

SUMMARY					
PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU					
LOCATION: BENGALURU					
DESCRIPTION : HVAC WORKS					
SL. NO	DESCRIPTION				
		APET AMOUNT		APFD AMOUNT	
		Supply	Installation	Supply	Installation
A	HIGH SIDE WORKS				
B	LOW SIDE WORKS				
TOTAL					
	TOTAL (Supply & Installation)				
<div>EXCLUSIONS:</div> <div>1 Kitchen exhaust system and Kitchen make-up air system considered as Rate only</div> <div>2 External wall louvers for fresh air and exhaust air is in civil scope</div> <div>3 Toilet door undercuts and door louvers for fresh air is in civil scope</div> <div>4 AHU room for 120 seater class room AC units - AAC block works, wall insulation, roof insulation is in civil scope</div> <div>5 Dog house for all shafts terrace is in civil scope</div> <div>DEPENDENCIES:</div> <div>1 Kitchen consultant inputs on Kitchen exhaust airflowrates and type of hoods used in kitchen</div> <div>2 Based on kitchen consultant inputs on kitchen ventilation requirement, kitchen exhaust ducting routing with shaft from ground floor to</div>					

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC HIGHSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	VRF UNITS							
1	Supplying, erecting, testing and commissioning VRF / VRV air conditioning system, out door unit (ODU) complying type-IV OEM standards working on HFC free refrigerant R410A or other required/suitable green equivalent refrigerant, for cooling capacity delivering 100% at 36 deg. celcius and non stop cooling even at 40 deg. celsius and coefficient of performance (COP) 3.00 to 4.00, modular type horizontal/vertical hot air discharge suitable for total piping length upto 1000 metre operation in cooling mode with inverter based VRF/VRV technology microprocessor based control compressor starter/control panel complete with scroll compressor, air cooled anti corrosive copper condenser coil of suitable shape for increasing maximum heat transfer area, built in oil separator, accumulator and oil receiver, copper tube aluminium fin air cooled condenser, condenser fan with motor suitable for 415V \pm 10%, 50 Hz, 3 phase power supply, internal copper refrigerant piping, internal wiring and first charge of refrigerant, etc. all housed in powder coated weather proof cabinet on provided angle iron frame or suitable foundation connected to the system in approved manner complete.							
a)	10 HP	NOS	1					
b)	12 HP	NOS	R/O					
c)	8 HP	NOS	R/O					
d)	6HP	NOS	1					
2	Supply, Installation and commissioning of Hi wall mounted indoor units with compact cooling coil, multispeed fan motor, the blower shall be dynamically balanced and designed for silent operation, the filters shall be washable synthetic media type arranged for convenient cleaning and replacement and drain pan. The unit shall be with necessary cables, the unit is supplied with cordless remote controller and shall as per specification.All units should have inbuilt drain pumps.(Contractor has to give quote on the basis Indoor unit cfm with maintaining the Capacity TR as specified) (the unit shall include cordless remote controller)							
a)	2.0 TR	NOS	R/O					
b)	1.5 TR	NOS	R/O					
c)	1.25 TR	NOS	R/O					
d)	1.0 TR	NOS	R/O					
3	Supply, Installation and commissioning of 4-way Cassette indoor units with compact cooling coil, multispeed fan motor, the blower shall be dynamically balanced and designed for silent operation, the filters shall be washable synthetic media type arranged for convenient cleaning and replacement and drain pan. The unit shall be with necessary cables, the unit is supplied with cordless remote controller and shall as per specification. All units should have inbuilt drain pumps.(Contractor has to give quote on the basis Indoor unit cfm with maintaining the Capacity TR as specified) (the unit shall include cordless remote controller)							
a)	3 TR	NOS	2					
b)	2.5 TR	NOS	R/O					

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
c)	2.0 TR	NOS	1					
d)	1.5 TR	NOS	1					
e)	1.25 TR	NOS	R/O					
f)	1.0 TR	NOS	3					
4	Central remote controller for VRF system	Lot	2					
	High side - VRF Units - Total							
	<u>DX UNITS</u>							
5	Supply, Installation and commissioning of 5 Star rated Hi wall mounted indoor & outdoor units with compact cooling coil, multispeed fan motor, the blower shall be dynamically balanced and designed for silent operation, the filters shall be washable synthetic media type arranged for convenient cleaning and replacement and drain pan. The unit shall be with necessary cables, the unit is supplied with cordless remote controller and shall as per specification. All units should have inbuilt drain pumps/customized drain pump. (Contractor has to give quote on the basis Indoor unit cfm with maintaining the Capacity TR as specified) (the unit shall include cordless remote controller)							
	The price quoted shall include isolator near the outdoor unit and cost of power, control cables, and earth conductors from the power outlets to the room units and outdoor units. The cables shall be armoured PVC & A cable and shall be clamped to the wall / ceiling using heavy duty GI clamps.							
a)	2 TR	NOS	2					
b)	1.5 TR	NOS	8					
c)	1 TR	NOS	2					
d)	Refrigerant copper piping with insulation for 1 circuit length. (Includes Liquid and Gas refrigerant piping) Note : Refrigerant Pipe installed in Exposed area (exposed to SUN) should be wrapped with White Tape to prevent damage for Insulation from Birds and UV light protective wrapping shall be considered.	RMT	21					
e)	Supply, installation and testing of CPVC Drain piping for the units With Insulation of Nitrile Rubber pipe section thickness of 9 mm and suitable for following pipe size (Includes necessary fittings such as adators, elbows etc. and supports)	RMT	21					
f)	MS stand for ODU installation as per typical installation detail for ODU with 35mm x 5 mm MS stand with 4 Nos bases of 100 mm x 100 mm X 5mm thick. Frame shall be painted with red oxide & 2 coats of Black enamel paint. Stand shall as per Drawings & Specifications. For the Installation of Outdoor units, provide neoprene pad below frame bases.	NOS	12					

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
6	Supply, Installation and commissioning of Inverter based DX Ductable ceiling mounted indoor & outdoor units with compact cooling coil, multispeed fan motor, the blower shall be dynamically balanced and designed for silent operation, the filters shall be washable synthetic media type arranged for convenient cleaning and replacement and drain pan. The unit shall be with necessary cables, the unit is supplied with cordless remote controller and shall as per specification. All units should have inbuilt drain pumps/customized drain pump. (Contractor has to give quote on the basis Indoor unit cfm with maintaining the Capacity TR as specified) (the unit shall include cordless remote controller)							
	The price quoted shall include isolator near the outdoor unit and cost of power, control cables, and earth conductors from the power outlets to the room units and outdoor units. The cables shall be armoured PVC & A cable and shall be clamped to the wall / ceiling using heavy duty GI clamps.							
a)	16.5TR, 6800CFM	NOS	2					
b)	11TR, 4400CFM	NOS	R/O					
c)	Refrigerant copper piping with insulation for 1 circuit length. (Includes Liquid and Gas refrigerant piping piping) Note : Refrigerant Pipe installed in Exposed area (exposed to SUN) should be wrapped with White Tape to prevent damage for Insulation from Birds and UV light protective wrapping shall be considered.	RMT	23					
d)	Supply, installation and testing of CPVC Drain piping for the units With Insulation of Nitrile Rubber pipe section thickness of 9 mm and suitable for following pipe size (Includes necessary fittings such as adators, elbows etc. and supports)	RMT	23					
e)	MS stand for ODU installation as per typical installation detail for ODU as per OEM standard. Frame shall be painted with red oxide & 2 coats of Black enamel paint. Stand shall as per Drawings & Specifications. For the Installation of Outdoor units provide neoprene pad below frame bases.	NOS	4					
High side - DX one to one Units - Total								
HVLS FANS								
7	Supply, installation, testing and commissioning of High Volume Low Speed (HVLS) fans. Fan construction shall include a universal ceiling mount, heavy gauge steel downtube/droptube, factory-programmed variable frequency drive, high torque-low speed direct drive type motor, aluminum airfoil blades (aerodynamic). Motor shall be suitable for 415V, 3 Phase, 50 Hz AC supply. Scope shall be inclusive of Electrical panel, required length of power cable, Zone controller for controlling all HVLS fans with touch screen technology, control box, communication cable (CAD5 or CAD6), etc. The control shall have minimum features of fan speed control, scheduling, fan status, BMS integration, etc. Fan shall be provided with a multi-point, redundant safety system comprised of a heavy-duty safety retention cable, guy wire kit, hub retention system, and airfoil retaining links. Fan shall be AMCA certified for Circulating Fan Performance.							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Note: The Vendor shall provide the fan selection and coverage based on actual CFD Analysis							
	Note: The Power Cable to the starter panel shall be under electrical scope and outgoing for all HVLS fans from starter panel shall be supplied from OEM with control cabling for controlling of all HVLS Fans							
	Air Volume: 7000 CFM	Nos	2					
	Max. continuous operating temperature: 104° Fahrenheit (40° Celsius).							
	Sound level: shall be less than 36 dBA							
	Controller: Touchscreen control with LCD display. Capable of operating up to 10 fans individually or in groups.							
	Fan Blade Finish: Mill Finish							
	Motor Size: 500 to 750W (240V, 1Ph, 50Hz)							
	Motor enclosure: IP54							
	Motor: High torque- Low speed direct drive type							
	VFD: Factory Programmed with IP40 enclosure							
	High side - DX one to one Units - Total							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	REFREGERENT COPPER PIPE							
1	Supplying, laying / fixing, testing and commissioning of standard refrigerant copper pipe for liquid line / suction line supply and return piping of suitable gauge (hard drawn copper pipe for liquid main line and for refrigerant) along with necessary supports, hangers, clamps, vibration isolators and fittings such as bends, tees, valves, gauges, strainers with insulation of 19 mm thick elastomeric nitrile rubber along with application of multicoating or using Truncking system suitable for use with VRV / VRF piping for protection against mechanical damages, fungal growth, flame spread, water permeance and ultra violet radiations complete with OEM standards of VRV / VRF air conditioning system and insulation as per ECBC-2017. Note : Refrigerant Pipe installed in Exposed area (Terrace floor/Exposed to SUN) should be wrapped with White Tape to prevent damage for Insulation from Birds and UV light protective wrapping shall be considered.							
a)	34.9	RMT	R/O					
b)	28.6	RMT	R/O					
c)	22.2	RMT	23					
d)	19.1	RMT	R/O					
e)	15.9	RMT	74					
f)	12.7	RMT	16					
g)	9.5	RMT	96					
h)	6.4	RMT	16					
1.1	Supplying and installation of high pressure grade required size copper connection Y or T- Joints / refnet for liquid and suction line complete erected on wall/ceiling with supports/raceways, Nitrile rubber insulation, painting etc. with brazing and testing for leakages confirming the normal operation of the VRV / VRF air conditioning system.	NOS	5					
1.2	Supply, installation and testing of CPVC Drain piping for the units With Insulation of Nitrile Rubber pipe section thickness of 9 mm and suitable for following pipe size (Includes necessary fittings such as adators, elbows etc. and supports)							
a)	32 mm	RMT	1					
b)	25 mm	RMT	66					
c)	20 mm	RMT	1					

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
1.3	Supply and installing following size of Hot dip galvanized ladder Type MS powder coated cable trays fabricated out of Single Sheet Mild Steel Confirming to I.S. 1079, finish Hot dip galvanized as per IS 2629, 65microns, Fasteners : Electro Galvanized including horizontal and vertical bends ,anchor fastner and C channel,GI bolt, reducers, tees, cross members at 300 mm interval and other accessories as required and duly suspended from the ceiling with fabricated MS angle supports etc as required. The rates shall include all leads, lifts & Staging/scffolding (if any).							
a)	750 mm X 100 mm X 2mm	RMT	R/O					
b)	450 mm X 100 mm X 2mm	RMT	R/O					
c)	300 mm X 100 mm X 2mm	RMT	50					
1.4	Control/Communication cabling for VRF system as per OEM standard	RMT	146					
1.5	Power cabling with 3 Pin plugtop for VRF indoor units as per OEM standard (based on number of indoor units)	Nos	7					
1.6	Power cabling between outdoor unit and Electrical isolator with all necessary accessories cable trays etc., as per OEM standard. Electrical isolator shall be provided by electrical vendor near the outdoor unit	RMT	20					
TOILET EXHAUST FAN								
1	Supplying, installing, testing and commissioning of direct driven PROPELLER FANS for exhaust/supply air as shown in drawings. Each fan shall be complete with permanent split capacitor or shaded pole motor, mounting plate, accessories like wire guard, bird screen and fixed louvers for weather protection as required. Fan selection arrangement and Electrical characteristics shall be as follows :							
a)	600CFM	NOS	R/O					
b)	500CFM	NOS	R/O					
c)	300CFM	NOS	R/O					
d)	100CFM	NOS	3					
3	Supply, installation, testing & commissioning of Double skin construction Floor mounted Cabinet type exhaust air fan , suitable for outdoor installation							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Casing: - Unit shall be modular type with pentapost frame. Unit shall be Double skin with 25 +/- 2 mm thick PUF / PIR type CFC free insulation sandwiched between the panels. The insulation shall be injected such that the density remains constant throughout the panels. Double skin wall panels shall be fixed to 3mm thick, hollow extruded aluminium profile with polyamide thermal break profile joined by 3D extruded aluminium chamfered corners, forming the structural frame work to house all internal components. The panels shall be of 0.8mm thick GSS sheet pre plasticised finish on the outer side and pre coated finish on the inner side of the unit. Panels should have complete with Glass view panel, motor guard, marine light, cable entry, drain connection at both ends. 18G SS drain tray insulated externally with 19mm nitrile rubber. Unit frame work shall be of extruded aluminium profile with three way corner frame sections.Casing of the unit shall comply to eurovent EN 1886 with casing strength D1 type, casing leakage L1, Filter bypass leakage F8, Thermal bridging factor TB2 and air handling performance as per EN 13053. The air leakage through ahu casing shall not exceed specified limits while tested as per class B of DW 143 standard.							
	Fan: The fan section shall be verticle type with twin/three fan arrangement. The fans shall be direct driven Plug type fan with Variable frequency drive. The fans section shall have centrifugal forward/backward curved blower duly supported on Al. frame through rubber-in-shear or spring vibration mountings and raised at a height to match the opening of the front discharge supply air opening. If the discharge is top than the blower shall be supported using brackets/Al. frame with rubber-in-shear or spring vibration mountings without the need for elevation. The impeller and shaft of the fan shall be both statically and dynamically balanced. The motor shall be IE3 or above type totally enclosed and fan cooled type with class F insulation and IP 55 Protection. Minimum fan efficieicy should not be less than 75%, Motor efficieny not less than 92%.The motor shall be of energy efficient type with high and flat efficiency curve for 50 to 100% load. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through direct drive arrangement based on the type of blower selected. The fan motor HP shall be at least 25% more than BHP.							
	150 mm x 150 mm vibration isolation rubber pads in two layers with an 18G GI sheet seperating the pads to be provided to isolate the unit from the foundation.							
	Unit shall have fire retardant canvas cloth with MS angles/supporting elements, MS rod/nut,bolt etc for respective duct connection.							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Static pressure and Motor Rating :Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							
	Note: Motors selection for all the below units at full load (Design CFM) to be not more than 45Hz.							
	Noise Level: Contractor to ensure noise level < 50 dBA all around the CSU at 1m distance.							
	Note:Limit switch and associated cabling to be considered							
	Note : GI sheet Canopy to be provided for all Terrace ventilation units along with supporting steel structure							
	CONSIDER ELECTRICAL INTERLOCK BETWEEN TOILET EXHAUST FAN AT TERRACE AND FRESH AIR FANS AT INDIVIDUAL FLOOR TOILETS							
	Toilet exhaust fan							
a)	1100Cfm and a static pressure of 30 mm WG ESP	NOS	1					
b)	3000Cfm and a static pressure of 30 mm WG ESP	NOS	1					
c)	3300Cfm and a static pressure of 30 mm WG ESP	NOS	1					
4	Supply, installation, testing & commissioning of Double skin construction Ceiling Suspended Cabinet type Fresh air fan							
	Casing:- CSU shall be modular type with pentapost frame. Unit shall be Double skin with 25 +/- 2 mm thick PUF / PIR type CFC free insulation sandwiched between the panels. The insulation shall be injected such that the density remains constant throughout the panels. Double skin wall panels shall be fixed to 3mm thick, hollow extruded aluminium profile with polyamide thermal break profile joined by 3D extruded aluminium chamfered corners, forming the structural frame work to house all internal components. The panels shall be of 0.8mm thick GSS sheet pre plasticised finish on the outer side and pre coated finish on the inner side of the unit. Panels should have complete with Glass view panel, motor guard, marine light, cable entry, drain connection at both ends. 18G SS drain tray insulated externally with 19mm nitrile rubber. AHU frame work shall be of extruded aluminium profile with three way corner frame sections.Casing of the unit shall comply to eurovent EN 1886 with casing strength D1 type, Casing leakage L1, Filter bypass leakage F8, Thermal bridging factor TB2 and air handling performance as per EN 13053. The air leakage through ahu casing shall not exceed specified limits while tested as per class B of DW 143 standard.							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Fan: The fans shall be direct driven Plug type fan with Variable frequency drive. The fans section shall have centrifugal forward/backward curved blower duly supported on Al. frame through rubber-in-shear or spring vibration mountings and raised at a height to match the opening of the front discharge supply air opening. The impeller and shaft of the fan shall be both statically and dynamically balanced. The motor shall be IE3 or above type totally enclosed and fan cooled type with class F insulation and IP 55 Protection. Minimum fan efficiency should not be less than 75%, Motor efficiency not less than 92%.The motor shall be of energy efficient type with high and flat efficiency curve for 50 to 100% load. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through direct drive arrangement based on the type of blower selected. The fan motor HP shall be at least 25% more than BHP. Note:Single fan only for 2000cfm Unit							
	Eurovent certified.							
	Filters: Each unit shall be provided with a factory assembled filter section containing washable synthetic type air pre filters media (MERV 8) mounted on Aluminum Frame. Filter bank framework shall be fully sealed and constructed from GSS. The efficiency of the pre filters shall be 90%down to particle size of 20 microns as per IS 7613, and ASHRAE 52.1. ,Commissioning filters to be considered for all units - 1 Set							
	Unit shall have fire retardant canvas cloth with MS angles/supporting elements, MS rod/nut,bolt etc for respective duct connection.							
	Static pressure and Motor Rating : Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							
	Note: Motors selection for all the below units at full load (Design CFM) to be not more than 45Hz.							
	Noise Level: Contractor to ensure noise level < 50 dBA all around the CSU at 1m distance.							
	Note:Limit switch and associated cabling to be considered							
a)	3600Cfm and a static pressure of 25mm WG ESP	NOS	R/O					
b)	4200Cfm and a static pressure of 25mm WG ESP	NOS	R/O					
4	Supply, installation, testing & commissioning of Double skin construction Ceiling Suspended Cabinet type Exhaust air fan							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Casing: - CSU shall be modular type with pentapost frame. Unit shall be Double skin with 25 +/- 2 mm thick PUF / PIR type CFC free insulation sandwiched between the panels. The insulation shall be injected such that the density remains constant throughout the panels. Double skin wall panels shall be fixed to 3mm thick, hollow extruded aluminium profile with polyamide thermal break profile joined by 3D extruded aluminium chamfered corners, forming the structural frame work to house all internal components. The panels shall be of 0.8mm thick GSS sheet pre plasticised finish on the outer side and pre coated finish on the inner side of the unit. Panels should have complete with Glass view panel, motor guard, marine light, cable entry, drain connection at both ends. 18G SS drain tray insulated externally with 19mm nitrile rubber. AHU frame work shall be of extruded aluminium profile with three way corner frame sections. Casing of the unit shall comply to eurovent EN 1886 with casing strength D1 type, Casing leakage L1, Filter bypass leakage F8, Thermal bridging factor TB2 and air handling performance as per EN 13053. The air leakage through ahu casing shall not exceed specified limits while tested as per class B of DW 143 standard.							
	Fan: The fans shall be direct driven Plug type fan with Variable frequency drive. The fans section shall have centrifugal forward/backward curved blower duly supported on Al. frame through rubber-in-shear or spring vibration mountings and raised at a height to match the opening of the front discharge supply air opening. The impeller and shaft of the fan shall be both statically and dynamically balanced. The motor shall be IE3 or above type totally enclosed and fan cooled type with class F insulation and IP 55 Protection. Minimum fan efficiency should not be less than 75%, Motor efficiency not less than 92%. The motor shall be of energy efficient type with high and flat efficiency curve for 50 to 100% load. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through direct drive arrangement based on the type of blower selected. The fan motor HP shall be at least 25% more than BHP. Note:Single fan only for 2000cfm Unit							
	Eurovent certified.							
	Unit shall have fire retardant canvas cloth with MS angles/supporting elements, MS rod/nut,bolt etc for respective duct connection.							

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	Static pressure and Motor Rating :Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							
	Note: Motors selection for all the below units at full load (Design CFM) to be not more than 45Hz.							
	Noise Level: Contractor to ensure noise level < 50 dBA all around the CSU at 1m distance.							
	Note:Limit switch and associated cabling to be considered							
a)	3600Cfm and a static pressure of 25mm WG ESP	NOS	R/O					
b)	4200Cfm and a static pressure of 25mm WG ESP	NOS	R/O					
5	Supply, installation, testing & commissioning of Double skin rectangular INLINE Type fresh air fan with MERV 8 filter, direct driven inline fan, suitable for Indoor installation. (Db levels to be less than 35)							
a)	150Cfm and a static pressure of 15mm WG ESP	Nos.	1					
b)	800Cfm and a static pressure of 25mm WG ESP	Nos.	8					
c)	1100Cfm and a static pressure of 25mm WG ESP	Nos.	1					
6	Supply, installation, testing & commissioning of Double skin circular INLINE Type exhaust air fan, direct driven inline fan, suitable for Indoor installation. (Db levels to be less than 35)							
a)	150Cfm and a static pressure of 15mm WG ESP	Nos.	2					
b)	1350Cfm and a static pressure of 15mm WG ESP	Nos.	1					
7	Supply, Installation, Testing & Commissioning of DDC controller microprocessor based panel for scheduling, ON/OFF control of toilet exhaust fans at terrace and toilet make-up air fans at individual floor levels with with necessary DI/DO, AI/AO points and all other mounting accessories complete as required,							
a)	Schedule, control and monitoring of 3 Nos. of Toilet Exhaust fans installed at terrace level and 6 fans installed inside toilet (refer HVAC drawing for location - Students toilet)	Lot	1					
b)	Control Cabling for above works shall be considered as per approved shop drawing	Lot	1					
	AIR DISTRIBUTION SYSTEM							

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				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
1	Supply, Fabrication, Installation and Testing of galvanized sheet metal ducts (FACTORY FABRICATED BOX TYPE DUCTS) in accordance with the approved shop drawings complete with all accessories like vanes, flanges, suspension rods , anchor bolts, GI bolts & nuts, canvas connections & splitter dampers etc.,GI Sheets shall be as per IS 277 with zinc coating of 120 gsm and as required by the specification as per SMACNA Standards							
	Note : For all the factory fabricated GI ducts, gasket to be not less than 15mm with thickness not less than 6mm.							
a)	24 gauge galvanized sheet steel	SQMT	632					
b)	22 gauge galvanized sheet steel	SQMT	75					
c)	20 gauge galvanized sheet steel	SQMT	R/O					
d)	18 gauge galvanized sheet steel	SQMT	R/O					
2	Supply, installation, testing and commissioning of Supply air plenums for air handling units with 16G GI double skin construction with external 25mm thick foam type insulation of 32 kg/cum density and perforated inner skin as per specifications The plenum shall be factory fabricated, powder coated & sufficient dummy pieces with necessary slip on flanges to be provided for connection of respective supply air ducts and the size approval should be taken from consultant/client.	SQMT	R/O					
3	Supply, Fabrication, Installation and Testing of MS sheet metal ducts conforming to IS 277:92 (FACTORY FABRICATED DUCTS) in accordance with the approved shop drawings complete with all accessories like vanes, flanges, suspension rods , anchor bolts, GI bolts & nuts,etc.							
	NOTE :16G MS ducting for kitchen exhaust							
a	16G MS ducting with Welded construction air tight and water tight with corrosion treatment inside and outside surface of duct	SQMT	10					
b	Thermal Insulation for kitchen exhaust duct of suitable thickness with 2hrs fire rating shall be provided	SQMT	10					
5	Supply, installation, testing and balancing of AI Volume Control Dampers with operating handle aero foil blade with rubber beeding for Supply/Return/Exhaust air duct branches in accordance with the approved shop drawings and specifications.	SQM	4					

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
5	Supply, installation, testing and commissioning of 90 mins rating Fire damper UL 555 certified, constructed the with outer shell with 1.6mm thick galvanized steel frame and the blade/Leaf with 1.6mm thick GSS. And with necessary flanges for connection with Fusible Link & spring mechanism, The damper shall be held open by a replaceable fusible link rated at 74degC as per specifications and drawings.							
a	Rate per Sq.mt	SQM	R/O					
b	No. of Fusible Links	Nos.	R/O					
6	Supply, installation, testing and balancing of powder coated Extruded Aluminum supply air Diffusers with removable core , Aluminum opposed blade volume control dampers & the diffuser shall be of tegular profile in accordance with the approved shop drawings and specifications to fit in the tile size of 600 x 600. The neck size shall be of following sizes (Aluminium diffusers shall be approved by Architect. Architect shall approve the shade of epoxy powder coating for grilles for supply air of the following sizes.)							
a	225 x 225 neck sizes	Nos.	R/O					
b	300 x 300 neck sizes	Nos.	R/O					
c	375 x 375 neck sizes	Nos.	34					
d	450 x 450 neck sizes	Nos.	R/O					
7	Supply, installation, testing and balancing of powder coated Extruded Aluminum return air Diffusers with removable core , the diffuser shall be of tegular profile in accordance with the approved shop drawings and specifications to fit in the tile size of 600 x 600. The neck size shall be of following sizes (Aluminium diffusers shall be approved by Architect. Architect shall approve the shade of epoxy powder coating for grilles for supply air of the following sizes.)							
a	225 x 225 neck sizes	Nos.	R/O					
b	300 x 300 neck sizes	Nos.	R/O					
c	375 x 375 neck sizes	Nos.	R/O					
d	450 x 450 neck sizes	Nos.	R/O					
8	Supply, Installation, Testing & Commissioning of Spigot & Butterfly Dampers of the following sizes.The damper shall be made of 18G GSS sheet. The blade shall have rubber gasket beeding for air tightness. Spigots to have dual notch for firmly fixing the flexible ducts.							
a	300 mm dia	Nos.	R/O					
b	250 mm dia	Nos.	R/O					
c	200 mm dia	Nos.	R/O					
d	150 mm dia	Nos.	32					

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
9	Supply & Installation, Testing and Balancing of mixing box of size 600 X 300 X300(ht) removable core & volume control dampers, Chains, links and hooking arrangements as per approved drawings and specifications. The insulation would be 15mm thick cross linked closed cell type Polyolefin foam with factory heat laminated reinforced Al. foil with density 25 kg/m3, the embossed PVC foil is lacquered with corrosive resistant, Insulation joints to be sealed using self adhesive aluminium tape supplied by the manufacturer & UV ray protective material, fire & smoke classification Class 'O' BS 476 part 6,7 along with standard installation and accessories.	Nos.	R/O					
10	Supply, installation, testing and balancing of Powder Coated Extruded Aluminum Linear supply Air Multi Slot Diffuser complete with air pattern controllers & Hit & Miss volume control damper as per specifications and approved drawings.(Aluminium Slot diffusers shall be approved by Architect. Architect shall approve the shade of epoxy powder coating for grilles for supply & return air of the following sizes.)							
a	2 slot (19mm slot gap)	RMT	R/O					
b	3 slot (19mm slot gap)	RMT	R/O					
c	4 slot (19mm slot gap)	RMT	R/O					
d	Hit & Miss damper	RMT	R/O					
11	Supply, Fabrication, Installation and Testing of the Insulated Flexible Ducting/CANVAS , complete with connecting rings, duct supports,The flexible duct shall be made of triple lamination of aluminium foil, polyester and Metalised Polyester film permanently bonded to a coated spring steel wire helix. The exterior shall be wrapped with 25mm thick 24 kg / m3 fibreglass insulation. The outer insulation jacket / vapour barrier shall be made of fibreglass reinforced Metalised Polyester film laminate... etc. as per standards and specification.							
	Note : In case of Canvas cloth supporting flanges to be considered .							
	Note : Max connection length to be not more the 0.6m							
a	300 mm dia	RMT	R/O					
b	250 mm dia	RMT	R/O					
c	200 mm dia	RMT	R/O					
12	Supply, installation , testing and balancing of Supply/Exhaust Air Circular Disk valve (Neck Size) for toilet exhaust as per specification & approved shop drawing.(Aluminium diffusers shall be approved by Architect. Architect shall approve the shade of epoxy powder coating for grilles for return air of the following sizes.)							

BILL OF QUANTITIES

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LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
a)	150 Dia	NOS	32					
b)	200 Dia	NOS	R/O					
13	Supply, Fabrication, installation and testing of the Flexible ducting with out insulation , complete with connecting rings, duct supports, inner core should be made of triple lamination of Aluminum Foil, Polyester & Metalized polyester film permanently bonded to a coated spring steel wire helix ..etc as per standards and specification							
	Note : Max connection length to be not more the 0.6m							
a)	Dia 150	RMT	32					
b)	Dia 200	RMT	R/O					
14	Supply & Installation, Testing and Balancing of Al. Powder coated Grills with collar dampers with necessary flanges,the grilles shall be extruded aluminum constructions with powder coated complete as per specifications and drawings, Aluminium grilles shall be approved by Architect. Architect shall approve the shade of epoxy powder coating for grilles for supply & return air.Sizes to be as per approved shop drawing.	SQM	7.4					
15	Supply & Installation, Testing and Balancing of Al. Powder coated Grills without collar dampers with necessary flanges,the grilles shall be extruded aluminum constructions with powder coated complete as per specifications and drawings, Aluminium grilles shall be approved by Architect. Architect shall approve the shade of epoxy powder coating for grilles for supply & return air.Sizes to be as per approved shop drawing.	SQM	13.4					
16	Supply, installation, testing & commissioning of circular INLINE Type Battery room exhaust fan shall be ATEX certified , suitable for Indoor installation. (Db levels to be less than 35)							
a	150Cfm and a static pressure of 15mm WG ESP	NOS	1					
17	Supply, installation, testing & commissioning of Hydrogen sensor for Battery room exhaust, it shall communicate/compatible with control panel	NOS	1					
18	Supply, installation, testing & commissioning of Hydrogen sensor based stand-alone control panel (Battery room exhaust)	NOS	1					

BILL OF QUANTITIES

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DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
19	Supply, Installation, Testing and commissioning of Extruded Al. Powder coated Exhaust Air louvers with bird screen mesh.	SQM	R/O					
20	Supply, Installation, Testing and commissioning of Extruded Al. Powder coated Fresh Air louvers with bird screen mesh.	SQM	R/O					
21	Supply, installation, testing & commissioning of AMCA Certified TUBE AXIAL FANS with galvanized steel Double flanged long casing, impellers of pressure casted aluminum adjustable pitch blades as per the specification. The fan shall be min IP 55 protection with direct driven motor and the air flowing from impeller to the motor for Lift Well pressurization application as per specification & as indicated in the Equipment Schedule. Motor shall be suitable for 415±10% volts, 50 cycles/second, 3 phase AC supply. Each fan shall include all accessories, controls, Flexible connection, vibration isolators, necessary supports as per the specification. The Motor shall be CLASS-F insulation.							
	Static pressure and Motor Rating : The Indicated static pressure and motor rating is only provisional. Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review / approval to the consultants. The procurement shall be processed only after duly verification / approval of calculation and selection from the consultants.							
	Note:Vendor should specify the type of the feeders / Starters required in TDS.							
	The fans should be suitable for outdoor type installation.							
	Note : GI sheet Canopy to be provided for all Terrace ventilation units along with support steel structure							
	LIFTWELL PRESSURIZATION							
a	5000Cfm and a static pressure of 25mm WG ESP	Nos.	1					
b	3000Cfm and a static pressure of 25mm WG ESP	Nos.	1					
22	Pressure Relief damper at locations shown in approved shop drawings. Pressure Relief Damper -60 Pascal Rating for pressurization system	SQM	0.7					
23	Non - Return Damper for locations shown in drawings and installed as per specifications.	SQM	R/O					
24	Bird Wire Mesh for Cowl ducts	SQM	3					

BILL OF QUANTITIES

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DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	INSULATION							
1	Supply ,installation and testing of 'CLASS-O' Elastomeric nitrile rubber insulation of preformed duct section (Thickness as below) with 7mili thick Fiber glass cloth plus two layers of shield coating for all ducts,fittings etc. Quoted price shall be inclusive of self Adhesive,Nitrile rubber tapes,etc The thermal conductivity should not exceed 0.037 w/m k.(Internal AC Duct) Note: Insualtion should be FM approved							
	13 mm thick for duct insulation	SQM	146					
2	Supply, Installation, Testing and commissioning of 32 mm thick, 48kg/m3 open cell type Acoustic insulation of rubber type on AHU room walls and covered with 3mm fiber cloth(mechanical protection) as per Specification Note: Insualtion should be FM approved	SQM	9					
3	Supply, fixing of 75mm thick Expanded Polustyrene OVERDERDECK INSULATION for the exposed Roof tops of AC areas(The insulation shall be fixed using hot bitumen and screws to hold them in place.) as per Specification,Note: Insualtion should be FM approved	SQM	R/O					
4	Supply and fixing of under deck insulation with 50 mm thick TF quality XPS insulating material. The insulation shall be suitably secured to 50 mm wide GI grid frame and laced with GI wire using GI washers, Screws. The density to be 32kg/cum Note: Insualtion should be FM approved	SQM	R/O					
5	Supply, Testing, Installation & Commissioning of Open Cell Duct acoustic insulation with 15 mm thick nitrile rubber and aluminium tape as per specs. Note: Insualtion should be FM approved							
	15 mm thick for duct insulation	SQM	58					
	KITCHEN HOOD EXHAUST FANS							

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

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DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
1	Supply, installation, testing & commissioning of Kitchen Exhaust fan , floor mounted, suitable for outdoor installation as per specification . Each complete with SISW Backward curved Centrifugal Fan with VFD, FC-102 , MS Frame work wih Aluminum paint, free standing single spring with sleeve damping with adjusting. Fan Bearing shall be outside the fan for easy maintenance. IP 55 with proper enclosure fan Motor shall be suitable for 415±10% volts, 50 cycles/second, 3 phase AC supply. (Suitable for indoor installation) guard for motor should be water leakage proof and size should be as per cable size. Should be approved by OEM							
	The unit shall be provided with suitable drain plug at the bottom to drain out the rain water entering inside the unit.							
	The exhaust side of the unit shall be properly ducted(22G GI duct Aluminum paint of 180GSM) by cowling to an angle of 45Deg wih wire mesh							
	Noise Level: Contractor to ensure noise level < 55 dBA @ 1.5 m from the fillter side and < 55 dBA all around the UNIT. Proper acoustic for motor to be given as per above noise level							
	fire retardant canvas connection with 18gauge GI flanges at both sides							
	Static pressure and Motor Rating :Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							
	ON/OFF CONTROL SWITCH SHALL BE PROVIDED NEAR THE HOOD FOR ACCESSIBLE TO KICTHEN STAFF OPERATION.							
	Note: Based on Kitchen consultant inputs on exhaust hood airflowrates and kitchen duty, fan shall be finalised							
a	8300Cfm and a static pressure of 60 mm WG ESP	Nos.	R/O					
b	5500Cfm and a static pressure of 60 mm WG ESP	Nos.	R/O					
c	4200Cfm and a static pressure of 60 mm WG ESP	Nos.	R/O					
2	Supply, installation, testing & commissioning of Double skin construction Ceiling Suspended Cabinet type exhaust air fan (General exhaust)							

BILL OF QUANTITIES

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DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Casing: - CSU shall be modular type with pentapost frame. Unit shall be Double skin with 25 +/- 2 mm thick PUF / PIR type CFC free insulation sandwiched between the panels. The insulation shall be injected such that the density remains constant throughout the panels. Double skin wall panels shall be fixed to 3mm thick, hollow extruded aluminium profile with polyamide thermal break profile joined by 3D extruded aluminium chamfered corners, forming the structural frame work to house all internal components. The panels shall be of 0.8mm thick GSS sheet pre plasticised finish on the outer side and pre coated finish on the inner side of the unit. Panels should have complete with Glass view panel, motor guard, marine light, cable entry, drain connection at both ends. 18G SS drain tray insulated externally with 19mm nitrile rubber. AHU frame work shall be of extruded aluminium profile with three way corner frame sections. Casing of the unit shall comply to eurovent EN 1886 with casing strength D1 type, Casing leakage L1, Filter bypass leakage F8, Thermal bridging factor TB2 and air handling performance as per EN 13053. The air leakage through ahu casing shall not exceed specified limits while tested as per class B of DW 143 standard.							
	Fan: The fans shall be direct driven Plug type fan with Variable frequency drive. The fans section shall have centrifugal forward/backward curved blower duly supported on Al. frame through rubber-in-shear or spring vibration mountings and raised at a height to match the opening of the front discharge supply air opening. The impeller and shaft of the fan shall be both statically and dynamically balanced. The motor shall be IE3 or above type totally enclosed and fan cooled type with class F insulation and IP 55 Protection. Minimum fan efficiency should not be less than 75%, Motor efficiency not less than 92%. The motor shall be of energy efficient type with high and flat efficiency curve for 50 to 100% load. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through direct drive arrangement based on the type of blower selected. The fan motor HP shall be at least 25% more than BHP. Note:Single fan only for 2000cfm Unit							
	Eurovent certified.							
	Unit shall have fire retardant canvas cloth with MS angles/supporting elements, MS rod/nut,bolt etc for respective duct connection.							
	Static pressure and Motor Rating : Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Note: Motors selection for all the below units at full load (Design CFM) to be not more than 45Hz.							
	Noise Level: Contractor to ensure noise level < 50 dBA all around the CSU at 1m distance.							
	Note:Limit switch and associated cabling to be considered							
	ON/OFF CONTROL SWITCH SHALL BE PROVIDED IN THE KITCHEN FOR ACCESSIBLE TO KICTHEN STAFF OPERATION.							
	Note: Based on Kitchen consultant inputs on exhaust hood airflowrates and kitchen duty, fan shall be finalised							
a	4200Cfm and a static pressure of 60 mm WG ESP	Nos.	R/O					
3	Supply, installation, testing & commissioning of Double skin construction Floor mounted Cabinet type Fresh air fan , suitable for outdoor installation							
	Casing: - Unit shall be modular type with pentapost frame. Unit shall be Double skin with 25 +/- 2 mm thick PUF / PIR type CFC free insulation sandwiched between the panels. The insulation shall be injected such that the density remains constant throughtout the panels. Double skin wall panels shall be fixed to 3mm thick, hollow extruded aluminium profile with polyamide thermal break profile joined by 3D extruded alumnium chamfered corners, forming the structural frame work to house all internal components. The panels shall be of 0.8mm thich GSS sheet pre plasticised finish on the outer side and pre coated finish on the inner side of the unit. Panels should have complete with Glass view panel, motor guard, marine light, cable entry, drain connection at both ends. 18G SS drain tray insulated externally with 19mm nitrile rubber. Unit frame work shall be of extruded aluminium profile with three way corner frame sections.Casing of the unit shall comply to eurovent EN 1886 with casing strength D1 type, casing leakage L1, Filter bypass leakage F8, Thermal bridging factor TB2 and air handling performance as per EN 13053. The air leakage through ahu casing shall not exceed specified limits while tested as per class B of DW 143 standard.							

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DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Fan: The fan section shall be verticle type with twin/three fan arrangement. The fans shall be direct driven Plug type fan with Variable frequency drive. The fans section shall have centrifugal forward/backward curved blower duly supported on Al. frame through rubber-in-shear or spring vibration mountings and raised at a height to match the opening of the front discharge supply air opening. If the discharge is top than the blower shall be supported using brackets/Al. frame with rubber-in-shear or spring vibration mountings without the need for elevation. The impeller and shaft of the fan shall be both statically and dynamically balanced. The motor shall be IE3 or above type totally enclosed and fan cooled type with class F insulation and IP 55 Protection. Minimum fan effieciency should not be less than 75%, Motor efficieny not less than 92%.The motor shall be of energy efficient type with high and flat efficiency curve for 50 to 100% load. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through direct drive arrangement based on the type of blower selected. The fan motor HP shall be at least 25% more than BHP.							
	150 mm x 150 mm vibration isolation rubber pads in two layers with an 18G GI sheet seperating the pads to be provided to isolate the unit from the foundation.							
	Filters: Each unit shall be provided with a factory assembled filter section containing washable synthetic type air pre filters media (MERV 8) mounted on Aluminum Frame. Filter bank framework shall be fully sealed and constructed from GSS. The efficiency of the pre filters shall be 90%down to particle size of 20 microns as per IS 7613, and ASHRAE 52.1. ,Commissioning filters to be considered for all units - 1 Set							
	Unit shall have fire retardant canvas cloth with MS angles/supporting elements, MS rod/nut,bolt etc for respective duct connection.							
	Static pressure and Motor Rating : Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							
	Note: Motors selection for all the below units at full load (Design CFM) to be not more than 45Hz.							
	Noise Level: Contractor to ensure noise level < 50 dBA all around the CSU at 1m distance.							
	Note: Limit switch and associated cabling to be considered							
	Note : GI sheet Canopy to be provided for all Terrace ventilation units along with supporting steel structure							
	Kitchen MAKE-UP AIR FAN							
a	7500Cfm and a static pressure of 30 mm WG ESP	Nos.	R/O					

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SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
b	5000Cfm and a static pressure of 30 mm WG ESP	Nos.	R/O					
c	3800Cfm and a static pressure of 30 mm WG ESP	Nos.	R/O					
4	Supply, installation, testing & commissioning of Double skin construction Ceiling Suspended Cabinet type Fresh air fan							
	Casing: - CSU shall be modular type with pentapost frame. Unit shall be Double skin with 25 +/- 2 mm thick PUF / PIR type CFC free insulation sandwiched between the panels. The insulation shall be injected such that the density remains constant throughout the panels. Double skin wall panels shall be fixed to 3mm thick, hollow extruded aluminium profile with polyamide thermal break profile joined by 3D extruded aluminium chamfered corners, forming the structural frame work to house all internal components. The panels shall be of 0.8mm thick GSS sheet pre plasticised finish on the outer side and pre coated finish on the inner side of the unit. Panels should have complete with Glass view panel, motor guard, marine light, cable entry, drain connection at both ends. 18G SS drain tray insulated externally with 19mm nitrile rubber. AHU frame work shall be of extruded aluminium profile with three way corner frame sections.Casing of the unit shall comply to eurovent EN 1886 with casing strength D1 type, Casing leakage L1, Filter bypass leakage F8, Thermal bridging factor TB2 and air handling performance as per EN 13053. The air leakage through ahu casing shall not exceed specified limits while tested as per class B of DW 143 standard.							
	Fan: The fans shall be direct driven Plug type fan with Variable frequency drive. The fans section shall have centrifugal forward/backward curved blower duly supported on Al. frame through rubber-in-shear or spring vibration mountings and raised at a height to match the opening of the front discharge supply air opening. The impeller and shaft of the fan shall be both statically and dynamically balanced. The motor shall be IE3 or above type totally enclosed and fan cooled type with class F insulation and IP 55 Protection. Minimum fan efficiency should not be less than 75%, Motor efficiency not less than 92%.The motor shall be of energy efficient type with high and flat efficiency curve for 50 to 100% load. Motor shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through direct drive arrangement based on the type of blower selected. The fan motor HP shall be at least 25% more than BHP. Note:Single fan only for 2000cfm Unit							
	Eurovent certified.							

BILL OF QUANTITIES

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DESCRIPTION : HVAC WORKS

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SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Filters: Each unit shall be provided with a factory assembled filter section containing washable synthetic type air pre filters media (MERV 8) mounted on Aluminum Frame. Filter bank framework shall be fully sealed and constructed from GSS. The efficiency of the pre filters shall be 90%down to particle size of 20 microns as per IS 7613, and ASHRAE 52.1. ,Commissioning filters to be considered for all units - 1 Set							
	Unit shall have fire retardant canvas cloth with MS angles/supporting elements, MS rod/nut,bolt etc for respective duct connection.							
	Static pressure and Motor Rating : Contractor to calculate static pressure based on final approved construction drawing and pressure drop of finalized Equipment / Items and submit for review/ approval to the Client / consultants. The procurement shall be processed only after duly verification / approval of calculation from the client/consultant.							
	Note: Motors selection for all the below units at full load (Design CFM) to be not more than 45Hz.							
	Noise Level: Contractor to ensure noise level < 50 dBA all around the UNIT at 1m distance.							
	Note: Limit switch and associated cabling to be considered							
	Kitchen MAKE-UP AIR FAN							
	3800Cfm and a static pressure of 30 mm WG ESP	Nos.	R/O					
5	DRY SCRUBBERS							
	Supply, installation, testing & commissioning of dry Scrubbers selected to treat oil mist, smoke, fume, grease & dust/ powder problems, shall be suitable for outdoor installation							
	Housing shall be constructed with minimum 1.2mm thick steel sheet with reinforced structure & powder coated to protect against rust and corrosion. It shall have a hinged door for cell access, located one side of the unit. The door shall be gasketed to prevent air leakage. There shall be a safety interlock switch to cut off primary supply when the access door is opened							
	Ionizing-Collecting cell(s) shall be of one-piece construction 13.38" (340mm) deep in direction of airflow.							
	The rated efficiency shall be up to 95% based on the NIOSH 5026 OIL MIST TEST							
	Note : GI sheet Canopy to be provided for all Terrace ventilation units along with supporting steel structure							
a	8300Cfm	Nos.	R/O					
b	5500Cfm	Nos.	R/O					
c	4200Cfm	Nos.	R/O					

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SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	ELECTRICAL STARTER PANELS, INTERNAL CABLES & CABLE TRAY WORK							
	ELECTRICAL STARTER PANELS							
1.0	Supply, Installation, Testing & Commissioning of Starter panel shall comprise of MPCB with suitable starter with or without VFD requirement and KW mentioned below to be provided inside the panel. All necessary On/Off/Trip indication lamps , OLR , contactors , VFD mode and bypass mode selector switches with indicators (wherever applicable) to be provided. NO NC contacts for BMS provision to be made/Fire panel integration shall be considered.							
	VENTILATION FANS							
	Toilet Exhaust fan at Lower ground floor 0.3KW, shall include electrical interlock with fresh air fans	Nos	1					
	Toilet Fresh air fan at Lower ground floor 0.3KW	Nos	1					
	Battery room Exhaust fan at Ground floor 0.2KW	Nos	1					
	Admin office Exhaust fan at Ground floor 1.5KW with VFD , shall include electrical interlock with fresh air fans. IP55 enclosure, indoor installed. Exhaust fan VFD ramp up/down shall be integrated with fresh air fan VFD.	Nos	1					
	Admin office Fresh air fan at Ground floor 1.5KW with VFD . IP55 enclosure, indoor installed.	Nos	1					
	Admin office Exhaust fan at First floor 2.2KW with VFD , shall include electrical interlock with fresh air fans. Suitable for indoor installation. Exhaust fan VFD ramp up/down shall be integrated with fresh air fan VFD.	Nos	1					
	Admin office Fresh air fan at First floor 2.2KW with VFD . Suitable for indoor installation.	Nos	1					
	Toilet Exhaust fans at Terrace 2.2KW with VFD , shall include electrical interlock with fresh air fans. Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	2					
	Toilet Exhaust fan at Terrace 0.75KW with VFD , shall include electrical interlock with fresh air fans. Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	1					
	Toilet Exhaust fan at Terrace 1.5KW with VFD , shall include electrical interlock with fresh air fans. Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	1					
	Toilet Fresh air fans at Ground, First and Second floors 0.3KW. Suitable for indoor installation.	Nos	6					
	Classrooms Fresh air fans at Second floor 0.3KW, shall include electrical interlock with DX Ductable unit. Suitable for indoor installation.	Nos	2					

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PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU								
LOCATION: BENGALURU								
DESCRIPTION : HVAC WORKS								
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SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Kitchen Exhaust fan at Ground floor Kitchen 5.5KW with VFD , shall include electrical interlock with fresh air fans. Suitable for indoor installation.	Nos	R/O					
	Fresh air fan at Ground floor Kitchen 4.0KW with VFD . Suitable for indoor installation.	Nos	R/O					
	Kitchen Exhaust fan at Ground floor Kitchen 5.5KW with VFD , shall include electrical interlock with fresh air fans. VFD ramp up/down shall be integrated with fresh air fan VFD. Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	R/O					
	Fresh air fan at Ground floor Kitchen 4.0KW with VFD . Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	R/O					
	Pressurizations fan at Terrace 3.7KW. Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	2					
	2.2KW starter panel. Weather proof enclosure shall be suitable for outdoor installation with necessary supports shall be considered.	Nos	R/O					
2.00	Auto Sequential Panel for Server room, UPS room and Battery room AC units							
	Supply, Installation, Testing & Commissioning of Auto Sequential Panel for Server room, UPS room and Battery room AC units. Schedule of working and stand-by units in equal hours and alarm for room temperature set point. NO NC contacts for BMS provision to be made/Fire panel integration shall be considered.	Nos	3					
	CABLES :							
4.0	Supply,unloading,storing,shifting to required location, Installation, of 1.1 kV grade, 1C/3C/3.5C/4C, XLPE insulated, and PVC inner & outer sheath, stranded aluminium / Copper conductor, flat steel strip/ wire armoured cables conforming to IS:7098/ Part I (with latest amendments)and of following sizes.The cable shall bear ISI certification mark. Laying of the cable in existing hume pipe/cable tray including transportation of cable to site, and providing cable route/ joint markers and cable tie,including supply and fixing of cable tags for every 0.5 to 0.75 mtr,etc., complete as required.							
	END TERMINATIONS & GLAND EARTHING :							

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
	Supply, Installation, Testing & Commissioning of End terminations for cables with brass gland of Double / Single compression and copper lugs etc, complete as per specifications. Also Supply & Installation of Gland Earthing Consisting of Suitable ring and Brass Nuts, Bolts and washers. gland earthing with 14 SWG copper wire to connect to nearest earth flat. Cost of Aluminum engraving cable tag for incoming and out going cables shall be inclusive in rate.							
	NOTE :							
	Gland type : Heavy duty Brass with nickel plated							
	Compression : Double compression above 35 Sq.mm							
	Sealing Ring : Natural rubber for indoor, Neoprene for Outdoor							
	PVC gland should be provided for single core & multi core flexible copper cables							
	Only long body copper lugs should be used for aluminum and copper armoured / unarmoured cables irrespective of sizes							
1.1	ARMOURED COPPER CABLES							
1.1.1	Supply & Installation of 3C x 10 Sqmm XLPE, Cu, Ar. Cable							
	Supply & Installation	Mtrs	R/O					
	End Termination							
	Supply & Installation	Nos.	R/O					
1.1.2	Supply & Installation of 3C x 6 Sqmm XLPE, Cu, Ar. Cable							
	Supply & Installation	Mtrs	46					
	End Termination							
	Supply & Installation	Nos.	8					
1.2	ARMOURED COPPER CABLES							
1.2.1	Supply & Installation of 3C x 4 Sqmm XLPE, Cu, Ar. Cable							
	Supply & Installation	Mtrs	213					
	End Termination							
	Supply & Installation	Nos.	36					
1.3	UNARMOURED COPPER CABLES (Flexible cables)							
1.3.1	Supply & Installation of 3C x 6 Sqmm Copper Flexible cable							
	Supply & Installation	Mtrs	R/O					
	End Termination							
	Supply & Installation	Nos.	R/O					

BILL OF QUANTITIES

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LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
1.3.2	Supply & Installation of 3C x 4 Sqmm Copper Flexible cable							
	Supply & Installation	Mtrs	R/O					
	End Termination							
	Supply & Installation	Nos.	R/O					
	CABLE TRAY & ACCESSORIES :							
1.4	Supply and installing following size of Pre Galvanized assembled ladder Type MS powder coated cable trays fabricated out of Single Sheet Steel Confirming to I.S. 1079 : 1973 / I.S. 513: 1994 including horizontal and vertical bends ,anchor fastner and C channel,GI bolt, reducers, tees, cross members at 300 mm interval and other accessories as required and duly suspended from the ceiling with fabricated MS angle / C Channel supports at 600/750 mm interval, etc as required. (Cable trays should be bolted type). RAL to be as per arch.							
	Pre manufactured Support arrangement for cable tray size of 1000mm and above Punched angle 50x50x5 mm Punched angle holder, M10x25 mm fastner for fixing horizontal angle to vertical angle, Cleat angle (for reinforcement).							
	For cable tray size above 600mm to 1000mm Punched angle 35x35x5 mm Punched angle holder , M10x25 mm fastner for fixing horizontal angle to vertical angle, Cleat angle (for reinforcement).							
	For cable tray size upto 600mm Boltable rack stand (65x50x3 mm c channel), Boltable rack, Ceiling holder for c channel.							
	All above fixing arrangements, design and sizing to be considered in respect to site condition, drawings issued for construction and to withstand the required weight.							
(A)	GI Ladder type cable trays							
1.4.2	300mm wide with 50 mm depth Light duty 2 mm thick Ladder type cable trays							
	Supply & Installation	Mtrs.	R/O					
1.4.3	150mm wide with 50 mm depth Light duty 1.6 mm thick Ladder type cable trays							
	Supply & Installation	Mtrs.	233					
1.4.4	100mm wide with 50 mm depth Light duty 1.6 mm thick Ladder type cable trays							
	Supply & Installation	Mtrs.	R/O					

BILL OF QUANTITIES

PROJECT :NATIONAL LAW SCHOOL OF INDIA UNIVERSITY, BENGALURU

LOCATION: BENGALURU

DESCRIPTION : HVAC WORKS

SUBJECT : HVAC LOWSIDE WORKS

SL. NO.	DESCRIPTION	UNIT	TOTAL QTY	RATE		AMOUNT		Remarks
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION	
1.5	Supply and laying following sizes of GI/Copper Wire/strips including supply of fixing clamps and accessories when laid inside the building and inclusive of excavation & refilling of earth when laid outside the building and interconnections with earth pit and equipment, terminations/ interconnections in an approved manner as per IS:3043 (with latest amendments) inclusive of supply of all hardwares complete as required.GI conductor joints shall be bolted and joints shall be protected with bitumen paint.Copper conductor joint shall be brazed or rivetted .The equipment connection shall be bolted using galvanized hardware or bolted by using passivated hardware.							
1.5.1	Providing and fixing 25mm x 3mm GI strip	Mtr	R/O					
1.5.2	Providing and fixing OF 8 SWG GI Wire	Mtr	R/O					
1.5.3	Providing and fixing OF 6Sqmm Cu Wire	Mtr	R/O					
	TOTAL							
NOTES								
1) DOOR LOUVERS & EXTERNAL EXHAUST & FRESH AIR LOUVERS ARE IN CIVIL SCOPE.								