curves normalization to maximum or centre for profiles and normalization to maximum, enter, position and value for isodose lines. Homogeneity and symmetry should be calculated automatically and various national and

	international protocols can be selected. Depth dose curves can be analyses according to the protocols DIN 6800/2 IAEA TR277, ICRU 35 CRMRI no.2, AAPM TH21/TG 25 and NACP.
6.6	**Data transfer and data presentation**
	Modules should allow automatic formatting and transferring of measured data to treatment planning system available in the department. The measured data can be stored in two different ASCII formats (with selectable separation characters). ASCII -data can be sent from external computers and be imported in to the water phantom software Image date for film dosimetry can be imported in to water phantom software. Data can be display graphically on the screen. Crosshairs should allow the easy manual evaluation of a curve. Plotting / printing of the measured data and correction functions can be printed (alphanumerically) and plotted (graphically).
7	**ARRAY DETECTOR**
7.1	One Array device must be based on ion chamber array resulting in an effective measuring field of 27 cm x 27 cm and giving the facility to use with slab phantom for measurements. The chamber must be vented plane-parallel square shaped ion chambers with 5mmx5mmx5mm size and centre to centre spacing must be 10mm.
7.2	It should be able to use for the dose verification of IMRT beams and routine quality control of high energy photon and electron beams by using the software and also it should be able to check the MLC leaf positioning. It should be able to measure the dose from dynamic and static fields in one run and display the readings in both dose rate and absorbed dose mode.
7.3	It should be able to perform the QA for high energy beams and dose verification for IMRT, IMAT, ARC beam techniques like RapidArc or VMAT. It should be capable of doing complete pre-treatment patient plan verification with on measurement.
7.4	Cylindrical & Rotational Phantom with inclinometer, lifting trolley & complete drive assembly with related software module for VMAT dynamic IMRT techniques. There should be a slot & provision to insert the 2D Ion Detector Array System into the Rotational Phantom for taking synchronous measurements with the Linac Gantry Rotation. The detector should always be perpendicular to the beam & thus removing the angular dependence.
7.5	The software should have the functionality like 3D volume analysis and CT overlay.
7.6	One additional Array Device with 900 or above liquid filled ionisation chamber for patient plane verification & quality control of small fields. Detector spacing should be 2.5mm & the maximum fit size should be above 10x10 cm & below 12 x 12cm essentially for use with Small field dosimetry. The Array device should also be usable for Stereotaxy work This Array device should be usable with the Cylindrical & Rotational Phantom
8	**Other tools:**

8.1	Calibrated Barometer and thermometer to be included.
8.2	Gafchromic films 1 box each of small & large size. A minimum of 50 films shall be provided since there are 2 Linacs to be Commissioned.
8.3	One parallel plate chamber for electron dosimetry, one number of pin point chamber for small field dosimetry to be used with absolute dosimetry system is to be supplied along with the calibration certificate for all these chambers.
8.4	ION chamber based Survey meters along with One Additional Pressurised ION Chamber to be supplied.
8.5	Winston Lutz tool with required software shall be provided for Isocentre check required for stereotactic treatments.
VI	**MOULD ROOM AND PATIENT FIXATION AND IMMOBILIZATION DEVICES/ACCESSORIES**
	The mould room and patient fixation and immobilization devices/accessories/ tools are required in developing and implementing of a comprehensive, ultra-modern 3-D CRT, IMRT/VMAT and SBRT program in the department of Radiation Oncology. The vendor should provide the all items with product information brochures.
1	Patient alignment laser system with patient support Couch for the mould room: The vendor should provide an stable flat top couch for medical use along with fixed sagittal green laser in-tune to aligned with the sagittal laser of the CT simulator and treatment room should be provided.
2	Patient Fixation / Immobilization Accessories : The vendor should provide high precision Radiotherapy immobilization devices for Head, Head & Neck, Pelvis and Breast with handle as ultra-light weight, remarkable reproducibility, stability and durability items are as follows: The Universal treatment base Plate shall be made of true carbon Fibre. It shall be One for All, Immobilization devices having a total solution to treat Paediatric to Adult in supine and prone and capable of treating Head, Head & Neck, Breast, Thorax. Abdomen, Pelvic and Extremities and with suitable attachments to the same Universal Treatment Base Plate offered, for frameless SRT / SRS and frameless SBRT (support device to be provided for frameless application, but shall not use fiducial frame / box, which makes the work to be tedious) and this important capability shall be supported by officially Vendor published Product catalogue/brochure. The Offered All IN One Base Plate shall be of a Long Board Minimum Length 160 cm and thickness 2cms.
	Universal treatment base plate (All in One) Made of true Carbon Fibre shall be provided which shall be compatible with the 6D couch top for Linac room. 2 nos.
	Universal treatment base plate (All in One) Made of true Carbon Fibre shall be provided for CT room. 1 No
	Identical to that of Universal treatment base plate Carbon Fibre, but made of Glass Fiber which is MR compatible (Not Acrylic) for mould room shall be provided. 1 No

	Head Rest made of carbon fibre 4 sets (One set containing 3 no of different shapes) Prone head Rest and Paediatric Head rest made of low density 4 sets to be provided
	Suitable Wedges 5 and 7 degrees made of carbon fibre and low Blocks to be provided – 4 sets
	Also, shall provide, appropriate attachment to that of the offered Universal treatment base plate to treat frameless Stereotactic radiotherapy/surgery (SRT / SRS) made of carbon fibre 2 nos and an identical of the carbon fibre should be made of glass Fibre for CT / MR compatible (fusion enabled). - 2 no. It shall also have facility to make Supine and Prone mask, custom made 3D thermo mask for Patient head support, Facial and Occipital for Individual Patients to maintain an accuracy and reproducibility of less than 0.3mm which is mandatory. This important capability shall be supported by officially Vendor published Product catalogue/brochure.
	The same Universal treatment base plate also shall be converted by adding the Bridge for thorax along with the suppression device, abdomen compression Belt, for SBRT. - 3 Sets
	Also, to provide lower and Upper Arm support, Indexed Couch stoppers, knee rest for comfort, feet rest and suitable device for Shoulder retractor for the same base plate of each shall be provided. - 4 sets each
3	**Breast Board:**
	Breast board made of carbon fibre with extended cushion aperture, lower adjustable arm supports with high arm cup, cranial adjustable arm supports with high arm cup, wide head support, bottom stop with hip position adjustment, integrated mask fixation points. : 4 set
4	**Vacuum cushion-based System:**
a.	Vacuum Cushion Breast Support : 50 x 70cm : : 40 no's
b.	Vacuum Cushion Pelvic Support : 65 x 65cm : : 40 no's
c.	Vacuum Cushion Body Support : 100 x 70cm : : 40 no's
d.	Vacuum Cushion Body Support : 200 x 70cm or more : : 40 no's
e.	Vacuum Pump (VP) : 2 no.s
5	Heat Gun: Professional Heat Gun , Rated power input: 2,000 W : 2no.s
6	Storage cabinet and Hanger to accommodate the above devices: (sizes of the storages cabinet should be as per the need of the immobilization devices) . : 4 no.s
7	The vendor should provide all appropriate locking mechanism for all offered base plates to couch. Density and also percent of attenuation of carbon fibre should be mentioned.
8	The vendor should provide 400 (numbers) thermoplastic sheets for Head and Head&Neck & Shoulder each, 250 numbers for pelvic 4 clamp (abdomen) and pelvic 6 clamp (abdomen upto thigh to cover both linac requirement for atleast one year depending on patient numbers.

9	Large Digital Water Bath System (One numbers) vendor should provide digital water bath system which should have minimum inner dimensions of 700 mm x 700 mm x 110 mm with adjustable position of water drainage, back safety opening bracket, digital temperature display.
10	Vendor should provide following accessories:
10.1	Tungsten eye shields set consist of three sizes, two sets, for paediatric and adult patients,
10.2	Small. medium and large sizes of testicle shields (each two numbers),
10.3	Gel Bolus sheets 30x30 cm of thickness 0.5, 1 of 15 each
10.4	Styrofoam cutter for photons 1 no.
10.5	Styrofoam cutter for electron 1 no.
10.6	Alloy Melter 1 no.
10.7	Low melt alloy 50 kg
10.8	Styrofoam blocks 12”x12”x3” -100 no’s
10.9	Styrofoam blocks 12”x12”x1” -100 no’s
10.10.	Body calliper 2 nos.
10.11	Curved stainless-steel calliper 2 nos.
10.13	Rectal & Vaginal marker 2 nos each .
10.14	CT markers (2mm dia) 300 nos.
10.15	MRI markers 100 nos.
11	Total Skin Electron Therapy (TSET) with Electron patient positioning vertical system having rotatable standing platform and fixed frame with two handgrips should be provided.
12	General Conditions and Requirements:
12.1	The Mould room and Dosimetry equipment/accessories/software offered against this tender shall have approval of the USA and CE Europe as well as of the AERB, India if applicable.
12.2	Installation of all these equipment/accessories shall be free of cost and should be completed in the specified time-frame manner. The vendor shall demonstrate all the acceptance and calibration tests, to the satisfaction of the user as well as of the Regulatory Authorities, as required for the safe use of the equipment.
12.3	Full warranty of all the hardware and software, for a total period of 5 years from the date of satisfactory commissioning and Rate of comprehensive maintenance charges per annum for the complete system after 6 to 10 years must be quoted.
12.4	All the participating firms should quote the price of all required spares for upkeep and smooth functioning of the equipment for a period of 5 years.
1	**Equipment Warranty and After-Sales Services**

1.1	The vendor shall give mandatory on-site warranty for first five years from the date of commissioning of the entire LINAC system (including for all locally supplied items including consumables like batteries of the UPS, printer cartridges etc) from the Principals, except for the wave-guide, beam-bending magnet assembly, electron gun, X-ray tube & RF system, which shall carry guarantee for 10 years. Pro-rata warranty is not acceptable.
1.2	Vendor should provide comprehensive maintenance contract (CMC) rate year-wise for quoted machine other accessories for next 5 years after warranty period.
1.3	Spare parts kit should be available for minimum of 10 years and price must be included in the offer
1.4	During the warranty period, all the software updates and upgradation should be provided without asking for free of cost.
1.5	Please quote the rates of necessary consumables recommended valid for 5 years block
1.6	Factory trained service Engineer/Application specialists should be available in NCI, Jhajjar to look after the installation and maintenance of the system without interruption to patient treatment.
2	**Quoted Linac Model Compliance with Standards and Safety**
2.1	Should be ISO, IEC, USA-FDA and European CE certified product.
2.2	Should comply with the national regulatory AERB/BARC guidelines
2.3	The offered LINAC model should have AERB type approval/ NOC.
2.4	Dosimetry, QA and Safety protocols should adherence to ICRP/ICRU/IAEA and national regulatory AERB/BARC guidelines/reports
2.5	Interlock system should be provided to afford maximum protection for personal against high voltage hazards.
2.6	High voltage protection and warning lights/symbols to be provided.
3	**Staff Training and Documentation**
3.1	**Comprehensive Training for LINAC , TPS & OIS shall be provided to 6 personnel (2 Radiation Oncologists, 2 Medical Physicists , 2 Radiotherapy Technologists) in advanced centre where these equipment are already in clinical use / training facility for a period of 15 days.**
3.2	On-site application training should be provided for minimum four weeks for all staff members in the department
3.3	Beam Data: Representative photon and electron central axis profile dose curves, as well as flatness and symmetry profiles measured on the accelerator to be installed shall be provided. These curves need not be warranted by the vendor for clinical use.
3.4	User/Technical/Maintenance manual to be supplied in English
4	**General Terms & Condition**

4.1	A list of installations existing in the county with 'satisfactory service certificate', if available from the user, may be submitted to support the claim of a good performance of the equipment. The supplier shall mention the number of installations in India and worldwide, for the quoted model only. Such installations should have been supplied directly by the quoting firm itself. Current performance and status report from the user departments for the model quoted shall be provided.
4.2	All claims regarding meeting the specification should be duly supported by appropriate, latest technical catalogues/brochures from the manufacturer. The vendors shall submit point-wise compliance statement in regard to the specifications asked for in the tender and should mention corresponding page numbers matching with the technical details in the compliance statement.
4.3	**a) Penalty clause: Penalty at the rate of Rs. 50,000 per day will be charged from the firm if the uptime falls below 96%. The calculation will be done on the basis of 365 days in a year,7 days in a week and 24 hours a day.** **b) If any item/items of the entire Linear Accelerator System which is/ are required for full functioning of the equipment mentioned in specification , but inadvertently missed in specifying in that many terms, the same shall be supplied without additional cost by the L1 vendor.**
5	Annexure-1: AERB approved Site and Facility Layout plan : The site layout may be obtained from NCI Jhajjar project office at AIIMS, Room no. 161.

Required Manufacture's Authorisation

Sl. No. as per spec.	Item Description	Reqd. MAF:
I	State of Art Linear Accelerator	Ex
II	Advanced Treatment Planning System	Non-Ex
III	Oncology Information & Record And Verify System	Non-Ex
V	Radiotherapy Dosimetry Equipment	Non-Ex
VI	Mould Room And Patient Fixation And Immobilization Devices/Accessories	Non-Ex

Abbreviations:

MAF: Manufacturer Authorisation Form as per Bidding Document.

Ex: Exclusive (i.e. One OEM can authorize only one agent for its product in a specific tender).

Non-Ex: Non Exclusive. (i.e. One OEM can authorize multiple agents for its product in a specific tender).

NOTE: Annexure-1 i.e. 'AERB approved Site and Facility Layout plan' is uploaded along with this amendment.

All other contents of the Bidding Document including terms & conditions remain unaltered.