Tender 06/2018

Linear Accelerator Machine

No.	Item Specification	Fill Your Specifications
1	**Description of Function:**	
1.1	Medical linacs utilize mono energetic electron beams between 4 and 18 MeV, giving an x-ray output with a spectrum of energies up to and including the electron energy.	
1.2	The x-rays are used to treat both benign and malignant disease. The reliability , flexibility and accuracy of the radiation beam produced have largely supplanted cobalt therapy as a treatment tool. In addition, the device can simply be powered off when not in use; there is no source requiring heavy shielding.	
1.3	The offered system shall comply with or exceed all of the minimum performance specifications as indicated below for the various sub-components, supported by factory-supplied product specifications / brochures. Any requested options and optional extras shall be clearly defined and a separate pricing schedule shall be provided by the Bidder.	
1.4	The equipment offered to tender the service shall be currently in production and date of production . (The manufacture of the device should not exceed 6 months or the device should not be in the store for a long time)	
2	**Operational Requirements:**	
2.1	High Energy Linear Accelerator complete with Working Consoles is required.	
3	**System Configurations:**	
3.1	The Multi Modality Medical Linear Accelerator.	
3.2	A Multi Leaf Collimator System (MLC).	
3.3	An Electronic Portal Imaging Device (EPID).	
3.4	An motorized Isocentric Treatment Couch.	
3.5	A Treatment Console.	
3.6	A Record- and-Verify Computer System, Hardware and software.	
3.7	A Range of Electron Beam Applicators.	
3.8	Electron Applicators.	
3.9	Laser, Sagital and two lateral.	
3.1	Intercom system.	
3.11	Patient observation system.	
3.12	Radiation Door.	
3.13	Chiller Unit and compressor target drive if needed.	
3.14	Networking.	
3.15	Bunker sheilding rooms electricity and air condition.	
4	**Technical Specifications:**	
4.1	Photon Energy: Dual Energy (6 & 10/or 15) MV.	
4.2	Electron Energy: five Energies between 4 to 20 MeV for Low & High Energy.	
4.3	The isocentric height of the accelerator shall be less than or equal to 130 cm.	
4.4	The energy reproducibility of the accelerator shall be better than 0.5% Bidder to state the percentages.	
4.5	The accelerator shall utilize a multi-element ionization chamber to allow for compensation of beam changes both with regard to steering of the beam and beam output. Beam changes shall be corrected for at all possible gantry angles.	
4.6	Representative photon and electron beam profiles and central axis depth 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.	
4.7	RF Source: Magnetron / Klystron.	
4.8	Waveguide Type: Standing / Travelling wave.	
4.9	Electron Gun: Sealed / Unsealed.	
4.1	**Treatment Modes:**	
4.10.1	· Normal - TSD / TAD	
4.10.2	· Rotation - CW / CCW	
4.10.3	· ARC - CW / CCW	
4.10.4	· Dose rate - MU/degree	
4.10.5	Dose-Rate for Photon energy: At least 400 MU/min in steps or higher dose rates for both photon beams.	
4.10.6	Dose-Rate for electron energy: At least 400 MU/min in steps or higher dose rates.	
4.10.7	The redundant channel will terminate an exposure of no more than 25 MU higher than the machine setting.	
4.10.8	The system shall also provide a back -up timer with a minimum significant time setting of 0.01 min.	
4.10.9	The back-up time shall be automatically calculated and set at a users -specified value above the expected duration of the treatment.	
4.11	**Field Size (Unclipped):**	
4.11.1	For Photons: Max - 40 x 40 cm² or more Min - 1 x 1 cm².	
4.11.2	Penumbra 10 mm for 10 x 10 cm² field at 10 cm depth.	
4.12	**Field Size(Unclipped):**	
4.12.1	For Electrons: Max – 25 x 25 cm² or more; Min - 4 x 4 cm².	
4.12.2	A method to obtain irregular field shapes shall be provided.	
4.12.3	Beam Flatness (PHOTONS) Variation of x-ray intensity relative to the central axis shall not exceed ±4 % over central 80% of radial and transverse axes for photons field sizes 10 x 10 cm² to 40x40 cm² at 10 cm depth.	
4.12.4	Beam Flatness (Electrons) Variation of electron intensity relative to the central axis shall not exceed ±5 % over central 80% of radial and transverse axes for photons field sizes 10 x 10 cm² to 40x40 cm² at 10 cm depth.	
4.12.5	Focal Spot size: X-ray target movable Please give full technical details.	
4.12.6	Photon Arc Therapy Bi-directional arc therapy shall be included with Automatic calculation of Dose per Degree based on the Dose Rate selected and the Arc angle set.	
4.12.7	The resulting energy spread of the electron beam shall be within 3% of the nominal energy when the beam strikes the x-ray target (for photon beams) or the scattering foil (for electron beams).	
5	**Photon beam characteristics:**	
5.1	The maximum dose rate shall equal at least 4 Gy/min (400 MU/min) for a 10x10 cm² field at the depth of maximum build-up at a TSD of 100 cm for both photon beams.	
5.2	The dose rate at the isocentre shall be variable between 0.25 Gy/min and 4 Gy/min.	
5.3	The time average dose rate shall be constant to within ± 3% for 2 min.	
5.4	The accelerator shall provide a continuously variable rectangular, unclipped field size from 1 x 1 cm² to 35 x 35 cm² at 100 cm SSD. The maximum clipped field size should equal or exceed 40 x 40 cm² at 100 cm SSD.	
5.5	The collimators shall be motorized.	
5.6	A detachable block holder shall be provided to accommodate block trays . The size of the blocking tray shall be at least 5 cm larger than the maximum field size . Specify location and size of blocking trays. The block carrying capacity of the shadow tray shall be at least 10 kg for all gantry angles.	
5.7	The photon leakage rate at any point 1 m from the target outside the cone defined by the primary x - ray collimator shall be < 0.1% of the absorbed dose at the isocentre.	
5.8	The leakage outside of the patient plane shall be < 0.1% of the maximum absorbed dose at the isocentre.	
5.9	The leakage through the diaphragms shall be < 0.5%.	
5.10	The neutron leakage in the patient plane shall be < 0.015% as a fraction of the x -ray leakage for all photon beam qualities. The neutron contamination of the beam shall be < 1.5 nSv/Gy.	
5.11	The penumbra width shall not exceed 10 mm. Penumbra is defined as the width between the 20% and the 80% isodose lines measured for the 10 x 10 cm² field size at a depth of 10 cm for 100 cm SSD.	
5.12	A motorized wedge system is required.	
5.13	The system shall provide effective wedge angles of 10°, 15°, 20°, 25°, 30°, 45° and 60° to a maximum of 30 cm beam size in the wedge direction and 40 cm field beam size perpendicular to the wedge direction.	
5.14	The accelerator shall be capable of delivering a pre -set dose over a pre -set arc of 360° or any fraction thereof. A range of dose rates shall be available and extent at least from 0.5 to 16 MU/degree in 0.01 MU/degree increments and shall be continuously variable	
6	**Electron beam characteristics:**	
6.1	The electron beam energies shall include a series of 5 energies ranging from 4 MeV to 22 MeV. Bidder to state which energies can be supplied.	
6.2	Energy shall be specified as the most probable energy (Ep) of the electron energy spectrum at 100 cm from the accelerator exit window.	
6.3	Specify the energies available, the R50 values (50% depth dose) and energies E0.	
6.4	Dose rate at the isocentre shall be variable from approximately 80 to at least 400 MU /min for each electron energy.	
6.5	A high dose rate for electrons (HDRE) of 1000 cGy /min is required on 6 MeV for Total Skin Electron Therapy. (Optional + Accessories).	

6.6	The electron beam size is defined by the inside dimensions of the electron beam applicators projected geometrically to a plain surface at a 100 cm SSD. A range of field sizes from 4 x 4 cm^2 to 25 x 25 cm^2 or greater is required. Specify beam size ranges to be provided.	
6.7	Specify distance from the distal end of the electron applicators to the surface.	
6.8	The electron applicators shall include inserts that will allow irregular beam shaping.	
6.9	It shall be possible to visualize both the field defining light and the optical distance indicator with an electron applicator in place.	
6.1	The x-ray contamination shall be < 3% for energies from 4 MeV to 15 MeV and < 5% for energies above15 MeV. The x-ray contamination is the amount of radiation measured at a depth of 10 cm beyond the 10% electron isodose line in a water phantom.	
6.11	The leakage in the patient plane shall be < 2% of the absorbed dose at the isocentre.	
6.12	It shall be possible to visualize both the field defining light and the optical distance indicator on the skin with an electron applicator in place.	
6.13	All electron applicators shall be fitted with anti-collision detectors activating an interlock preventing injury to the patient.	
7	**Gantry :**	
7.1	Beam Symmetry The maximum percent difference of average doses shall not exceed ±2 % for Electrons and ± 3% for Photons.	
7.2	Gantry Rotation ±190° (380° total).	
7.3	Read out - Digital and Mechanical.	
7.4	Accuracy dig-readout 0.01° , Mech-readout 0.5°.	
7.5	Control - Hand pendent and control-console.	
7.6	Target - Axis Distance. - 100 ± 0.2 cm.	
7.7	ODI Range- 75 cm to 150 cm.	
7.8	ODI Accuracy ± 0.1 cm.	
7.9	Gantry Rotation Isocentre ± 2 mm diameter Sphere.	
7.1	Considering the mechanical isocentre to be defined by the intersection of the collimator and gantry rotation axes with the table rotation axis , all 3 axes of rotation shall be confined to a sphere with ≤ 1 mm radius.	
7.11	The rotation speed of the gantry shall be continuously variable up to 1 rpm.	
7.12	The gantry shall have the necessary mechanical strength and stability to allow for Image Guided Radiotherapy (IGRT), radio surgery and 4D-radiotherapy. The basic connections for KV cone beam CT shall be upgradable.	
7.13	No Beam-stopper.	
8	**Collimeter and Treatment head:**	
8.1	Collimator: Rotation - ± 190° about mid position.	
8.2	Control - Hand pendent and control- console.	
8.3	Readout Accuracy dig-readout 0.01° , Mech-readout 0.5°.	
8.4	The rotation speed of the treatment head shall be continuously variable between 0.2 rpm and 3 rpm.	
8.5	Collimator Rotation Isocentre ± 2 mm diameter Sphere.	
8.6	Motorized Wedge.	
8.7	Asymmetric Collimators X & Y both asymmetrical. Specify travel ranges & over travel range.	
8.8	Multi-leaf collimator (MLC) No. of Physical Leaves (80 and above), Independent drives.	
8.9	Leaf width at isocentre <= 10 mm.	
8.10	A field illuminating light system shall be provided for both photon and electron modes . The edge of the defining light field shall coincide to within ± 2 mm of the 50% isodensity line on an x -ray film taken with minimum build-up for any field size at 1 meter and any angulations of the gantry or collimator system.	
8.11	The beam light shall produce sufficient output with crosshairs indicating the isocentre within ± 0.5 mm.	
8.12	An optical distance indicator , which indicates the SSD to at least ± 4 mm over the 75 to 150 cm range ,shall be provided. The accuracy of the ODI at 100 cm shall be ± 1 mm.	
8.13	The distance from the end of the collimator accessory ring to the isocentre should be as large as possible to facilitate treatment position and angle flexibility. The bidder to state the distance.	
8.14	A detachable compensator/ block holder shall be provided to accommodate compensator/ block trays.	
8.15	The size of the compensator / block trays shall cover at least 5 cm larger than the maximum field size . The Bidder to state dimensions.	
8.16	At least 30 blank, coded and compensator/block trays shall be supplied.	
8.17	The Bidder to state the largest block thickness possible and the compensator/ block tray to isocentre distance.	
8.18	Capable of performing 3D Conformal therapy procedures. Interface between MLC & existing network system shall be provided. network system shall be provided.	
8.19	Facility to treat patients conventionally, using blocks without MLC.	
8.2	Work Station HW/SW with latest hardware and software. Bidder to specify details.	
8.21	Integration (full Networking) with Planning System and & Quoted Simulator.	
8.22	IMRT delivery shall be upgradable.	
9	**Multileaf Collimator Control System:**	
9.1	The control system for the multileaf collimators shall be fully integrated into the accelerator control software. The control system shall be enabled for static IMRT.	
9.2	An electronic fault detection system and collision detection system shall be provided.	
9.3	The system used for detection of leaf positions shall be described.	
9.4	Independent monitoring of leaf position is a prerequisite.	
9.5	The system shall allow minor alterations during patient set-up and record any alterations on the treatment record sheet.	
9.6	Any interruption of the beam should be properly registered by the system.	
9.7	The complete prescription of the leaf positions for each field for a specific patient shall be stored on the system allowing easy transfer of the prescription between systems such as the simulator, the treatment planning computer and the linear accelerator.	
9.8	**The bidder shall be provide the following in figure and Description :**	
9.8.1	Max. leaf retracting position.	
9.8.2	High over centre travel of MLC leaves (<=10 cm) for IMRT treatments.	
9.8.3	Max. field length.	
9.8.4	Leaf height & material.	
9.8.5	Coincidence of light & x-ray field.	
9.8.6	Penumbra.	
9.8.7	Transmission.	
9.8.8	Interleaf leakage.	
9.8.9	Leaf position accuracy.	
9.8.10	Max. Carriage speed.	
9.8.11	Max. Leaf speed.	
9.8.12	Positional accuracy of the leaves during treatment.	
9.8.13	MLC Calibration Methodes and Tools	
9.8.14	Inter-digitation of leaves if available.	
10	**Electronic Portal Imaging Device (EPID) The bidder shall be provide the price :**	
10.1	The detector panel shall be based on state-of-the-art Technology and DICOM 3 format supported.	
10.2	The Bidder is to state the construction of the receptor.	
10.3	The imaging area shall be at least 35 x 40 cm . Please state the maximum imaging area of the offered system.	
10.4	The Bidder to state how the imaging area stated is accomplished.	
10.5	The Bidder to state the largest field size that can be imaged with the imager at 120 cm form the target.	
10.6	The limiting spatial resolution shall not be less than 12 lp/cm with the test object at the isocentre . Please state the resolution of the offered unit.	
10.7	A 16bit grey scale imaging depth is required.	
10.8	The large area contrast ratio shall be <1%. Please state the lowest contrast ratio achievable on the offered unit.	
10.9	Noise reduction capability is required. The bidder to state the noise reduction and image enhancement tools available.	
10.10	It shall be possible to retract the detector panel fully into the gantry to get full access to the patient at the head end of the couch.	
10.11	It shall be possible to position the detector arm to pre-programmed positions.	
10.12	The maximum gantry angle that can be achieved with the couch at 90 or 270 degrees shall be no less than 40 degrees. State maximum image field size at the maximum gantry angle	
10.13	It shall be possible to produce a patient exit dose fluence map at a user selectable source to imager distance for quality control purposes.	
10.14	It shall be possible to capture digitally reconstructed radiographs (DRRs) generated on the treatment planning system for comparison with portal images and dose maps produced on the offered system.	
10.15	Comprehensive image registration and matching software tools shall be supplied for measurements and comparisons between DRRs, portal images and dose maps, including the generation of LINAC and couch movements required to align the patient correctly. The Bidder to give full details.	
10.16	The Bidder to state if relative or absolute dose measurements across the radiation beam (fluence dose map) can be determined with no patient in the beam, for example for beam flatness determination.	
10.17	The Bidder to state if relative or absolute exit dose measurements can be determined.	
10.18	The Bidder to state if relative or absolute dose measurements can be determined in the patient plane.	
10.19	The control panel shall include a 21" medical grade display monitor and keyboard.	
10.2	The offered system shall be enabled for future upgrading to produce MV images.	

10.21	The Bidder to provide details about the image archiving and storage facilities , as well as the number of 1024 x1024 resolution images that can be stored on the internal hard drive (s). The hard drives(s) shall be of a large-capacity industry standard, and easily upgradeable.	
10.22	It shall also be possible to store/archive images on commercially available DVD disks in a generally recognizable and readable DICOM format.	
10.23	The offered system shall have all the necessary DICOM options and licenses in order to perform image queries, image transfers, image printing, using DICOM 3, with the existing equipment (CT scanners and MRI system, virtual simulator, simulator and radiotherapy treatment planning system TPS.	
10.24	The system shall provide DICOM and DICOM RT import and export of all images, all beam treatment parameters and all field shaping parameters, including all necessary licenses.	
10.25	The system shall provide DICOM and DICOM RT protocol image query, image transfer, and image printing with other compatible devices [including CT scanners, MRI system, Laser cameras, virtual simulator, simulator and radiotherapy treatment planning system (RTPS) on the existing TPS network, including all necessary licenses.	
10.26	The Bidder shall include the costs for a network link to the existing RTPS Ethernet network switch.	
10.27	The offered network shall comply with the IT Departmental standards.	
10.28	The flat panel detector shall include a collision avoidance system.	
10.29	An Electronic Portal Imaging Device quality control measurement tool and software is required for measurement of linearity, isotropy, noise, low and high contrast resolution, etc of the supplied EPID. (Phantom and Software or equivalent) including all necessary licenses	
10.3	Shall fully integrate with Accelerator.	
10.31	Shall be able to take images at any Gantry angles with variable X-Y-Z movements.	
10.32	Robotics Arm with remote control.	
10.33	Shall have Digital technology with High Resolution flat pannel Detector >=(40 X 35 cm^2)	
10.34	Auto Field Sequencing.	
10.35	Stereotactic Treatment.	
11	**Treatment Couch:**	
	The patient treatment couch shall be fully isocentric and floating offering the following movements:	
11.1	Longitudinal movement.	
11.2	Lateral movement.	
11.3	Vertical movement.	
11.4	Rotation around the isocentre.	
11.5	Rotation around the couch support.	
11.6	The couch shall be capable of supporting patients to a maximum weight of 250 kg.	
11.7	The Bidder to state the offered unit's maximum sag of the couch at full longitudinal extension . Table sag shall not exceed 5 mm deflection at maximum extension with an 150 kg weight equally distributed about the isocentre.	
11.8	The bidder shall state the vertical movement range as measured from the finished floor.	
11.9	The vertical movement speed shall be continuously variable between 0.2 cm/s and 4 cm/s.	
11.1	The vertical movement shall offer digital read-out to an accuracy of ± 1mm.	
11.11	Lateral and longitudinal movements shall be both manual and motorized.	
11.12	The lateral movement shall have a range of ± 25 cm.	
11.13	The speed of the lateral movement shall be continuously variable from 0.2 to 4 cm/s.	
11.14	The lateral movement shall offer digital read-out to an accuracy of ± 1 mm.	
11.15	The longitudinal movement shall have a range at least 100 cm.	
11.16	The speed of the longitudinal movement shall be continuously variable from 0.2 to 4 cm/s.	
11.17	The longitudinal movement shall have a digital read-out to an accuracy of ± 1 mm.	
11.18	The column rotation range shall be ± 90°.	
11.19	The isocentric rotation range shall be ± 95°.	
11.20	The isocentric speed shall be continuously variable from 0.3 to 5°/s.	
11.21	The Bidder to state the displacement of the rotation axis from the isocentre upon isocentric rotation . This shall be less than 1 mm.	
11.22	The isocentric digital read-out shall have an accuracy of ± 1°.	
11.23	All couch movements shall be controlled from a hand-held controller.	
11.24	For the isocentric rotation, column rotation, lateral movement and longitudinal movement, manual control is required.	
11.25	**The following mechanical couch parameters are required:**	
11.25.1	Couch top width: > 52 cm;	
11.25.2	Couch top length: > 230 cm (may include extension panels);	
11.25.3	Couch lift capacity: 250 kg.	
11.26	Patient support panels in the couch (tennis racket or Mylar) shall be provided with combined dimensions exceeding 70 cm L x 45cm W to facilitate large posterior treatments and extended distances without moving the patient.	
11.27	Motorized motions shall be controlled with 2 hand -held pendants , capable of variable speed control mounted to the treatment couch . Controls for motorized couch motions shall also be located on both sides of the treatment couch.	
11.28	The Bidder to confirm that all the patient couch motorized movements can occur simultaneously and independently of each other.	
11.29	In the event of a power failure an emergency power source shall enable vertical drive, lateral motion, longitudinal motion and column rotation as well as functioning of brakes to ensure removal of the patient from the couch.	
11.30	A mechanical override shall be available in the event of a power failure to allow lowering of the table from the treatment position. Alternatively emergency power supplied to the vertical drive as well as the brakes of the lateral, longitudinal and column rotation movements shall be available to allow easy removal of the patient. State full details.	
11.31	The patient support system shall conform to IEC 976/977 performance specifications.	
11.32	A high quality couch top is required.	
11.33	**Versatile extended range couch with indexed immobilization Movements:**	
	Longitudinal, Lateral, Vertical and Rotation	
11.34	Electrical / Mechanical Control.	
11.35	Control-Local and/or Remote.	
11.36	Opening window - Tennis Racket / Mylar.	
11.37	Fully Carbon Fibre table top for better Quality Portal Images.	
11.38	Minimum height from floor –approx 40 cm .	
11.39	Side Rails on both sides of Couch for Mounting Accessories.	
12	**Treatment Console:**	
12.1	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 display of accelerator parameters. A number of controls are specified below. It is required of the supplier to fully list the accelerator controls of the offered accelerator.	
12.2	The total dose control shall set the desired total dose per field.	
12.3	The time control shall set time for the patient's treatment.	
12.4	The mode selector shall select x-rays or electrons for treatment.	
12.5	The x-ray energy selector shall select the photon beam energy.	
12.6	The electron energy selector shall select the electron beam energy.	
12.7	The radiation ON control shall turn on the radiation.	
12.8	Activation of the interrupt control shall immediately stop treatment.	
12.9	It shall be possible to adjust the dose rate of the beam.	
12.1	A separate mode of operation (system calibration and servicing) shall be provided which is used to monitor accelerator parameters and facilitate adjustments to those parameters. List the adjustments that the operator shall be able to accomplish from the control console while in the calibration and service mode of operation.	
12.11	During clinical operation, the accelerator shall record relevant equipment parameters for later review in the event of abnormal machine conditions, such as dosimetry interlocks, minor interlocks, etc.	
12.12	An automatic system that will allow remote patient set-up from the console is required. The system shall allow patient and machine set-up between treatment fields without requiring the radiographer to go into the treatment room between treatment fields. The minimum parameters to be included in the automatic set-up are gantry angle, collimator rotation angle and field size.	
12.13	It shall be possible to monitor essential parameters from the control console. List the parameters that could be monitored from the control console.	
12.14	An automated means of operating the accelerator at all clinical energies (photon and electron) to perform a series of daily quality assurance checks shall be provided. This series of checks shall be defined by the hospital and shall be capable of being edited. Critical accelerator operational parameters shall be recorded for each of the QA tests and a report of these parameters shall be printed at the end of daily QA procedures.	
12.15	To simplify mechanical motion control and expedite patient set-up, the motorized mechanical motion control system of the accelerator shall be computerized such that gantry rotation, collimator rotation, collimator jaw settings (MLC settings) and treatment couch vertical, lateral, longitudinal and turntable rotation about isocentre can be operated with either of two hand-held pendants capable of continuously variable speed control. If two operators are in the treatment room, both pendants shall be capable of being used simultaneously. The hand pendants shall each have a hardwired motion-enabled switch, which must be depressed to activate these motions.	
12.16	The control console shall be capable of receiving full treatment parameters (leaf positions, collimator angles, etc.) from the TPS via a network connection.	

12.17	A network connecting the treatment planning systems (TPSs) in the department (the new TPS capable of MLC planning as well as the existing system) to the LINAC shall be installed. All necessary switches and servers shall be supplied.	
12.18	The Bidder to state whether in-vivo dosimetry results can be integrated with the R & V system.	
12.19	An additional workstation shall be provided for remote entry of patient prescription, and for editing, while	
12.2	the LINAC is being used for treatment.	
12.21	The control console shall be capable of receiving full correct treatment prescriptions and MLC beam shaping information from the existing TPS and the proposed new TPS currently in the bid process, which could be any commercially available system. The Bidder to take full responsibility for a correct and complete transfer process and all the necessary licenses.	
12.22	A network link between the control console and the existing TPS private ethernet network switch located in the Planning Section, Radiation Oncology Department.	
12.23	The ability to store and print an electronic patient treatment chart recording the progress of daily treatment. The Bidder to state full details.	
12.24	An universal printer shall be provided for printing of patient treatment records.	
12.25	The system shall enable set-up of a central database and networking to allow transfer of patients between existing treatment units in the event of a scheduled and unscheduled downtime.	
12.26	The control room equipment shall be minimised. Please state numbers of computers, monitors and keyboards required to operate the requested LINAC configuration.	
12.27	DICOM RT READY Image Networking	
12.28	Two workstations with minimum 21 inch flat LCD/LED monitor.	
12.29	Oncology Information System complete with Networking. (Bidder to specify details and price .)	
13	**Record & Verify System:**	
13.1	The control software of the linear accelerator shall incorporate full record-and-verify functionality.	
13.2	The record-and-verify functions shall include patient data set-up parameters, control of jaws and MLC, control of wedge positioning, control of monitoring units, dose recording and full recording of the treatment process as well as a summary of the fields given at conclusion of the treatment course.	
13.3	The Record and Verify System shall allow automatic set-up of patient parameters for a specific patient, drawn from the database as well as automatic set-up of subsequent beam parameters following application of each beam.	
13.4	The Record and Verify System shall be Dicom RT compatible allowing communication with TPS , EPID and network computers within the department.	
13.5	The system shall enable set-up of a central database and networking to allow transfer of patients between treatment units in the event of a scheduled and unscheduled downtime.	
13.6	Transfer and receive of all parameters from Simulator & Treatment Planning System to the accelerator for automatic treatment setup & delivery shall be provided.	
13.7	Transfer of Fluoroscopy images from Simulator to Portal Imaging System for Comparison shall be provided.	
13.8	Transfer & Execution of MLC Position Parameters for normal treatment & IMRT treatment including step & shoot from Treatment Planning System shall be provided.	
13.9	Shall be compatible with existing network system all required interfaces shall be provided.	
14	**Shall come with the following accessories:**	
14.1	Front pointer - mechanical.	
14.2	Accessory mount - shadow block tray.	
14.3	Blocks – divergent / non-divergent.	
14.4	Universal Clamps.	
15	**Laser Alignment System :**	
	The system shall include:	
15.1	One ceiling or opposing wall mounted sagittal laser.	
15.2	Two lateral (patient left and right) wall mounted horizontal and vertical lasers.	
15.3	The laser lines shall be less than 1 mm thick on the patient surface.	
15.4	All laser lines shall be easily focusable and adjustable, at a suitable level of fineness and resolution, in two translation directions and three rotational directions. This is a requirement.	
15.5	All lasers shall intersect at the isocentre within ± 1mm and shall be angled either true vertically or true horizontally, thus coinciding with the machine principle axes.	
16	**Electron Applicators:**	
16.1	The electron applicators shall be fitted with anti-collision detectors activating an interlock preventing injury to the patient.	
16.2	The electron applicators shall accept coded insert required for individual beam shaping.	
16.3	**The following set of electron applicators shall be supplied:**	
16.3.1	6 x 10 cm^2.	
16.3.2	9 x 14 cm^2.	
16.3.3	10 x 16 cm^2.	
	Squares applicators:	
16.3.4	6 x 6 cm^2.	
16.3.5	10 x 10 cm^2.	
16.3.6	14 x 14 cm^2.	
16.3.7	20 x 20 cm^2.	
16.3.8	25 x 25 cm^2 or greater.	
	Circular applicators:	
16.3.9	2 cm diameter.	
16.3.10	3 cm diameter.	
16.3.11	4 cm diameter.	
16.3.12	5 cm diameter or greater.	
17	**Protection and safety:**	
17.1	Interlock systems shall be provided to afford maximum protection for personnel against high voltage hazards.	
17.2	The weight of any single accessory attachment to the machine shall be < 10 kg.	
17.3	It shall not be possible to raise the treatment couch top above isocentre without releasing an interlock switch. In addition, a means to lower the coach in the event of a power failure shall be provided.	
18	**Intercom System:**	
18.1	The offered unit shall have a good quality two way intercom system between the control console and treatment room for patient communication. This shall preferably be one integrated system.	
19	**Patient Observation System:**	
19.1	**The dual CCTV camera system required for observation of patients during radiation therapy shall meet or incorporate the following minimum requirements:**	
19.1.1	Two wall mounted cameras shall be fully remote controlled regarding zoom, focus, iris and direction. 2 Color flat LCD/LED monitor 20" or higher.	
19.1.2	Good quality color monitors are required at the control console for in-room patient monitoring.	
19.2	Power shall be supplied to all components by means of the Linac master power switch. It shall be possible to override this switch for operation independent of the Linac.	
20	**Dosimetry System (Photons) :**	
20.1	Built-in chambers. Two separate sealed chambers.	
20.2	The dosimeters shall be reproducible to within ± 0.5 % or 1 MU, whichever is greater at any fixed gantry angle from 0 to 360°.	
20.3	The linearity of the dosimeters shall be ± 0.5% or 1 MU , whichever is greater , for accumulated doses between 50 and 999 MU.	
20.4	The integral dose shall be retained on a counter , which indicates the monitor units delivered to that time with the unexpected loss of power or malfunction of the accelerator or dose measuring systems . The dose shall be retained for at least 20 minutes after power interruption.	
20.5	Precision ± 1% or 1 MU	
21	**Accessories, Spare Parts and Consumables:**	
21.1	All consumables and accessories required for installation ,standardization of system and for the proper operation shall be included in the offer.	
21.2	The Chiller system shall be provided along with the machine by the principals. No local system shall be accepted	
21.3	A closed-circuit colour TV system with TV monitors and two cameras in the linac tratment room shall be supplied. A patient calling system with 6 channels shall be supplied. Internet broad band connectivity for remote servicing shall be provided. A LCD Projector shall be supplied.	
21.4	All recomended accessories/consumables/spare parts required for the proper operation of the above item shall be included in the offer as annual price list . Bidders shall specify, in a separate Excel worksheet, the quantity, price and details of any items included in this offer which have not been specified in this Technical Specifications Form.	
21.5	All standard Maintenance , QC tools/software and cleaning/ lubrication materials where applicable shall be included. Bidders shall specify, in a separate Excel worksheet, the quantity, price and details of any items included in this offer which have not been specified in this Technical Specifications Form.	
22	**Infrastructure Requirements:.**	
22.1	The display offer must include the working enviroment of the device such as electricity ,cooling room and cooling system of the device .	
22.2	Disassemble the old machine and configure the room to meet the requirement and specifications of the new machine .	
23	**Installation and Commissioning:**	

23.1	The Bidders shall perform a site visit.	
23.2	The bidder must perform the data collection and input data on the planning system through an expert medical physicist (The commissioning by the Bidder)	
23.3	The successful Bidder shall be required to submit detailed floor/building or electrical wiring drawings/schematics, should any structural changes, air conditioning, electrical distribution or any electrical wiring and medical gases be required.	
23.4	Any alteration or additions (structural, electrical, plumbing, cooling and cosmetic) that are required to the physical location or environment of the Multi Modality Linear Accelerator or to install the Multi Modality Linear Accelerator and its associated equipment shall form part of the Bidders offer	
23.5	The Bidder shall inspect the existing wiring and quality of power supply and add any additional equipment/appliances necessary to prevent damage to the offered system as a result of electrical supply shortcomings/inconsistencies. The additional equipment/appliances shall form part of the main offer.	
23.6	The successful Bidder will make available the necessary circuit diagrams of the equipment and all associated equipment, together with the interconnecting wiring diagrams	
23.7	All information for corrective maintenance shall be supplied.	
23.8	Installation drawings, lubrication charts, maintenance instructions and all information pertinent to the correct operation of the system shall be included.	
23.9	The successful Bidder shall make good any damages that occur to the walls, floors and ceilings during alterations/installation.	
23.1	The bidder must arrange for the equipment to be installed by certified or qualified personnel; any prerequisites for installation to be communicated to the purchaser in advance, in detail	
23.11	The end user will conduct system commissioning according to the International standards and the installed system must comply.	
24	**Operating Environment :**	
24.1	The system offered shall be designed to operate normally under the conditions of Sudan . The conditions include power supply ,climate,temperature,Humidity,Dust ,etc	
24.2	power supply : 380-415VAC3PHASE50Hz fitted with appropriate plug.The power cable must be at least 3 metres in length..The power cable must be at least 3 metres il length.	
24.3	Provide Servo controlled stabilizer/CVT	
24.4	UPS of at least 30 minutes operation with suitable rating shall be supplied for the computer system.	
25	Leakage & Scatter Radiation Safety:	
25.1	X-ray absorbed dose due to leakage radiation (excluding neutrons) outside useful beam but inside a plane circular area of radius 2 m centred around and perpendicular to central axis at normal treatment distance. As per International Specifications (ICRP No 33)	
25.2	Collimator transmission: As per International Specifications (ICRP No 33)	
25.3	Neutron dose Inside the treatment area and Outside the treatment area: As per International Specifications (ICRP No 33)	
25.4.2	Basic Safety Standard.	
26	**Training:**	
24.4.4	**The Bidder shall undertake to provide a comprehensive training schedule, for both User Departments and Clinical Engineering staff of the Hospital to ensure:**	
25	Correct use of the equipment, and Comprehensive technical support capability of the equipment, of at least 1st and 2ed levels (basic faultfinding level)	
26.1	The Bidder must state the cost and level of additional technical training offered.	
26.1.1	Initial training of at all users shall be provided by the successful Bidder at no extra cost.	
26.1.2	The successful Bidder at no extra cost shall provide additional future support of users in the use of all features of the equipment offered.	
26.1.3	**Local Training:**	
26.1.4	The supplier will be bind to provide operational training at installation site for one week at least, starting immediately after acceptance & commissioning.	
26.2	**OverseasTraining:**	
26.2.1	The supplier will be bind to provide training at a credit training center and factory for two weeks at least, starting immediately after acceptance & commissioning.	
26.3	Two Medical Physicists.	
26.3.1	Two Radiation Therapist .	
26.3.2	Two Clinical Engineers. At least 2 levels in factory	
26.3.3	Two Radiation Oncologist.	
26.3.4	The Supplier shall conduct user training for this equipment to enable operators to use the equipment properly. The training shall include the use of all operational functions of the equipment, as well as routine checks and maintenance expected by users.	
26.3.5	Two weeks on-site training by manufacturers' application specialist and service engineer for training of medical and technical staffs to familiarize in proper operation and basic maintenance and troubleshooting.	
26.3.6	External Training for 8 Persons for Each Unit.	
27	**Warranty:**	
27.1	Comprehensive warranty for 2 years for all systems after approval acceptance test. Extended 3 years warranty bidder shall provide the cost.	
27.2	**Warranty (Individually) for the following:**	
27.2.1	Accelerator Guide (Beam Centre Line) including Target, Bend Magnet, Electron Gun & Vacuum Pumps. - 10 Years.	
27.2.2	RF Source Magnetron/Klystron. - Five Years.	
27.2.3	Thyratron - Five Years.	
28	**Maintenance Service During Warranty Period:**	
28.1	During warranty period supplier must ensure preventive maintenance & corrective/breakdown maintenance whenever required.	
28.2	Manufacturer shall commit the availability of spare parts and consumables and accessories for at least 10 years.	
28	**Documentation:**	
28.1	These shall be original These shall be original (soft in CD & hard)documents, not copies and in English and submitted in duplicate. documents, not copies and in English and submitted in duplicate.	
28.2	Two complete sets of user manuals shall be supplied.	
28.3	Two complete sets of workshop /service manuals, including wiring schematics shall be supplied where applicable. State what is supplied.	
28.4	Two customer acceptance test protocol.	
28.5	User (Operating) manual in English.	
28.6	Service (Technical / Maintenance) manual in English.	
28.7	List of important spare parts and accessories with their part numbers and costing.	
28.8	Certificate of calibration and inspection from factory.	
29	**Upgrade Policies:**	
29.1	Bidders are to state the policy with regard to future hardware and software updates that will be involved.	
29.2	All future upgrades (hardware and software) involving patient safety shall be offered at no additional cost.	
29.3	All future upgrades removing software bugs from existing hardware and software shall be supplied at no cost.	
29.1	Any upgrade after the guarantee period of the equipment involving additional cost shall be brought to the attention of the Hospital Manager.	
30	**Maintenance Contract:**	
30.1	State percentage guaranteed up time of machine. This should be at least 98%	
30.2	The Bidder to suggest a planned maintenance programme , estimated on a year -by-year basis for at least 3 years after expiration of the two year of warrantee (plus possible extensions as provided for under “GUARANTEE CONDITIONS” above) based on the Comprehensive Maintenance Agreement:	
30.3	The maintenance contract may be purchased and paid for up front with the purchase of the equipment.	
30.4	This contract is for the complete system including all possible options and associated equipment.	
30.5	The Bidder to state the cost of the upfront fully comprehensive maintenance contract, which shall be inclusive of relevant taxes.	
30.6	This option shall be seen as an extended guarantee and shall include all the conditions as stipulated under the guarantee conditions and shall include all labour , travelling, sundries, all spares (including magnetron, thyr`atron, etc.) preventative maintenance, corrective maintenance (call outs), installations and QA checks (as prescribed by the Department of Health , Directorate: Radiation Control) over a 3 years period after the guarantee/warrantee period expired.	
30.7	The Bidder to provide a pricing schedule per year i .e. Year 1 to Year 3. (NB. Year 1 is the year following the guarantee period). All prices must include VAT.	