Indian Institute Of Technology, Bombay
(Maharashtra)

TENDER DOCUMENT

For

Supply, Installation, Testing & Commissioning of A.V. System
for P.C. Saxena Auditorium inside the campus of
IIT Bombay, Powai, Mumbai – 400 076

VOLUME – 2 : TECHNICAL SPECIFICATIONS

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### Technical Specification

**Volume - 2**

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1. **Scope of works**

The work covered by the sections of this specification comprises the design, supply, installation and commissioning of the facilities under the technical equipment section headings, identified elsewhere in this document, and training of technical staff.

The Trade Contractor will supply and install the equipment necessary to meet the requirements and provide all labour and materials, whether or not described in full, necessary to produce complete and fully operational systems in accordance with the intent of this document.

A comprehensive ‘systems’ approach to the installation shall be taken. This shall include, but not be limited to following the architectural concepts where available, designing the detailed AV facilities, implementation, and careful integration with other facilities, documentation and thorough user training.

The Trade Contractor must familiarise himself with the site drawings and the scope of the facilities that is required in the various areas. He should ensure that he is aware of the operational requirements under which the systems and associated facilities are to be installed and used.

The installed systems must be in all respects suitable for the purposes for which they are intended. The area wise & equipment wise detail specifications are given below.

2. **PC Saxena Auditorium**

This area will be used for laptop and Blu-ray player presentations, and will use large motorised front projection screen with over-head fixed projector suspended from ceiling to display presentation material.

The specification for this room should be read in conjunction with the following drawings schematics:

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2.1. **Projection Screen**

Within the room, one 290” (diagonal size) mounted motorised front projection screen will be used. The screens will be controlled via RS232/485 interface from an external control system with the virtual touch panel software. The screen is to be ceiling mounted using purpose designed and built brackets. Specifically, the projection screen will be Da-Lite matt white screen. This screen will be free issued by IIT Mumbai to the selected trade contractor. The trade contractor shall include the dismantling cost of the screen from the existing convocation hall.

2.2. **Projector**

The projector will be a single chip DLP type and is to be capable of producing an image with a brightness of no less than 8000 ANSI lumens at a resolution of WUXGA (1920 x 1200). A high brightness projector will be used due to the possible high ambient light level of the room. The projector is to be ceiling mounted using a fixed length pole mount to the ceiling slab. All visible cabling to the projector will be shrouded in a flexible sleeve of white/black finish. Specifically, the projector will be Projection Design F32. This projector along with a fixed length ceiling mount will be free issued by the IIT Mumbai to the selected trade contractor. The trade contractor shall include the dismantling cost of the projector & ceiling mount (including any modification required for the ceiling mount) from the existing convocation hall. Also, the trade contractor shall check the health of the projector prior to the installation in the PC Saxena Auditorium. He shall also alert the client if any servicing is required for the same prior to installation.

2.3. **Video, data and audio matrix switcher**

An HDMI video switcher will be required to switch between all the input sources and provide an output to the display screen.

The specification of the switcher shall be as below:

- The switcher shall have fixed / Modular I/O matrix with 8 HDMI inputs and 8 HDMI output.
- It shall be capable of distribution and routing of HDCP-compliant digital video and embedded digital audio signals.
- It shall be HDCP complaint and shall maintain the key encryption between input and output devices.
- Support HDMI specifications up to 1080p/60 Deep Color (12-bit) and 1920x1200 at data rates up to 6.75 Gbps or above.
- Switcher shall support embedded HD lossless audio formats.
- It shall support independent routing of audio and video signals.
- Switcher Shall support one-to-one, one-to-many, or one-to-all cross point switching with HDCP-encrypted content.
- It shall provide automatic EDID management between connected devices with the option for user selectable EDID setting.
- The switcher shall have physical buttons on front panel for manual source and sink switching.
- It shall have one Ethernet one Serial port for communication.
• Shall have automatic input equalisation feature.
• The serial port shall support RS232/Rs 422 Protocol.

2.4. Shielded twisted pair Extenders for stage area
Due to the cable distance between the stage and the control room, the HDMI, VGA and audio signals are to be extended over shielded twisted pair copper cabling, requiring transmitter and receiver units at each end to drive the signal over the distance required.

The STP transmitter shall be capable of the transmitting HDMI, VGA, audio and control signals over a single cat-6 cable.

The specification of the twisted pair extender shall be as below:

Transmitter for stage area wall plates
• The STP transmitter shall have minimum two inputs one VGA and one HDMI
• STP transmitter shall provide automatic switching between the input sources and switch the active input when connected
• STP transmitter shall have a configurable switching priority when multiple inputs are active
• STP Transmitter shall digitize analog video input signals prior to transmission to the digital video output
• STP transmitter shall support HDMI specifications including 1080p/60 Deep Color, data rates up to 6.75 Gbps, 3D, and HD lossless audio formats for HDMI input port
• Support video resolutions up to 1920x1200, including HDTV 1080p/60 and 2048x1080p/60
• STP transmitter shall transmit the audio video signal minimum up to 70 meters with the maximum resolution, without affecting the signal quality
• STP transmitters shall provide automatic EDID management between connected devices
• STP transmitter shall be HDCP compliant
• It shall have contact closure or serial port for remote switching control.
• STP transmitters shall be compatible with shielded CAT 5e, CAT 6, and CAT 7
• STP transmitter shall be supplied with under desk mounting clamp

Transmitter for the Display on stage, Green rooms and main auditorium
• The STP transmitter shall have one HDMI input and one Bidirectional RS-232 Pass through and one twisted pair output
• STP transmitter shall support HDMI specifications include data rates up to 6.75 Gbps, Deep Color up to 12-bit, 3D, HD lossless audio formats
• It shall support embedded digital audio on HDMI input port
• It shall support video, audio, and control signal over a single twisted pair cable
• STP transmitter shall support the transmission of audio, video, control signal up to 70 meter at 1920x1200, including HDTV 1080p @ 60 Hz using a single twisted pair cable
• It shall Buffer display data channel
• STP transmitter shall be HDCP compliant
• It shall support EDID and HDCP transmission
• STP transmitter shall support being locally or remotely powered
• STP transmitters shall be compatible with shielded CAT 5e, CAT 6, and CAT 7
• Transmitter shall support the use of HDMI to DVI-D cables or adapters for DVI-D

The specification for the receivers shall be as below:

Receivers for the Display on stage, Green rooms and main auditorium
• The STP receiver shall have one HDMI output and one Bidirectional RS-232 Pass through and one twisted pair input
• It shall support HDMI specifications include data rates up to 6.75 Gbps, Deep Color up to 12-bit, 3D, HD lossless audio formats
• It shall support embedded digital audio on HDMI output port
• It shall support receiving video, audio, and control over a single twisted pair cable
• STP receivers shall support the reception of audio, video, control signal upto 70 meter at 1920x1200, including HDTV 1080p @ 60 Hz using a single twisted pair cable
• It shall Buffer display data channel
• STP receivers shall be HDCP compliant
• It shall support EDID and HDCP transmission
• STP receivers shall support being locally or remotely powered
• STP receivers shall be compatible with shielded CAT 5e, CAT 6, and CAT 7
• It shall support embedded HD lossless audio formats
• Transmitter shall support the use of HDMI to DVI-D cables or adapters for DVI-D

2.5. Audio De-embedder for HDMI signals
The entire video switching system is designed based on the latest digital formats and due to this HDMI video switcher is used for video switching, and there is need to extract the presentation audio source to feed it to the audio system and audio De-embedder is required for the same.

The specification for the Audio De-embedder shall be as below:
• It shall support HDMI specifications include data rates up to 6.75Gbps, Deep Color up to 12-bit
• It shall be HDCP compliant
• It shall support HDTV 1080p/60 or computer-video resolutions up to 1920x1200 resolution for input and output
• It shall extract the audio with or without HDMI output connected
• It shall have one analogue balanced stereo and one Digital SPDIF audio output and both the output shall be active simultaneously
• It shall maintain continuous HDCP encryption between input and output devices
• It shall support multi-channel audio formats including Dolby DTS and Dolby surround
• It shall do input source cable equalisation for HDMI source
• It shall automatically manage the EDID communication between input source and output sink
2.6. **Control System**

A centralised control system is required to control the various AV devices like Display, video matrix switcher audio processor, Blu Ray player etc. AV devices to be controlled for different functionalities through the processor via serial communication a program is written to allow control over the specific components that are installed into the AV system.

**The specification for the AV Control system shall be as below:**

- It shall have 6 bidirectional Serial communication ports with DB9 male connection port
- It shall support RS232, RS422 and RS485 serial protocol
- Serial communication port shall support baud rate up to 115.2K
- It shall have 8 I/O communication ports
- It shall have 8 Infrared ports
- It shall have 8 configurable relay ports
- It shall have feature to expand the memory up to 2GB or more
- The control system shall have provision to expand the serial port with the additional expansion cards
- It shall have 64 Mb of inbuilt SD RAM
- It shall have one or more network Ethernet port for network communication

2.7. **Media presentation keypad**

To control various functionality from stage a multi key button panel is required. This button panel will be mounted on the podium and will provide limited functionality to user like, AV System On/Off, Source selection, Volume Up/Down, Lights On/Off and menu and playback tool bar for Blu-Ray player.

**The specification for the Control keypad shall be as below.**

- The color of the keypad shall be Black.
- It shall have minimum 15 programmable push buttons with backlit labelling.
- It shall have programmable LED feedback indicators.
- It shall have programmable continues rotary encoder.
- It shall have programmable LED bar graph indicator
- It shall have menu navigation key like left/Right, Up/Down, Enter keys to access the menu functionality of Blu Ray player.
- It shall have one Ethernet port for network communication
- It shall have one USB port for firmware upgradation.
- It shall have feature of having power via POE Ethernet connection for operation power.
- It shall have option to insert customised printed labels.

2.8. **Wireless touch panel**

In addition to the keypad a tablet will be used as mobile user interface to control various AV functionality. This tablet will communicate with control system over Wi-Fi network communication. And it will have control system user interface app installed on it. The home functionality of the tablet shall be disabled.
The specification for the Tablet shall be as below.
- It shall have Wi-Fi (802.11a/b/g/n); dual channel i.e.2.4GHz and 5GHz.
- It shall have storage memory of minimum 16 GB or higher.
- The operation system upgrade feature on the tablet shall be free upgrade through the app store.
- It shall have minimum 7-inch (diagonal) LED-backlit Multi-touch display
- The resolution of the display shall be at least 1024 x 768 or higher.
- It shall have Built-in rechargeable battery with minimum 8 hours of operation time.
- The display of tablet shall have fingerprint resistant screen.
- The tablet to be supplied with the table top docking and charging station.

2.9. Wi-Fi Access Point
The Wi-Fi access point is required for communication between wireless touch panel and control processor, and thus two access points are required. The first will be installed on stage and second will be in AV control room.

The specification for the Wi-Fi Access point shall be as below.
- It shall supports 802.11a, 802.11b, and 802.11g wireless protocols.
- WEP, WPA and WPA2 with TKIP & AES security.
- It shall have Built-in DHCP server.
- It shall have Web browser based configuration and management.
- It shall support Power over Ethernet.
- It shall be 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP client and server.
- It shall support dual RF band 5.8 or 2.4 GHz.
- It shall do the event logging for the connected devices.

2.10. POE Network Switch
A 16 Port POE network switch is required for communication between control processor and Wi-Fi access point and other AV equipment like audio processor.

The specification for the network switch shall be as below:
- The switch shall have 16 RJ 45 standard network communication port.
- The switch shall be layer3 Managed switch.
- It shall support 1000BASE-T, 100BASE-TX, and 10BASE-T copper Ethernet technology.
- It shall support IEEE 802.1D, IEEE 802.1p, IEEE 802.1Q, IEEE 802.1s, IEEE 802.1w, IEEE 802.1x, IEEE 802.3ad networking standards.
- It shall support 10/100/1000 Mbps data transfer rates.
- It shall provide POE on the LAN communication ports.
- It shall have quality of service support capability.
- It shall be capable of doing web base management.
- It shall support HTTP/HTTPS/TFTP web management protocol.
2.11. AV Connectivity floor box with connectivity plates

Two units of AV connectivity floor plates are required for various AV connections on the stage area. These plates to be installed on the stage with detail coordination with architect team considering aesthetics and utility of the auditorium. These plates will be installing near proscenium so it will be hidden audience but at same time easily accessible from the stage.

The specification for the Floor plates shall be as below:

- The finish of the plates shall be stainless steel with name screen printed on it for AV connectivity
- The plate shall have 4 nos. microphone in, 1 no audio line out, 2 nos. of AV LAN ports (these will be used only for AV transmitter and receivers), 2 nos. of general purpose LAN ports 4 nos. of 5/15 Amp power outlets
- Selected trade contractor to be submit the drawings for approval prior to the fabrication of these plates.
- The floor plate shall have secured boxing for protection.
- It shall have separate compartment for AV and Power connectivity.

The specification for the Camera wall plate shall be as below:

- The finish of the camera wall plate shall have stainless steel finish with label printed on it
- The each camera wall plate shall have one 75 Ohm BNC connector and two power outlet
- It shall be installed at strategic location for easy access

2.12. Power Distribution Unit

A networked PDU is required for remote power management of AV equipment. This PDU to be installed on IIT’s Local area network.

The specification for the Network PDU shall be as below:

- It shall have feature of network management interfaces that provide standards-based management via Web, SNMP, and Telnet.
- It shall allow users to access, configure, and manage rack device from remote locations.
- It shall have feature of remote power outlet management and it shall provide flexible option to power On/Off individual or all outlet together.
- It shall allow users to configure the sequence in which power is turned on or off for each outlet.
- It shall also allow user to setup delay time for power on or off sequence.
- It shall have ability to Indicates overload and warning conditions based on the user-defined alarm thresholds, and alerts users of potential overloaded circuit.
- It shall have 16 Amp single phase input power supply and 8 x 5 Amp IEC power outlets.
- The Maximum current drain capacity of the unit shall be 20 Amps.
- It shall have cable manager for securing the power cable connected to the outlet.

2.13. AV equipment rack.

The AV equipment rack is required to install all the AV equipment securely and for proper cable management and interconnectivity between the equipment.
The specification for AV Rack shall be as below.
- The AV rack shall have 36 rack unit mounting space.
- The dimension of the rack shall be 600 mm wide x 800 mm deep.
- AV rack shall have perforated open able side panels with lock and key for security.
- It shall have front door shall be with glass window and rear shall be perforated metal door.
- It shall have four silent motor fans installed at top for proper ventilation. The rating of the each fan shall be above 40 CFM.
- AV rack shall have caster wheels with lock.
- The AV rack shall have five full rack size shelves.
- It shall have horizontal 10 cable manager and two vertical cable trays.
- It shall have two power strips for power distribution.
- AV rack to be supply with all the necessary blank, vent panels and required mounting accessories for the secure equipment installation in the rack.

2.14. Motorised microphone suspension system
Four shotgun microphones will be installed above the stage area to capture the audio during the Drama, Live performance. These microphones will be suspended from the ceiling with the help of motorised suspension system.

The specification for motorised microphone suspension system shall be as below.
- The suspension system shall have ability to install two shotgun microphones on each mechanism.
- The suspension system shall have low voltage contact closure interface for third party control integration.
- It shall have 8 feet dropping capability from the ceiling.
- The microphone suspension bar shall be made of lightweight aluminium alloy.
- It shall have universal adjustable microphone clamps for mounting of shotgun microphone.
- It shall have cantilevered arm to balance the microphone weight.

2.15. Blu-Ray player
The Blu-Ray player is required to playback the digital audio video content to the main display system.

The specification for Blu-Ray player shall be as below
- It shall support playback of Blu-ray (BD) including BD-3D, DVD, DVD-A, AVCHD, SACD, CD, HDCD, Kodak Picture CD, CD-R/RW, DVD+-R/RW, DVD+-R DL, BD-R/RE.
- It shall have two HDMI 1.4 and composite video output.
- It shall have 7.1 multichannel analogue RCA/Phono output, 1 x S/PDIF, 1 x Toslink, Dedicated 2 channel stereo analogue RCA/Phono output.
- It shall have USB interface to connect external storage device.
- It shall have one Serial and IR in port for third party control interface.
1.8. Audio system
The sound reinforcement system is required for main hall for uniform sound distribution. This system will comprise of stack of array loud speaker installed in stereophonic fashion. These speakers will be suspended from the main slab ceiling with the help of array mounting bracket.
In addition to this there will be subwoofer speaker will be used to reproduce the low frequency audio.
Power amplifiers will be used to drive the array speakers and subwoofers.
In addition to these three will be distributed audio system which will be used to relay the audio in the adjacent areas like Green rooms, Pre-function and post function area.
Pre-function area and green rooms will have ceiling recessed speakers and Post function area will have wall mounted speakers. These speakers will relay the same audio from the auditorium.
Each adjacent area will have independent volume control to control the speaker levels in that area.
Audio system will also have the 32 channel audio mixing console and Digital audio processor for manipulation of audio signals.
Wired and wireless microphone will be used to for audio presentation. Stage fold back monitors will be used for the audio fold back.
IIT Mumbai will free issue the Audio equipment to selected trade contractor and they need to install the same as per the global standard and tune and align it as per the IIT Mumbai requirement.
Selected trade contractor shall include the installation cost of these audio equipment in their proposal.

2.17. LED displays
Led displays of various sizes are required to relay the video content to adjacent areas of the auditorium hall. These displays will be wall mounted with the wall mount brackets.

The specification of LED displays for Green rooms and stage area shall be as below:
- The size of the display shall be 32” diagonal
- The display shall have thin bezel and it shall be sleek in design
- Display shall have one analogue D-SUB, DVI-D, two HDMI, and audio inputs
- Vertical and horizontal viewing angle of the display shall be higher than 140 degree
- The dynamic contrast ratio of the display shall be 2500:1 or higher
- The display shall support resolution of 1920x 1080p @60 Hz or higher
- It shall have serial and Ethernet port for third party control interface
- The Brightness of the display shall be 400 nits or higher
The specification of LED displays for Pre-function and post function area shall be as below:

- The size of the display for pre-function area shall be 40" diagonal or above.
- The size of the display for post function area shall be 46” or above.
- Display shall have one analogue D-SUB, DVI-D, two HDMI, and audio inputs.
- Vertical and horizontal viewing angle of the display shall be higher than 160 degree.
- The dynamic contrast ratio of the display shall be 4000:1 or higher.
- The display shall support resolution of 1920x 1080p @60 Hz or higher.
- It shall have serial and Ethernet port for third party control interface.
- The Brightness of the display shall be 700 nits or higher.
- Operating temperature of the display shall be 0 to 40 degree with 10 to 80 humidity.

2.18. **Video streaming system**

Video streaming system is required to capture the video from PC Saxena auditorium and distribute it in the IIT Campus. This system shall comprise of video signal extenders, Professional camera with 8 hours continues recording option, Portable camera tripod and the scan converter for live transmission of content on the video system.

The specification of Video extender shall be as below:

- The video extender shall have 3G HDSDI input/and output for video connectivity.
- It shall support the extension of the video transmission up 30 kilo meter on single mode optical fibre.
- It shall support transmission data rates from 19Mbpsto 2.97 Gbps.
- It shall do input cable equalisation for connected source.
- It shall do automatic re-clocking of the signal.
- Each transmitter receiver shall loop through video out for preview monitor.
- It shall have industry standard LC connectors provide reliable physical connectivity and precise fibre core alignment.
- It shall also support embedded audio with video signal.

The specification of 3G HD-DSI to HDMI scaler shall be as below:

- The scaler shall be high performance broadcast grade 3G-SDI to HDMI scaler that converts 3G-SDI, HD-SDI, and SDI signals to HDMI.
- It shall scales SMPTE video resolutions from 480i and 576i up to 1080p/60 and 2K, and offers multiple output rates up to 1920x1200, including HDTV 1080p/60 and 2K.
- It shall be capable of doing input equalization and output reclocking on the buffered SDI output.
- It shall have ability to embed the analogue input audio or embedded AES audio into HDMI output.
- It shall have one serial port for remote configuration and control and also have front panel key control for quick access to menu.
- It shall have auto image setup for detecting input resolution.
- It shall automatically mute video and sync output to the display device when no active input signal is detected.
- It shall provide inbuilt test pattern generator.
- Scaler shall have ability to adjust brightness, contrast, and detail, as well as horizontal and vertical positioning, over scan, and size of the picture.

**The specification of Video recording camera shall be as below.**
- Camera shall be broadcast quality with HDMI and SDI output.
- The image sensor for the camera shall be 1/3 Type Progressive, 2.2Mil Pixels, 3MOS.
- It shall have fixed lens with optical image stabilizer, motorized/manual mode switching, and minimum 18x optical zoom.
- The shutter speed for the camera shall be 1/12sec to 1/250 sec or higher.
- It shall support the flash card up to 64 GB as recording media.
- It shall support sampling rate of audio recording 48 KHz or higher.
- The camera to be supplied with two rechargeable batteries.
- Camera be supplied with two no of 64 GB SDXC memory card.

3. **Projection System for the Old Convocation Hall**

This area will be used for presentations, video & audio conferencing, and require fabric fixed projection screen and high brightness projector to display the presentation content. The specifications for this area should be read in conjunction with the following schematics:

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<tr>
<td>1168i-IIT-006</td>
<td>High Level Plan</td>
</tr>
<tr>
<td>1168i-IIT-007</td>
<td>Section</td>
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</table>

3.1. **Video Projector**

High performance cinema quality projector is required for reproduction of the video content on the projection screen.

**The specification of Video Projector shall be as below.**
- The projector shall be 3Chip DLP projector.
- The Brightness of the projector shall be 13000 lumens or higher.
- The native resolution of the projector shall be 1920 x 1080 pixels
- The projector shall have One RGBHV, one dual link DVI and one HDMI input.
- It shall have standard zoom lens.
- The projector shall use High brightness Mercury lamp and lamp life shall be 1500 hours or higher.
- It shall have dust sealed optical light engine.
- It shall have lens shift and geometric correction option.
- It shall have serial and Ethernet port for third party control interface.

**The specification of Projection screen shall be as below.**
- The size of the screen is 360” diagonal with 16:9 formats.
- The screen shall make out of fabric or flexible PVC.
• The screen fabric material shall be flame retardant.
• The Gain of the screen shall be unity.
• The half viewing angle of the screen shall be 60 degree.
• The screen to be install with the mild steel structure supported from the main building structure.
• The screen shall be installed on the MS structure with the help of bungee cords or screen ties.
• The black masking border to be done at all four sides of the screen to cover hide the MS frame.

4. Final Information

4.1. Instruction Manuals

The format of information and operational documents will be submitted for approval early in the project and before the main installation work commences. Documentation is considered an integral part of this project and the project will not be deemed complete and handed over until the final documentation, described below has been received and approved.

The selected trade contractor shall supply three complete copies of operational manuals, as-built schematics, cable schedules and manufacturers’ equipment instructions for each room/area installation. Separately, one complete set of the manufacturers’ handbooks for each piece of equipment installed will be supplied in a separate file. The front page will contain contact details for the Trade Contractor.

4.2. Control System Software

The selected trade contractor will be responsible for providing all software and associated documentation necessary for the operation and maintenance of the equipment. On completion of the installation, the trade contractor will hand-over the codes, modules, written software and the programme to the client in a CD/DVD format as agreed with in two copies. This will be inclusive of the source codes, actual program, touch panel layouts, mixer configuration files, and associated modules.

The trade contractor will include additional 15 days of control panel programming to take place 1st and 3rd month after completion of the installation to allow for fine-tuning of the programmes, GUIs. On completion, the software will be updated and issued by the trade contractor at no extra charge to the client providing complete ownership of the code and IPs.

4.3. Drawings

The trade contractor is to provide the following information and documentation upon completion of the installation so that it may be checked as part of the final on-site witness testing.

The trade contractor should supply three copies of all “as-built” drawings. These are to include all system schematics, cable schedules, termination schedules and room layouts (both plan and elevations). In addition to the hard copy “as-built” drawings, provide these and any other related drawings in electronic format for use on AutoCAD systems. The format of the AutoCAD drawings has to be agreed with the Employer.

4.4. Routing of Cables

Mains cabling to the individual units will be routed down one side of the rack separate to that of the AV cabling. The mains cabling will terminate in IEC blocks, which are connected to an
integral mains distribution unit. All mains and AV cabling will be labeled clearly in accordance with as-built drawings. Cabling will be neat and tidy, accessible for rearrangement without undue work and brought into the rack from underneath unless where otherwise stated. Use of insulated straining bars is required. Cross wiring of cables is not acceptable. Cables shall be secured using Velcro grips instead of plastic cable ties which may damage the cable when too tightly wound. The cables should enter into the AV racks only through the entrance holes in the top or bottom of the rack.

Special care has to be taken to make sure that the cables are not installed with bend radius less than the respective manufacturer recommendations.

4.5. **Serviceability**

In the interest of effective servicing, all equipment is to be installed such that access is not hampered. To further aid the serviceability of the equipment racks, service loops are to be provided on all equipment allowing easy removal from the front and also, quick rectification of faults.

4.6. **Labelling**

Each rack will, on completion of the installation, have a cable schedule attached to the outside of the rack. This will clearly identify all the connections and numbering of all cables within the rack.

4.7. **System Schematics**

On completion of the installation, the trade contractor will attach to each rack a laminated copy of the system “as-built” schematics.

4.8. **Cable Specifications**

All site wiring must conform to the following:

- AS3080: Integrated telecommunications cabling systems for commercial premises.
- AS3084: Telecommunications installation, pathways and spaces for commercial buildings and any other regulations in force at the time of installation.

Pin 1 on both free and fixed XLRs will not be connected to the XLR casing anywhere in the installation to avoid panel earth (which is building earth) from being connected to the clean technical earth. Any metalwork that is not already earthed through conduit will be earthed to an approved point.

Where applicable, AV cables will be installed tidily on tray, in trunking and through conduits. Those on trays will be to one side of the tray, leaving space for further cables to be added at a later date. Cables on trays will be secured at regular intervals to ensure no cross wiring can occur. Any extra trunking or conduit needed to complete the installation will be the responsibility of the trade contractor. Cables should be neatly loomed and combed to avoid crossovers.

Cables will not be held so tightly that permanent indentation or cutting of the outer sheath or conductor insulation occurs.

All cables must be low-smoke and halogen free type. All cables will be labeled within 300mm of each end of the cable and visible to the naked eye. This will include a colour coded cable number as well as a circuit identification label. A unique cable-numbering scheme will be used;
the Employer will approve this at the start of the contract. All labels should be permanent self-laminating wrap-around ones with computer generated prints. Where practical, all AV system cabling will be installed a minimum of 600mm away from mains cabling and power systems, and only cross such systems perpendicularly.

4.9. **Audio cables**

All audio cables will be of the balanced twisted pair type. Installed cables will have a braided, lapped or foil screen around each pair. The four cores making up the pairs will have 0.22 mm minimum two copper conductors, and will have different colored insulation. Screen shielding for each pair will be 94% coverage or better. The same type of cable will be used throughout the installation; the trade contractor will state the type of cable in the RFP return. No cross wiring of cabling will be accepted.

4.10. **Video Cables**

High quality cable such as PSF 1/3 or 1/7 will be used for all video cabling. The same type of cable will be used throughout the installation; the trade contractor will state the type of cable and its specification in the tender return. Where a number of cables run together, e.g. to the projector or a connection panel, the variation in cable length will be less than 100 mm. No cross wiring of cabling will be accepted.

4.11. **Graphics Cables**

Any graphics cabling will be suitable for use for signals of up to 600 MHz bandwidth. The same type of cable will be used throughout the installation; the trade contractor will state the type of cable and its specification in the tender return. Where a number of cables run together, e.g. to a connection panel, the variation in cable length will be less than 10mm. No cross wiring of cabling will be accepted.

4.12. **Equipment – Variable Controls**

All equipment with variable controls will have their presets marked for recognition following commissioning. Method of marking is to be approved by the Employer prior to being adhered. This equipment will also have secure covers so no unauthorized person(s) may adjust preset levels.

4.13. **Network Connections**

Network connections will be provided by others, and will be drawn into the AV rack using patch leads.

5. **System Engineering and Quality**

The systems shall be engineered so that in the event of failure, it will be possible for a technician to locate and rectify faults easily.

5.1. **Patching facilities**

Patching facilities are stipulated where required.
5.2. **Earthing**

Earthing for equipment within the systems/installation should be arranged so that hum resulting from earth loops is eliminated. Whatever arrangements are used, they must not compromise the earthing procedure necessary to comply with electrical safety requirements.

5.3. **Labelling**

The Trade Contractor must ensure that free and fixed connections and all controls of the installation are properly and permanently labelled in a clear and unambiguous way.

5.4. **Installation of equipment**

The Trade Contractor must install all of the systems and equipment in full conformity with the manufacturers' recommendations, current building regulations, Health & Safety Requirements and all relevant global standards whether specified, implied or otherwise.

6. **Mains Power and Technical earth**

6.1. **Mains supplies**

The Employer will supply and install the cabling for the mains power supplies associated with the technical equipment and facilities. Dedicated mains supplies for use with the technical earth facilities, will be installed and terminated for all audio visual equipment.

Further details of the supplies will be provided after appointment.

Upon appointment and at a time to be agreed, the Trade Contractor is to:

- Advise the Employer of any amendments he requires to the isolator locations and the sizes of supplies being made available;
- Provide the Employer with a layout of the areas in which equipment is being installed. On the layouts, confirm where the power supplies are required;
- supply and install all necessary cabling required to connect the power supply to the equipment racks and to any other items of equipment that he is installing;

Liaise with the other trades prior to connecting equipment and establish a working method that will enable such connections to be implemented safely.

The Employer may, at his discretion, request that any equipment that is brought to site be tested for electrical compliance prior to being connected to the electrical supply.

6.2. **Technical earth**

Where a technical earth is supplied all the AV equipment will be connected to it.

6.3. **Trunking, conduit and facility panels**

Dedicated trunking and conduit systems for the cabling associated with the facilities and systems that the Trade Contractor is installing will be provided by others where the Employer sees fit to do so. The containment will consist of trunking or tray and conduit as appropriate to link elements such as connector panels, equipment racks and any other items associated with the systems being installed.

The Trade Contractor is to use the containment provided for all high and low level cabling associated with the various technical facilities he is installing, and augment where necessary.
Cabling within ceiling voids, floor voids and within walls must be run using standard practice.
The main containment routes will be supplied by others, but the final route from the
containment provided to the equipment must be secured according to normal practice. **Loose
laid cabling is not acceptable.**
Where cables are routed from under the floor, grommet holes will be provided. The Trade
contractor must indicate on drawings the location and size of grommet holes required for this
cabling associated with the audio visual facilities.
**Cables must be sleeved with braided sleeves to ensure there is no chaffing or damage
to cables.**
Where power and AV cables are to come from under the floor, these may not share the same
grommet hole except under exceptional circumstances, when approval must be sought from
The Employer prior to installing these cables.
No AV-related cables will not be installed closer than 600mm from power cables where they
run in parallel. Only where necessary will AV cables cross power cables and this will be done at
right angles. The AV cables will not rest on mains power cables.
**Where there is no conduit, trunking or tray, you are not required to provide it.**

6.4. **Specialist cabling**
The installation and termination of all site cabling will be the responsibility of the successful AV
contractor.
All internal rack cabling will be supplied by and carried out by the successful AV contractor.
Sufficient tails length on cables will be left to enable the associated equipment and panels to be
connected and withdrawn for inspection and maintenance.
The trade contractor should satisfy himself that a minimum clearance of 600mm has been left
between audio circuits and any cables associated with mains power circuits, unless otherwise
agreed.
Where the cable routes are in close proximity to other services, he should ensure that the
cables are sufficiently well screened.
He should ensure that all cables associated with the systems he is installing are properly and
permanently labelled, in a clear and unambiguous way.
Any cables that cross power must do so at 90° in order to minimise any interference.

6.5. **Cable types**
The Trade Contractor must ensure that the cables he installs meet the identified requirements
and are fit for the purpose.
If asked, he must be prepared to submit to the Employer samples of the cables he proposes to
use for the various services for comment.
All cables that are to be installed in this installation must be low smoke and halogen free.

7. **Testing, Commissioning and Training**
The Trade Contractor must rectify any defects in workmanship, materials, maladjustments,
performance or other irregularities that become apparent during the programme of tests. He will be
responsible for the costs associated with correcting the defects, along with any additional costs
incurred by the Employer resulting from tests having to be repeated. Some of the site testing may
not be practicable during normal working hours. The Trade Contractor may therefore be required to work out-of-hours.

7.1. **Commissioning**

The client will carry out full off-site witness testing of the completed systems prior to their delivery to site. This testing may also be attended by representatives of the client’s in-house multimedia team.

All systems will also be fully tested on site upon their completion. In both cases, witness testing will not commence until the Trade Contractor has completed all of his own testing, rectified all faults and can demonstrate a fully working system, including all modes of control systems.

The Trade Contractor will submit for approval a commissioning schedule at least 2 weeks before commissioning is due to start. This schedule will include drafts of the test results sheets to be used to record all tests. Snagging is to be completed prior to practical completion.

Testing and commissioning will be carried out in accordance with the requirements of this specification in the presence of, and to the satisfaction of the Employer.

The Trade Contractor may be asked to provide the following test equipment at commissioning. Proof of calibration will be provided on demand.

7.1.1 **Audio**
- Phase tester and cable continuity/short tester
- Sound level meter
- Test tone generator
- Portable loudspeaker

7.1.2 **Video**
- Video colour test pattern generator to generate 75% colour bars in PAL
- Portable video monitor

7.1.3 **Graphics**
- High-resolution wide bandwidth test pattern generator

7.2. **Cabling tests**

All cabling will be tested by the Trade Contractor and the results noted. A random selection of cables may be re-tested during the commissioning period to check the validity of the results. The final results will be included within the O & M manual.

Audio cables will be tested for continuity, polarity and conductor isolation from each other and from building earth. Video cables will be tested for continuity and central conductor to screen isolation and isolation from building earth.

7.3. **Commissioning of audio**

The following tests may be carried out and the results noted for all paths through the audio system (up to the inputs of the loudspeaker amplifiers):
- signal polarity (at all points in the audio chain)
- frequency response
- signal to noise ratio at nominal operating level (+4dBm)
- Level of program audio loudspeakers and ceiling loudspeakers
- The Trade Contractor will demonstrate that the sound levels of all loudspeaker systems have been set up correctly

The Trade Contractor will demonstrate that all audio sources are operational. The Trade Contractor will supply source material.

7.4. **Commissioning of video and graphics equipment**

The Trade Contractor will demonstrate that any display device is set up correctly and parameters stored for all common computer graphics resolutions and for video in both 16:9 and 4:3 formats. To this end the Trade Contractor will supply a computer capable of generating graphics at different resolutions in both 16:9 and 4:3 formats. The Trade Contractor will also supply a DVD and will be able to demonstrate record and playback where required.

When required, the Trade Contractor will need to provide the necessary test equipment and demonstrate to the Employer, that the system performance parameters have been met. Where the satisfactory performance of systems is not based on measurements, he will need to demonstrate the operation of such systems in full, to the satisfaction of the Employer.
# LIST OF APPROVED MAKES

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Approved Makes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P.C. Saxena Auditorium</td>
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<tr>
<td></td>
<td>Projector Ceiling mounts</td>
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<tr>
<td>1</td>
<td>32 Inch LED display for Green room including mounting arrangement</td>
<td>Samsung - ME32C</td>
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<tr>
<td></td>
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<td>Panasonic - TH-32VMB6DM</td>
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<tr>
<td>A</td>
<td>Video System</td>
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<tr>
<td>2</td>
<td>Three Input Switcher with Integrated DTP Transmitter</td>
<td>Extron - DTP T USW 233</td>
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<td>Kramer - SID-X1</td>
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<tr>
<td>3</td>
<td>HDMI Twisted Pair Receiver</td>
<td>Extron - DTP HDMI 230 Rx</td>
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<tr>
<td></td>
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<td>Kramer - PT 572 Plus/ TP 574</td>
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<tr>
<td>4</td>
<td>HDMI Twisted Pair Transmitter</td>
<td>Extron - DTP HDMI 230 Tx</td>
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<td>Kramer - TP 573</td>
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<td>5</td>
<td>HDMI Audio De-Embedder</td>
<td>Extron – HAE 100</td>
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<td>Kramer - FC-46XL</td>
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<td>6</td>
<td>8 x8 HDMI Matrix Switcher</td>
<td>Extron – DXP 88 HDMI</td>
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<td>Kramer - VS88-HN</td>
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<td>7</td>
<td>Shielded twisted pair cable (305 meter)</td>
<td>Extron – DTP 24(22-236-03)</td>
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<td>Kramer - DIGikut 7a23</td>
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<td>8</td>
<td>Shielded twisted pair plug kit</td>
<td>Extron – XTP DTP 24 Plug (101-005-02)</td>
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<td>3' (1.8 m) High Speed HDMI Cable</td>
<td>Extron – HDMI Pro/3 (26-650-03)</td>
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<td>Kramer - C-HM/HM/PRO-10</td>
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<td>Kramer - C-HM/HM/PRO-25</td>
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<td>12' (3.6 m) Male to male VG with Audio cable</td>
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<td>Blu Ray player</td>
<td>Cambridge audio - BD 752</td>
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<td>Control System</td>
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<td>15</td>
<td>Dual Bus Control System.with C2E Net 1 Card</td>
<td>Crestron – AV2</td>
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<td>AMX - NI 3100</td>
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<td>I PAD 4 16 GB with crestron control app</td>
<td>Apple – I PAD 4</td>
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<td>17</td>
<td>Table top docking station for IPAD</td>
<td>Crestron - IDOC-PAD-DSC</td>
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<td>18</td>
<td>Media Presentation Button Panel B20 with custom button printing</td>
<td>Crestron - MP-B20 +PW2407RU + MP/MPC/IPAC_FRONT_LABEL_ENGRAVED-B-T AMX - SP-16-AX-TR-US</td>
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<td>19</td>
<td>Wall Mount 802.11a/b/g Wireless Access Point</td>
<td>Crestron – CEN-WAP-ABG-1G</td>
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<td>16 Port managed POE LAN switch</td>
<td>AMX - NXA-WAP1000</td>
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<td>C</td>
<td>Cables &amp; Connectors</td>
<td>Cisco - SRW2016P</td>
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<td>Co Axial cable</td>
<td>Extron – RG 6 (22-098-02)</td>
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<td>Kramer - BC-RG63G</td>
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<td>Belden - 10GX53F</td>
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<td>Panduit - TX6000</td>
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<td>23</td>
<td>Bulk connector lot (XLR, 9 PIN, 15PIN, Phono, RJ45, RCA, BNC,)</td>
<td>Neutrik / Extron / Kramer / Canare / Switchcraft</td>
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<td>D</td>
<td>Hardware &amp; Other Items</td>
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<tr>
<td>24</td>
<td>8 Channel power sequencer</td>
<td>APC – 7921</td>
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<td>ATEN - PE6108G</td>
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<td>25</td>
<td>AV connectivity BOX with Power, 8 x Mic in/ 1 x Line out / 1 x VGA+Audio +1 HDMI , 2 x AV LAN</td>
<td>System integrator custom made</td>
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<tr>
<td>26</td>
<td>Wall plates for camera connectivity</td>
<td>System integrator custom made</td>
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<tr>
<td>27</td>
<td>36 RU closed rack with front glass door, 12 outlet power strip, silent motor ventilation fans, 5 shelves and cable manager and mounting accessories</td>
<td>Valrack / Netrack</td>
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<td>28</td>
<td>Servo reeler system for shotgun microphone with Low voltage interface</td>
<td>Servoreeler - (SRL-8)X8, (SRC-6)X2,(Option-A) X2,(TRAP-[1']) X2,(BRK-1)</td>
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<td>29</td>
<td>Microphone stand</td>
<td>K&amp;M / Ahuja</td>
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<tr>
<td>II</td>
<td>Pre-function Area</td>
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<tr>
<td>A</td>
<td>Display System</td>
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<tr>
<td>30</td>
<td>40 Inch LED display for reception area as digital notice board including mounting arrangement</td>
<td>Samsung - PE 40 C</td>
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<td>Panasonic I - TH-42LF60</td>
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<td>31</td>
<td>HDMI Twisted Pair Transmitter</td>
<td>Extron – DTP HDMI 230 Tx</td>
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<td>Kramer - TP 573</td>
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<td>Post-function Area</td>
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<td>A</td>
<td>Display System</td>
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<tr>
<td>33</td>
<td>46 Inch LED display for reception area as digital notice board including mounting arrangement</td>
<td>Samsung - PE 46 C</td>
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<td>Convocation Hall</td>
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<td>14000 Lumens Full HD projector with standard Zoom lens(ILS 1.25-1.6SX+/1.16-1.49HD)</td>
<td>Christie – HD14K-M</td>
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<td>Panasonic – PT-DZ13K</td>
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<td>35</td>
<td>Projector mount Kit above projector</td>
<td>Chief – CMA345+VCMU+CMS0608 +CMA640</td>
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<td>36</td>
<td>360&quot; Fabric projection screen</td>
<td>Harkness Screens - Stagelite contrast grey 70 Showtex - No limit matt white</td>
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<td>37</td>
<td>Customised MS frame to install the fabric screen</td>
<td>System integrator custom made</td>
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<td>B</td>
<td>Audio System</td>
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<tr>
<td>38</td>
<td>16 Channel audio mixer  Soundcraft - LX7ii 16 channel</td>
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<td>39</td>
<td>32 Channel audio mixer  Soundcraft - LX7ii 32 channel</td>
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<td>Audio sneak cable 8 core  Euro Cable - CVS LKSSS08C</td>
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<td>41</td>
<td>Stage breakout box with 8 mic in with all XLR connectors  Neutrik - NSB1C-8/0</td>
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<td>42</td>
<td>Monitoring headphone  AKG – K99</td>
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<td>43</td>
<td>XLR Male connectors cable end  Neutrik - NC3MXX</td>
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<tr>
<td>44</td>
<td>Bulk connectors for mixer connection with existing system  Neutrik/ Canare</td>
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