DEPARTMENT OF ELECTRICAL ENGINEERING
INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY,
SHIBPUR, HOWRAH-711 103.

No. 174/2020/EE-3/21(KM-PEL) Dated: 28/02/2020

From : The Head of the Department,
Electrical Engineering,
IIEST, Shibpur, Howrah-711 103

To : Enlisted vendors of the institute and other interested parties/ For Website Tender.

Dear Sir(s),

Sealed quotations are invited for supply of the following item(s) within 12/03/2020. The quotation should include the taxes as per rule, delivery charges, entry tax if any, etc. to Indian Institute of Engineering Science and Technology, Shibpur and should mention a firm delivery period. Preferences will be given to the suppliers who can supply ex-stock.

The vendors, who are not enlisted in the Institute register, should submit the copies of their valid Trade License, PAN, latest Income Tax / Sales Tax Statement /Return, SSI/MSME certificate, GST certificate if any etc. and any other commercial credentials.

Yours faithfully,

28/2/2020

Signature of the indenting Officer/
Concerned Faculty Member

Prof. & Head of EE Dept.
IIEST, Shibpur, Howrah – 711 103

Prasid Syam
Professor & Head
Electrical Engineering Deptt.
Indian Institute of Engineering Science
and Technology, Shibpur
Howrah-711 103

List of Items: Required for Power Electronics laboratory, IIEST Shibpur:

Specifications for Inverter kit – 1 set

A three leg MOSFET based H-Bridge inverter kit (for indoor laboratory usage at room temperature of 40 degree C) is required having the following important features:

1) The kit will be powered from 230V, 50 Hz., single phase AC mains

2) The kit should have a single phase 50 Hz. 230V/45V, 500VA dry type, naturally cooled transformer (Class F/H insulation) at the input. It will feed a full wave diode bridge rectifier at its input with DC link capacitors, followed by the 3-phase bridge inverter stage. It should have a suitable NTC at the diode rectifier input to limit the inrush current for every starting. Diodes of the bridge rectifier should be at least 12A, 300V capacity and with suitable snubber. DC bus voltage will be around 62V nominal. DC

link capacitor bank along with high-frequency snubber capacitors should be at least 2200μF, 250V (working) with total ripple current rating of at least 12A. Suitable bleeder resistors should be provided. Inverter MOSFETS should be at least each 20A, 300V. High frequency snubber capacitors to be provided across MOSFETs. Busbar layout should be optimized to ensure minimum stray inductance. The inverter devices should have short-circuit protection features. LED based indication should be available to the user under such cases and system should be hard-reset in such cases and should be again manually started after fault clearing. The short-circuit protection feature should be designed by sensing the DC link current with the help of a suitable current sensor and when the DC link current exceeds a requisite value, the system should be hard-reset and has to be started again after fault-clearing. Suitable dead-times to be implemented through hardware to have protection against DC bus shoot-through. There should be an additional protection such that if the DC bus voltage goes below 40V, the inverter should remain disabled and only after the DC bus voltage is restored, the system should be hard-reset.

3) The three phase inverter will be loaded with star-connected R-load (10-20 ohms in star) and R-L load (10-20 ohms, 5A resistor with 5A, 20mH/30mH inductor) – **load is NOT to be provided by vendor but some idea is given here to vendor for arriving at the ratings of the elements of the inverter power stage.**

4) Two legs of the same three phase inverter may sometimes be utilized to use it as a single phase H-bridge inverter also.

5) The switching frequency should be set at a fixed value in and around 5 kHz. The inverter should have the capability to operate under sinusoidal pulse width modulation strategy (under-modulation/over-modulation) or in square wave mode (180 degree conduction) either as a single phase bridge inverter (with both unipolar and bipolar SPWM options)utilizing any four MOSFETS or as a three phase H-bridge inverter utilizing all six MOSFETs. Suitable selector switch (switches) should be provided to select the proper control/modulation strategy. The amplitude modulation ratio should be settable at some fixed settable values from 0.1 (with a POT) in under-modulation zone to high values for over-modulation/square wave zone. The fundamental frequency of the inverter should be controllable and settable at some settable fixed values between 30 Hz and 70 Hz with a POT. Both the POT output terminals and the control system ground terminals should be brought out for user's measurement. The whole control-cum-modulation strategy has to be realized with a suitable microcontroller/DSP.

6) A 'select' key should be provided so that the user can select the inverter to either be used as a 3-phase inverter or a 1-phase H-bridge inverter. When used as a single phase H-bridge inverter, options should be given to select either a unipolar sine PWM mode of operation or a bipolar sine PWM operation.

7) The driver stage should be supplied from an isolated power supply. The driver stage with proper electrical isolation should be properly designed and built/connected inside with overload, short circuit protection features. The (isolated) control circuit ground terminal, the 6 switching signals for the MOSFET with respect to the control circuit ground and the gate-cathode terminals of the MOSFETs should be all brought out through proper terminals in the front panel of the kit for access by the user for viewing waveforms. A separate switch, fuse, indicating LED/light along with plug and wires should be there in the kit which would power up the control and driver circuit. This power should be drawn from single phase 230V, 50 Hz utility available at user's premises.

8) The three inverter output terminals, DC bus terminals and the front-end transformer input terminals (10A) with lock nut facilities should be available to the user.

9) The whole kit should be housed inside a rugged enclosure with at least one face made up of transparent material so that user can physically see the components inside. The front panel/face of the kit should be made out of a hard material and should have a silk-screen printing based drawing of the power and control circuit of the inverter with terminals, as mentioned earlier.

10) There should be 5A glass fuse-based protection at the output and 4A glass fuse based protection at the input of the kit.

11) The offer from the vendor should be such that the customer gets a conviction that the vendor has technically performed some system engineering and preliminary design behind framing his/her offer. Upon receipt of the offer from the vendors, before deciding their technical compliance, if the customer feels, the vendors might be called by the customer for a presentation followed by a question/answer session to assess the technical capability of the vendor and to understand whether the vendor has understood the customer's requirements properly.

12) During delivery of the kit, the selected vendor will have to hand over the detailed schematics of the driver circuits, the control/logic circuits showing the microcontroller, ADC connections and the power circuit mentioning the detailed specifications of the items and components used. The source codes of the microcontroller/DSP programmes in high-level language will also have to be submitted by the selected vendor.

13) After installation, the given kit will be tested with existing laboratory R and R-L loads as mentioned previously and only after satisfactory test results obtained, payments will be made.

Warranty requirements: 1 year at least.