Notice Inviting Quotation (E-Procurement mode)

कोटेशन को आमंत्रित करने की सूचना (इ-प्रोक्योर्मेंट मोड)

INDIAN INSTITUTE OF TECHNOLOGY DELHI

भारतीय प्रौद्योगिकी संस्थान दिल्ली

HAUZ KHAS, NEW DELHI-110016

हौज ख़ास, नई दिल्ली -110016

Dated/ दिनांक **: 27/09/2017**

Open Tender Notice No. / खुला प्रस्ताव निविदा सूचना नंबर: IITD/BEEN(SP-1270)/2017

Indian Institute of Technology Delhi is in the process of purchasing following item(s) as per details as given as under.

इंडियन इंस्टीट्यूट ऑफ टेक्नोलॉजी दिल्ली निम्नलिखित मदों की खरीद की प्रक्रिया में है।

Details of the item आइटम का विवरण	**Real time digital simulator**
Earnest Money Deposit to be submitted बयाना जमा करने के लिए जमा राशि	**NIL**
Warranty वारंटी अवधि	**≥ 1 Year(s)**

Tender Documents may be downloaded from Central Public Procurement Portal http://eprocure.gov.in/eprocure/app . Aspiring Bidders who have not enrolled / registered in e-procurement should enroll / register before participating through the website http://eprocure.gov.in/eprocure/app . The portal enrolment is free of cost. Bidders are advised to go through instructions provided at 'Instructions for online Bid Submission'.

निविदा दस्तावेज केन्द्रीय सार्वजनिक खरीद पोर्टल http://eprocure.gov.in/eprocure/app से डाउनलोड हो सकते हैं ई-प्रोक्योरमेंट में पंजीकृत नहीं होने वाले इच्छुक बोलीदाताओं को वेबसाइट http://eprocure.gov.in/eproc ure/app के माध्यम से भाग लेने से पहले पंजीकरण करना चाहिए। पोर्टल नामांकन मुफ्त है बोलीदाताओं को सलाह दी जाती है कि 'ऑनलाइन बोली के लिए निर्देश' पर दिए गए निर्देशों के माध्यम से जाने की सलाह दी जाए।

Tenderers can access tender documents on the website (For searching in the NIC site, kindly go to Tender Search option and type 'IIT'. Thereafter, Click on "GO" button to view all IIT Delhi tenders). Select the appropriate tender and fill them with all relevant information and submit the completed tender document online on the website http://eprocure.gov.in/eprocure/app as per the schedule given in the next page.

निविदाकर्ता वेबसाइट पर निविदा दस्तावेज का उपयोग कर सकते हैं (एनआईसी साइट में खोज के लिए, कृपया निविदा खोज विकल्प और 'आईआईटी' टाइप करें। उसके बाद, सभी आईआईटी दिल्ली निविदाओं को देखने के लिए "गो" बटन पर क्लिक करें) उपयुक्त निविदा का चयन करें और उन्हें सभी प्रासंगिक सूचनाओं से भरें और वेबसाइट पर http://eprocure.gov.in/eprocure/app पर पूरा निविदा दस्तावेज ऑनलाइन जमा करें। अगले पृष्ठ में दिए गए कार्यक्रम के अनुसार

No manual bids will be accepted. All quotation (both Technical and Financial should be submitted in the E-procurement portal).

कोई मैन्युअल बोली स्वीकार नहीं की जाएगी। सभी कोटेशन (तकनीकी और वित्तीय दोनों को ई-प्रोक्योरमेंट पोर्टल में जमा करना चाहिए)

SCHEDULE

Name of Organization	Indian Institute of Technology Delhi
Tender Type (Open/Limited/EOI/Auction/Single)	Open
Tender Category (Services/Goods/works)	Goods
Type/Form of Contract (Work/Supply/ Auction/ Service/ Buy/ Empanelment/ Sell)	Buy
Product Category (Civil Works/Electrical Works/Fleet Management/ Computer Systems)	Device
Source of Fund (Institute/Project)	Project Code RP03346G
Is Multi Currency Allowed	YES
Date of Issue/Publishing	27/09/2017 (15:00 Hrs)
Document Download/Sale Start Date	27/09/2017 (15:00 Hrs)
Document Download/Sale End Date	18/10/2017 (15:00 Hrs)
Date for Pre-Bid Conference	---
Venue of Pre-Bid Conference	---
Last Date and Time for Uploading of Bids	18/10/2017 (15:00 Hrs)
Date and Time of Opening of Technical Bids	20/10/2017 (15:00 Hrs)
Tender Fee	Rs._____NIL____/- (For Tender Fee) (To be paid through RTGS/NEFT. IIT Delhi Bank details are as under: Name of the Bank A/C : IITD Revenue Account SBI A/C No. : 10773572622 Name of the Bank : State Bank of India, IIT Delhi, Hauz Khas, New Delhi-110016 IFSC Code : SBIN0001077 MICR Code : 110002156 Swift No. : SBININBB547 (This is mandatory that UTR Number is provided in the on-line quotation/bid. (Kindly refer to the UTR Column of the Declaration Sheet at Annexure-II)
No. of Covers (1/2/3/4)	02
Bid Validity days (180/120/90/60/30)	90days (From last date of opening of tender)
Address for Communication	Prof. B.K Panigrahi, Room no. II-134 Electrical Engineering Department, Indian Institute of Technology, Hauz Khas, New Delhi – 110016(INDIA)
Contact No.	09582782220(M)
Email Address	bkpanigrahi@ee.iitd.ac.in

Chairman Purchase Committee
(Buyer Member)

Instructions for Online Bid Submission/ ऑनलाइन बोली (बिड) के लिए निर्देश:

As per the directives of Department of Expenditure, this tender document has been published on the Central Public Procurement Portal (URL:http://eprocure.gov.in/eprocure/app). The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

व्यय विभाग के निर्देशों के अनुसार, यह निविदा दस्तावेज केंद्रीय सार्वजनिक प्रापण पोर्टल (यूआरएल: http: //eprocure.gov.in/eprocure/app) पर प्रकाशित किया गया है। बोलीदाताओं को मान्य डिजिटल हस्ताक्षर प्रमाण पत्र का उपयोग करते हुए सीपीपी पोर्टल पर इलेक्ट्रॉनिक रूप से अपनी बोलियों की सॉफ्ट प्रतियां जमा करना आवश्यक है। सीपीपी पोर्टल पर पंजीकरण करने के लिए निविदाकर्ताओं की सहायता करने के लिए नीचे दिए गए निर्देशों का मतलब है, सीपीपी पोर्टल पर आवश्यकताओं के अनुसार अपनी बोलियां तैयार करें और अपनी बोलियां ऑनलाइन जमा करें।

More information useful for submitting online bids on the CPP Portal may be obtained at:

अधिक जानकारी सीपीपी पोर्टल पर ऑनलाइन बोलियां जमा करने के लिए उपयोगी हो सकती है:
http://eprocure.gov.in/eprocure/app

REGISTRATION

1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL:http://eprocure.gov.in/eprocure/app) by clicking on the link "Click here to Enroll". Enrolment on the CPP Portal is free of charge.

   बोलीदाताओं को "नामांकन के लिए यहां क्लिक करें" लिंक पर क्लिक करके सेंट्रल पब्लिक प्रोक्युरमेंट पोर्टल (यूआरएल: http: //eprocure.gov.in/eprocure/app) के ई-प्रोक्योरमेंट मॉड्यूल पर भर्ती करना आवश्यक है। सीपीपी पोर्टल पर नामांकन नि: शुल्क है

2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.

   नामांकन प्रक्रिया के भाग के रूप में, बोलीदाताओं को अपने खाते के लिए एक अद्वितीय उपयोगकर्ता नाम चुनना होगा और एक पासवर्ड प्रदान करना होगा।

3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.

   बोलीदाताओं को सलाह दी जाती है कि पंजीकरण प्रक्रिया के भाग के रूप में अपना वैध ईमेल पता और मोबाइल नंबर पंजीकृत करें। इन का उपयोग सीपीपी पोर्टल से किसी भी संचार के लिए किया जाएगा।

4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / TCS / nCode / eMudhra etc.), with their profile.

   नामांकन पर, बोलीदाताओं को सीसीए इंडिया द्वारा मान्यता प्राप्त किसी प्रमाणन प्राधिकरण द्वारा जारी किए गए अपने मान्य डिजिटल हस्ताक्षर प्रमाण पत्र (कक्षा द्वितीय या कक्षा III प्रमाण पत्र के साथ महत्वपूर्ण उपयोग पर हस्ताक्षर करने) की आवश्यकता होगी (जैसे सिफी / टीसीएस / एनकोड / ई-मुद्रा आदि) , उनके प्रोफाइल के साथ

5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSCs to others which may lead to misuse.

केवल एक मान्य डीएससी एक बोलीदाता द्वारा पंजीकृत होना चाहिए। कृपया ध्यान दें कि निविदाकर्ता यह सुनिश्चित करने के लिए ज़िम्मेदार हैं कि वे अपने डीएससी को दूसरों को उधार नहीं देते हैं जिससे दुरुपयोग हो सकता है।

6) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / eToken.

   बोलीदाता फिर अपने यूजर आईडी / पासवर्ड और डीएससी / ईटीकेन के पासवर्ड को दर्ज करके सुरक्षित लॉग-इन के माध्यम से साइट पर लॉग ऑन करता है।

SEARCHING FOR TENDER DOCUMENTS/ निविदा दस्तावेजों के लिए खोजना

1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, organization name, location, date, value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as organization name, form of contract, location, date, other keywords etc. to search for a tender published on the CPP Portal.

   सीपीपी पोर्टल में निर्मित विभिन्न खोज विकल्प हैं, ताकि बोलीदाताओं को कई मापदंडों से सक्रिय निविदाएं खोज सकें। इन मापदंडों में निविदा आईडी, संगठन का नाम, स्थान, तिथि, मूल्य आदि शामिल हो सकते हैं। निविदाओं के लिए उन्नत खोज का एक विकल्प भी है, जिसमें बोलीदाता कई नामों को जोड़ सकते हैं जैसे संगठन का नाम, अनुबंध का स्थान, स्थान, सीपीपी पोर्टल पर प्रकाशित निविदा की खोज के लिए तारीख, अन्य कीवर्ड आदि।

2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.

   बोलीदाताओं ने एक बार निविदाएं चुनी हैं जिसमें वे रुचि रखते हैं, उसका वे आवश्यक दस्तावेज / निविदा कार्यक्रम डाउनलोड कर सकते हैं। ये निविदाएं 'मेरी निविदाओं' फ़ोल्डर में ले जाई जा सकती हैं। इससे सीपीपी पोर्टल को बोलीदाताओं को एसएमएस / ई-मेल के माध्यम से सूचित किया जा सकता है, यदि निविदा दस्तावेज में कोई शुद्धि जारी कि गई है।

3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

   बोलीदाता को प्रत्येक निविदा को निर्दिष्ट अद्वितीय निविदा आईडी का नोट बनाना चाहिए, अगर वे हेल्पडेस्क से कोई स्पष्टीकरण / सहायता प्राप्त करना चाहते हैं।

PREPARATION OF BIDS / बोली (बिड) की तैयारी

1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.

   बोलीदाता को अपनी बोलियां जमा करने से पहले निविदा दस्तावेज पर प्रकाशित किसी भी शुद्धि को ध्यान में रखना चाहिए।

2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

   कृपया बोली के भाग के रूप में जमा किए जाने वाले दस्तावेजों को समझने के लिए निविदा विज्ञापन और निविदा दस्तावेज ध्यान से देखें। कृपया उन अंकों की संख्या पर ध्यान दें जिन में बोली दस्तावेज जमा करना है, दस्तावेजों

की संख्या - जिसमें प्रत्येक दस्तावेज के नाम और सामग्री शामिल हैं, जिन्हें प्रस्तुत करने की आवश्यकता है। इनमें से कोई भी विचलन बोली को अस्वीकार कर सकता है।

3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF formats. Bid documents may be scanned with 100 dpi with black and white option.

   बोलीदाता, अग्रिम में, निविदा दस्तावेज / अनुसूची में बताए अनुसार प्रस्तुत करने के लिए बोली दस्तावेज तैयार करना चाहिए और आम तौर पर, वे पीडीएफ / एक्सएलएस / आरएआर / डीडब्ल्यूएफ स्वरूपों में हो सकते हैं। बोली दस्तावेजों को 100 डीपीआई के साथ काले और सफेद विकल्प स्कैन किया जा सकता है।

4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use “My Space” area available to them to upload such documents. These documents may be directly submitted from the “My Space” area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

   मानक दस्तावेजों के एक ही सेट को अपलोड करने के लिए आवश्यक समय और प्रयास से बचने के लिए जो प्रत्येक बोली के भाग के रूप में जमा करने के लिए आवश्यक हैं, ऐसे मानक दस्तावेज अपलोड करने का प्रावधान (जैसे पैन कार्ड कॉपी, वार्षिक रिपोर्ट, लेखा परीक्षक प्रमाण पत्र आदि)) बोलीदाताओं को प्रदान किया गया है। ऐसे दस्तावेजों को अपलोड करने के लिए बोलीकर्ता उनके लिए उपलब्ध "मेरा स्पेस" क्षेत्र का उपयोग कर सकते हैं। बोली जमा करते समय ये दस्तावेज़ सीधे "मेरा स्पेस" क्षेत्र से जमा किए जा सकते हैं, और उन्हें बार-बार अपलोड करने की ज़रूरत नहीं है इससे बोली जमा प्रक्रिया के लिए आवश्यक समय में कमी आएगी।

<u>SUBMISSION OF BIDS/</u> बोली (बिड) का जमा करना

1) Bidder should log into the site well in advance for bid submission so that he/she upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

   बोलीदाता को बोली प्रस्तुति के लिए अच्छी तरह से साइट पर लॉग इन करना चाहिए ताकि वह समय पर बोली अपलोड कर सके या फिर बोली प्रस्तुत करने के समय से पहले। अन्य मुद्दों के कारण किसी भी देरी के लिए बोलीदाता जिम्मेदार होगा।

2) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

   बोलीदाता को निविदा दस्तावेज में दर्शाए अनुसार एक-एक करके आवश्यक बोली दस्तावेजों को डिजिटल हस्ताक्षर और अपलोड करना होगा।

3) Bidder has to select the payment option as “on-line” to pay the tender fee / EMD as applicable and enter details of the instrument. Whenever, EMD / Tender fees is sought, bidders need to pay the tender fee and EMD separately on-line through RTGS (Refer to Schedule, Page No.2).

   बोलीदाता को निविदा शुल्क / ईएमडी को भुगतान के लिए "ऑन लाइन" के रूप में भुगतान विकल्प चुनना होगा और उपकरण का विवरण दर्ज करना होगा। जब भी, ईएमडी / निविदा शुल्क की मांग की जाती है, बोलीदाताओं को टेंडर शुल्क और ईएमडी अलग-अलग आरटीजीएस के माध्यम से ऑन लाइन पर भुगतान करने की आवश्यकता होती है (अनुसूची, पेज नं .2 देखें)।

4) A standard BoQ format has been provided with the tender document to be filled by all the bidders. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. Bidders are required to download the BoQ file, open it and complete the white colored (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the

details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

एक मानक BoQ प्रारूप को सभी बोलीदाताओं द्वारा भरने के लिए निविदा दस्तावेज प्रदान किया गया है। बोलीदाताओं को इस बात का ध्यान रखना चाहिए कि उन्हें आवश्यक प्रारूप में अपनी वित्तीय बोली जमा करनी चाहिए और कोई अन्य प्रारूप स्वीकार्य नहीं है। बोलीकर्ताओं को BoQ फाइल को डाउनलोड करने, इसे खोलने और अपने संबंधित वित्तीय उद्धरण और अन्य विवरण (जैसे बोलीदाता का नाम) के साथ सफेद रंगीन (असुरक्षित) कोशिकाओं को पूरा करना आवश्यक है। कोई भी अन्य कक्ष नहीं बदला जाना चाहिए। एक बार विवरण पूरा हो जाने पर, बोलीदाता को इसे सहेजना होगा और इसे ऑनलाइन जमा करना होगा, बिना फ़ाइल नाम बदलना। यदि BOQ फ़ाइल को बोलीदाता द्वारा संशोधित किया गया है, तो बोली को खारिज कर दिया जाएगा।

OR/ या

In some cases Financial Bids can be submitted in PDF format as well (in lieu of BOQ).

कुछ मामलों में वित्तीय बोलियां पीडीएफ प्रारूप में भी जमा की जा सकती हैं (BOQ के बदले)

5) The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.

   सर्वर का समय (जो बोलीदाताओं के डैशबोर्ड पर प्रदर्शित होता है) बोलीदाताओं द्वारा बोलियों को खोलने के लिए समय सीमा को संदर्भित करने के लिए मानक समय के रूप में माना जाएगा। बोलीदाताओं को खोलना आदि। बोलीदाताओं को बोली प्रस्तुत करने के दौरान इस समय का पालन करना चाहिए।

6) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done.

   बोलीदाताओं द्वारा प्रस्तुत सभी दस्तावेज पीकेआई एन्क्रिप्शन तकनीकों का उपयोग करके एन्क्रिप्ट किया जाएगा जिससे डेटा की गोपनीयता सुनिश्चित हो सके। दर्ज किए गए डेटा को अनधिकृत व्यक्तियों द्वारा बोली खोलने के समय तक नहीं देखा जा सकता है। बोलियों की गोपनीयता को सुरक्षित सॉकेट लेयर 128 बिट एन्क्रिप्शन तकनीक का उपयोग कर रखा जाता है। संवेदनशील क्षेत्रों का डेटा संग्रहण एन्क्रिप्शन किया जाता है।

7) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.

   अपलोड किए गए निविदा दस्तावेज केवल अधिकृत बोलीदाता द्वारा निविदा खोलने के बाद ही पठनीय हो सकते हैं।

8) Upon the successful and timely submission of bids, the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.

   बोलियों के सफल और समय पर जमा होने पर, पोर्टल एक सफल बोली प्रस्तुत करने का संदेश देगा और एक बोली सारांश बोली संख्या के साथ प्रदर्शित किया जाएगा। और अन्य सभी प्रासंगिक विवरणों के साथ बोली प्रस्तुत करने की तारीख और समय।

9) Kindly add scanned PDF of all relevant documents in a single PDF file of compliance sheet.

   कृपया अनुपालन पत्रक की एक पीडीएफ फाइल में सभी प्रासंगिक दस्तावेजों के स्कैन किए गए पीडीएफ़ को जोड़ दें।

ASSISTANCE TO BIDDERS / बोलीदाताओं को सहायता

1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

   निविदा दस्तावेज से संबंधित कोई भी प्रश्न और इसमें निहित नियमों और शर्तों को निविदा आमंत्रण प्राधिकरण को निविदा के लिए या निविदा में वर्णित प्रासंगिक संपर्क व्यक्ति से संबोधित किया जाना चाहिए।

2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk. The contact number for the helpdesk is 1800 233 7315.

   ऑनलाइन बोली प्रस्तुत करने या सामान्य में सीपीपी पोर्टल से संबंधित प्रश्नों की प्रक्रिया से संबंधित कोई भी प्रश्न 24x7 सीपीपी पोर्टल हैल्पडेस्क पर निर्देशित किया जा सकता है। हेल्पडेस्क के लिए संपर्क संख्या 1800 233 7315 है

General Instructions to the Bidders / बोलीदाताओं के लिए सामान्य निर्देश

1) The tenders will be received online through portal http://eprocure.gov.in/eprocure/app . In the Technical Bids, the bidders are required to upload all the documents in .pdf format.
   निविदाएं पोर्टल http://eprocure.gov.in/eprocure/app के माध्यम से ऑनलाइन प्राप्त होंगी तकनीकी बोलियों में, बोलीदाताओं को सभी दस्तावेजों को। पीडीएफ प्रारूप में अपलोड करना होगा।

2) Possession of a Valid Class II/III Digital Signature Certificate (DSC) in the form of smart card/e-token in the company's name is a prerequisite for registration and participating in the bid submission activities through https://eprocure.gov.in/eprocure/app. Digital Signature Certificates can be obtained from the authorized certifying agencies, details of which are available in the web site https://eprocure.gov.in/eprocure/app under the link “Information about DSC”.
   कंपनी के नाम में स्मार्ट कार्ड / ई-टोकन के रूप में मान्य क्लास II / III डिजिटल हस्ताक्षर प्रमाण पत्र (डीएससी) के पंजीकरण के लिए एक शर्त है और https://eprocure.gov.in/eprocure/ के माध्यम से बोली प्रस्तुत करने की गतिविधियों में भाग ले सकते है। डिजिटल हस्ताक्षर प्रमाण पत्र अधिकृत प्रमाणित एजेंसियों से प्राप्त की जा सकती है, जिनमें से जानकारी "डीएससी के बारे में सूचना" लिंक के तहत वेब साइट https://eprocure.gov.in/eprocure/app पर उपलब्ध है।

3) Tenderer are advised to follow the instructions provided in the ‘Instructions to the Tenderer for the e-submission of the bids online through the Central Public Procurement Portal for e Procurement at https://eprocure.gov.in/eprocure/app.
   निविदाकर्ता को सलाह दी जाती है कि वे निविदाकार को निर्देश दिए गए हों ताकि ई-प्रोक्योरमेंट के लिए सेंट्रल पब्लिक प्रोकॉर्ममेंट पोर्टल के जरिए https://eprocure.gov.in/eprocure/app पर ऑनलाइन निविदाएं जमा कर सकें।

Department of Electrical Engineering
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NOTICE INVITING QUOTATIONS

Dated: 27/09/2017

Subject : Real time digital simulator

Invitation for Tender Offers

Indian Institute of Technology Delhi invites online Bids (Technical bid and Commercial bid) from eligible and experienced OEM (Original Equipment Manufacturer) OR OEM Authorized Dealer for **supply, installation & integration of Real time digital simulator** with (warranty period as stated at page #1 of this tender) on site comprehensive warranty from the date of receipt of the material as per terms & conditions specified in the tender document, which is available on CPP Portal http://eprocure.gov.in/eprocure/app

TECHNICAL SPECIFICATION:

Real Time Digital Simulator	
INTRODUCTION The Power System Simulator must be a digital system able to perform electromagnetic transient simulations continuously in real time (frequency range DC to ~3kHz). Since one of the main purposes of the simulator will be to test physical controllers and protection devices, it must be equipped with sufficient analogue and digital input and output facilities as well as have the ability for high level communication capabilities (e.g. IEC 61850, IEEE C37.118, IEC 60870, DNP3, etc.). In addition to testing protective relays and control devices, the simulator will also be used for general power system studies and power system training as well as Power Hardware In-the-Loop (PHIL) testing. **1. REAL TIME** For the purpose of this specification, real time simulation shall be interpreted as hard real time simulation as per the following definition – a) The calculation time for the entire power system model, including the time required for communication and servicing of I/O, is completed with respect to real world time in less than the timestep selected for a particular simulation case. b) Each simulation timestep is equidistant from the next with	

respect to real world time.

2. SIMULATION ALGORITHM

2.1 Nodal Analysis

The real time simulation must use nodal analysis to solve the main circuit node voltages and branch current as outlined by Dr. Herman Dommel in his famous paper published in the IEEE Transactions on Power Apparatus and Systems (Volume: PAS-88, Issue 4) in 1969 and implemented in EMTP, PSCAD, etc.

The nodal approach finds the solution of the node voltages by solving the equation [V] = [I] x [Y]-1 where Y is the corresponding admittance matrix of the network. The solution requires the inversion or decomposition of the Y matrix. The superiority of this simulation methodology has been identified particularly when the network solution used is able to decompose the Y matrix every simulation timestep. It facilitates the inclusion of continuously variable admittance elements which is advantageous for embedding component models into the main network solution to avoid the need for numerical interfaces.

2.2 Real Network Solution

The impedance matrix used for the nodal analysis must be reformulated from the admittance matrix every timestep (i.e. the admittance matrix must be decomposed or otherwise inverted every timestep). Furthermore the size of the admittance matrix which is decomposed every timestep must be a minimum of 300 x 300 elements. Therefore 300 single-phase main circuit nodes must be allowed in one tightly coupled subsystem (i.e. no decoupling elements are allowed within the subsystem) and continuously varying admittance elements must be permitted at and between each and every node.

It shall be possible to include no fewer than 500 single-phase switches within each subsystem (i.e. network solution).

These requirements allow the maximum flexibility for the complex network simulations anticipated.

3. HARDWARE

The simulator must be modular in design to allow future expansion and upgrading of the system.

The basic module of the simulator must perform three functions:

1) Computation (i.e. solution) of the power and control system algorithms
2) Ethernet communication to allow control of the simulator via a standard computer workstation
3) Dedicated, high speed communication to allow expansion

of the simulator using additional modules

3.1 Computational Units

The power and control system computation within each module shall be performed by a multicore RISC processor housed on a printed circuit board. The processor cores shall not be dedicated to simulating specific models and the function of each core shall be completely defined by software.

To prevent adverse effects caused by communication restrictions, it shall be possible to connect high accuracy, 16-bit digital to analogue and analogue to digital converters, plus digital input and output, directly to the computational units.

3.2 Ethernet Communication

The basic simulator module shall have ability to connect directly to a 100/1000BaseT Ethernet Local Area Network (LAN) so that it can be accessed remotely by a large group of users.

It shall also be possible via the simulator software and the Ethernet communication to control, monitor and interact with simulations during execution. This is a key aspect of the simulator, allowing the user to "operate" the simulated power system in a manner similar to that of a real power system (i.e. the simulator operator must have continuous communication with and control of the simulator during real time simulations).

3.3 Global Time Synchronization

It shall be possible for the simulation timestep to be synchronized to a 1 Pulse Per Second (1PPS), IEEE 1588 or IRIG-B time reference signal provided by an external device (i.e. GPS clock). Synchronization of the simulation timestep to an external time reference is necessary for Phasor Measurement Unit (PMU) benchmark testing and it is advantageous for IEC 61850-9-2 sampled value output. The simulation of a constant phase angle shall not drift whatsoever over time with respect to the external GPS reference signal and shall exhibit a jitter not larger than 1 microsecond.

3.4 Expandability

It shall be possible to expand the simulator by adding additional modules to the system. Dedicated communication shall be used between simulator modules so that the simulation timestep is not affected in a negative way.

Additionally, if multiple modules are used in the simulator, a precision optical communication channel shall be used to ensure absolute synchronization of computation in all modules.

To facilitate future expansion for large scale real time simulations, it shall be possible to extend the simulator capacity to accommodate up to twelve thousand three-phase buses (equivalent

to approximately thirty six thousand single-phase nodes).

It is well understood that to enable real time simulation of large scale systems that the electrical network is broken into smaller parts called subsystems. The simulator design shall allow direct communication between all subsystems for maximum flexibility and efficiency of the hardware usage.

3.5 Input / Output Capabilities

The simulator shall provide the following minimum input/output capabilities:

1) **Analogue Output** (high resolution / optically isolated) - a minimum of 12, 16-bit analogue output channels shall be available on the simulator to facilitate connection to external devices. These outputs shall meet the following minimum specifications:

- usable dynamic range ~ 400:1 (based on 100kHz BW limited signal & 28db SNR)
- output voltage range +/- 10 Volts

For standard simulations operating with timesteps in the range of 50 microseconds, the analogue output signal shall be oversampled at a rate of 1 microsecond.

The analogue output shall be equipped with a "watch dog" circuit to ensure the output voltage is set to zero within 1 millisecond of a simulation being stopped. The zeroing of the d/a output shall be within 1 millisecond regardless of how the simulation is terminated, either intentional or accidental.

2) **Analogue Input** (high resolution / optically isolated) - a minimum of 12, 16-bit analogue input channels shall be available on the simulator to facilitate importing analogue signals from external sources. These inputs shall meet the following specifications:

- usable dynamic range ~ 400:1 (based on 100kHz BW limited signal & 28db SNR)
- input voltage range +/- 10 Volts

3) **Digital Input** (optically isolated) - a minimum of 64 optically isolated digital input channels shall be available to allow the connection of multiple external devices to the system. At least 60 of the 64 digital inputs shall be capable of providing a digital input timestamp with an accuracy of 250 nanoseconds or better.

4) GPS synchronization to IRIG-B, 1PPS, or IEEE 1588 time sources.

5) The simulator shall have overall capability for Ethernet protocol-based communications (GOOSE, PMU, DNP3, SV, TCP/UDP, Playback, IEC 104) IEEE C37.118 PMU output, IEC 61850 GOOSE messaging, and TCP/UDP protocols must be included in the scope of supply. **Two protocols must be able to**

operate simultaneously. The minimum capability of each protocol is described elsewhere in the document.

It shall be possible to locate any and all of the I/O described above up to 75 metres away from the simulator processing elements. The data transfer shall be facilitated via optical fibre connection(s). Remote location of the I/O components is necessary to minimize the distance electrical signals are transmitted to equipment under test which in some cases must be physically removed from the simulator processing elements.

4 SIMULATION REQUIREMENTS

4.1 Simulator Capacity and Simulation Timestep

The simulator shall be capable of representing, in real time with a digital timestep of less than 20 microseconds, the power system defined in Appendix 1.

4.2 Numerical Stability

The simulator shall be capable of simulating the systems shown in Appendix 1 continuously in real time for a minimum duration of twelve (12) hours with a maximum simulation timestep of around 20 microseconds. The operator shall manually apply faults at random times during the test to ensure the numerical stability and continuous operation of the system.

4.3 Power Electronic Simulation

4.3.1 Line Commutated Power Electronic Converters

The simulator shall be capable of representing line commutated power electronic converter (i.e. HVDC, SVC, TCSC) with an effective firing accuracy of 1 microseconds or better. The accuracy shall be maintained at all times and regardless of whether the firing pulses are generated internally by a simulated controller or externally by a physical controller. Furthermore it is required that these converters be solved as embedded parts of the main network solution and not as isolated subsystems. This is important to ensure maximum numerical stability and the proper representation of harmonics. These models shall also allow the representation of internal faults.

4.3.2 Voltage Source Converter (VSC) Based Power Electronic Schemes

4.3.2.1 VSC Subnetworks

VSC based power electronic schemes typically operate with higher frequency switching, particularly when driven by Pulse Width Modulation (PWM) control. Depending on the power level and application, PWM frequencies typically range from approximately 1 – 10 kHz and the dynamics of these schemes cannot be accurately represented using a timestep in the range of 25-50 microseconds. Therefore the simulator shall have the ability to

represent the VSC schemes as special subnetworks that operate with timesteps in the range of 1-4 microseconds.

It shall be possible to interface the VSC subnetworks to the main simulation so that the interaction of the VSC with a large scale network can be represented and studied. The VSC subnetworks shall be freely configurable through the simulator's standard graphical user interface and able to include a minimum of 30 nodes and 36 switching devices (an IGBT – Back Diode pair shall count only as one device). In addition to the power electronic components, it shall also be possible to include the following elements in the VSC subnetworks; transformers, transmission lines, cables, permanent magnet synchronous machines, double fed induction machines, breakers, filters, etc.

It shall also be possible to interconnect multiple VSC subnetworks via traveling wave transmission line or cable models. Travel times as low as the on VSC subnetwork timestep (i.e. 1-4 microseconds) shall be allowed. The interconnection of subnetworks via traveling wave models will be exploited to expand the network represented with timesteps in the range of 1-4 microseconds.

4.3.2.2 Testing of External Controls for 2- and 3-Level Converters

The subnetworks containing the VSC's are required to accurately represent converter behavior with switching for PWM frequencies in the order of <10 kHz for 3-level converters and >40 kHz for 2-level converters.

The VSC converter models shall be capable of testing the firing pulse controllers (i.e. averaging models are not acceptable) for 2- and 3-level bridges. Therefore the simulator's analogue output and digital input hardware must be respectively capable to send out and read new values every subnetwork timestep (i.e. in the range of 1-4 microseconds) and the loop delay must be minimized.

5 SOFTWARE

5.1 Graphical User Interface

All aspects of the simulator operation, from construction of simulation cases, to operation of the simulator, to post analysis of results must be controlled by a single Graphical User Interface (GUI). The GUI shall consist of modules for the following functions:

1) Circuit Construction - a module to allow the construction of simulation circuits. It shall be possible to use predefined modules from a library of components to assemble new simulation cases. It shall be possible to construct the diagram in either three-line or single-line diagram format and it shall be possible to toggle between the two different views of the same circuit.

2) Transmission Line and Cable Constants – a module to calculate the traveling wave and pi-section parameters for transmission lines and cables. It shall be possible to input the physical parameters of transmission lines and cables to calculate the parameters. Alternatively for overhead transmission lines it shall be possible to input positive and zero sequence data for 3 and 6 conductor transmission lines to calculate the parameters.

3) Simulator Operation – a module for operation of the simulator and the retrieval of simulation results. This module shall allow simulation cases to be started and stopped. The operation of the power system (i.e. changing of set-points and breaker operations), fault applications, monitoring of system status (e.g. RMS voltages and currents), and the retrieval of details simulation results (similar to a fault recorder) must be possible without interrupting the simulation (i.e. while it is running).

4) Storing of Results - it shall be possible to save simulation results directly from the GUI in ASCII, jpg, emf (vector format), pdf or COMTRADE format.

5) Post analysis of simulation results

5.2 Batch Mode Operation

Software shall be provided to allow the user to program a series of simulations to run automatically (i.e. batch mode). The batch mode software shall be capable of nested looping (e.g. if, for and while) to allow adaptive algorithms to be used during automatic operation. The batch mode software shall also be capable of recording key results in ASCII format and selectively printing or storing simulation results.

The batch mode software shall have the ability to embed text and simulation results (in jpg or emf format) directly into Microsoft® Word™ documents.

The batch mode software will be used to conduct automated relay testing where many hundreds or thousands of cases may be simulated during a day.

5.3 Power System Models

A minimum of the following power system models shall be available for the simulator:

- Traveling wave and pi-section multi-phase (max. 18 conductors), coupled transmission line and cable models. It shall be possible to embed breakers in each end of the transmission line models with a maximum of 6 conductors. The nodes introduced by the breakers shall be solved by the transmission line model and shall not count as part of those solved by the main network solution.
- A phase domain frequency dependent transmission line model

shall be available to represent a minimum of 12 coupled conductors. - Transformers with 2 or 3 windings and autotransformers with an optional tertiary winding. It shall be possible to include saturation with hysteresis, and online tap changers in the models. It shall also be possible to represent the transformers with internal turn-to-turn and winding to ground faults. - Synchronous machines (standard and permanent magnet). The synchronous machine models must be solved as part of the main network and are not allowed to be numerically interfaced to the network solution. The synchronous machine model shall optionally allow the unit transformer and/or stator side breaker to be embedded as part of the model so the transformer secondary nodes or breaker nodes do not reduce the number available in the network solution (i.e. if breaker and/or transformer are embedded to the machine model, no extra nodes need be counted as solved by the network solution). Also, the possibility of initialization of the machine based on the load flow results, as well as entering the machine parameters in both "R & X" and "impedance and time constant" formats, and inclusion/exclusion of magnetic saturation and saliency must be provided. A synchronous machine model must be available that will allow a true stator-ground fault. The machine model must also be solved as part of the main network and is not permitted to be interfaced or decoupled from the network solution. It shall be represented in the network solution as continually varying admittance elements. The model shall also make the field winding available as power system nodes to allow faults to be placed on the field. - Multi-phase synchronous machines. A multi-phase synchronous machine model with access to the neutral point and both ends of the stator windings must be available. Modelling of the machine with any number of phases (up to 12 phases) including ones that are not a multiple of 3, such as 5, 7 or 11 must be possible. Disabling/enabling damper windings must also be available. Multi-phase (3-12) control components (e.g. ABC to DQ transformation) must also be available for use. - Induction machines (squirrel cage and double fed) - DC machines - Voltage sources with definable equivalent impedances, source magnitude, frequency and phase - Passive Resistive, Inductive and Capacitive components (including various filter configurations) - Circuit breakers & fault switches - Bus arrestors	

- Series capacitors with ZnO arrestors and bypass switches - Thyristor Controlled Series Capacitors (TCSC) with ZnO arrestors and bypass switches - HVDC valve groups for transmission and back-to-back schemes. The HVDC valve groups shall include 6-pulse and 12-pulse configurations. The 12-pulse configurations shall be fed from a 3-winding transformer with an option to include a 4th winding for the freely configurable connection of filters and or reactive power compensation. The valve group models shall support internal valve faults and shall be solved as part of the main network solution. It is not acceptable that the valve groups are numerically decoupled from the network solution or interfaced to the network solution. - Filter bank model to allow multiple banks of up to 12 switchable filters to be added to simulations without reducing the number of switches or nodes available in the main network solution - Static VAR Compensators (SVC) including TCR and TSC branches. The TCR and TSC branches shall be embedded in the network solution as continuously variable conductance elements. - Instrument transformers including current transformers (CT), inductive voltage transformers (PT), and capacitive voltage transformers (CVT) with full support for saturation and hysteresis loop modeling - Voltage Source Converters: STATCOM, UPFC, SSSC, VSC-based HVDC, DFIG wind generation, etc. - COMTRADE and ASCII Playback. It shall be possible to playback COMTRADE, or ASCII, data files as large as 4 GB. The switches representing HVDC, SVC, and TCSC thyristor valves must be embedded in the main network solution and not solved as independent subsystems. **5.4 Control System Models** A minimum of the following control system components shall be available for the simulator: □ User-Input - Slider, switch, button, dial, etc. □ Constants – integer, floating point, PI □ Data conversion- deg-rad, rad-deg, int-float, float-int □ Math functions – gain, exp, log, ln, ex, xy, sqrt, inverse, abs, sum, multiply, divide, max, min, etc. □ Complex math functions – multiply, divide, add, subtract, etc. □ Trigonometric functions – sin, arcsin, cos, arcos, tan, arctan, arctan2 □ Standard control blocks - deadband, pulse generator, edge	

detector, time, counter, ramp, ramp limits, limiters, phase-locked loop (PLL), flip-flops, fourier transform, integrator, lead-lag, wash-out, lookup table, non-linear gains, etc.

- Logic functions – and, or, nor, bit shift functions, bit -> word, if-then-else, etc.
- Meters – real and reactive power, RMS (single- and three-phase), angle difference, frequency
- Signal processing – sample & hold, down sampler, moving average, FIR, DFT, ABC-DQ0, DQ0-ABC, ABC-αβ, αβ-ABC, vector rotator, etc.
- Generator controls – exciters (IEEE Type 1 to 5, AC1 to 4, ST1 to 3, X1, X2, 2A, SCRX, DC2, IVO, etc.), governors (IEEE Type 1-3, IVO, European BBGOV1, Gas turbine, steam turbine, hydro turbine, etc.), power system stabilizers (PSS2A, IEEEST, IEE2ST)
- On-Load Tap Changer control

5.4.A Relay models – as a minimum the following relay models **must be available in the software library (inbuilt)**

- line distance protection
- differential protection
- generator protection
- overcurrent protection

5.4. B Software Phasor Measurement Unit (PMU) – model (inbuilt)

- The **library of the software must contain both P and M type PMU devices** which shall be represented with selectable reporting rates from 1 – 240 frames per second. **The software PMU must comply with IEEE C37.118.1-2011 (Measurement compliancy).** This will operate in a manner similar to commercial PMU devices.

- Further, it should comply with IEEE C37.118.2-2011 synchrophasor **data transfer standard.**

5.5 User Defined Models

It shall be possible for the user to create power and control system models for the simulator to run in real time together with standard models provided by the supplier. The facility provided shall allow custom icon graphics and input menus to be created for the new component. Furthermore the facility shall allow high level programming (for example C code) of the real time simulation algorithm and the facility shall include all necessary compilers.

5.6 Load Flow Initialization

The software shall include a load flow calculation which can be used to initialize the simulation components before the real time

electromagnetic transient simulation is begun.

5.7 PSS/E Conversion

It shall be possible for the simulator to import and convert PSS/E data for simulation in real time. Once converted, the PSS/E system must also be available in picture format for modification.

5.8 PSCAD Conversion

It shall be possible for the simulator to import and convert PSCAD network data for simulation in real time.

5.9 Processor Allocation Details

It shall be possible to view the processor allocation details showing loading of processors or cores with various component used in the simulation case. The allocation chart or table should show control system components and power system component separately.

5.10 Testing of Physical PMUs

The software should be equipped with tools or utilities for testing hardware PMUs based on according to the IEEE C37.118-1.2011 and C37.118.1. The tools or utilities shall gather measurements made by the hardware PMU (Total Vector Error, Frequency Error, Rate of Change of Frequency Error, and Rate of Change of Frequency) and compare them to theoretical values.

5.11 Software Licensing

The software shall be provided with a site license so that it is possible to install all software included with the simulator supply on any number of desktop or laptop computers. If a site license cannot be provided a minimum of twenty independent licenses shall be provided for all software provided with the simulator.

6. COMMUNICATION PROTOCOLS

The simulator can be utilized to model modern Smart Grid and Distributed Generation scenarios and as such must be able to provide high level Ethernet based communication as a minimum via the protocols described below.

6.1 Generic Socket Communications

The simulator shall be able to both send and receive generic UDP/TCP packets via an Ethernet based socket connection to external equipment (e.g. computer or controller).

6.2 IEC 61850 GOOSE Messaging

The simulator shall be able to both publish and subscribe to IEC 61850 GOOSE formatted messages for binary (e.g. trip and breaker status) and analogue signals.

The simulator shall be able to publish and subscribe to GOOSE messages and be able to act as a minimum of 4 separate Intelligent Electronic Devices (IEDs). Each of those IEDs shall be able to publish and subscribe to a minimum of 32 points, either Boolean or floating point, plus quality bitmaps for each point (64 points if

quality bitmaps are not required). This totals 256 points for publishing and 256 points for subscribing.

The simulator shall also be able to subscribe to **GOOSE messages from a minimum of 16 separate IED's.**

It shall further be possible to manipulate the quality bits, "test" bit and "needs commissioning" bit of the GOOSE messages to test the response of the external protection and control devices.

6.3 IEC 61850-9-2 Sampled Value Messaging

The simulator shall be capable of providing a minimum of two IEC 61850-9-2 sampled value data streams (i.e. two sets of 4 x voltage and 4 x current channels) to protection and control equipment. The sampled values shall be provided at 80 or 256 samples per cycle for a single data stream. It shall be possible to manipulate the quality bits of the sampled value messages to test the response of the external protection and control devices.

It shall also be possible to subscribe to a minimum of one IEC 61850-9-2 sampled values data stream at 80 or 256 sample per cycle as input to a simulation.

6.4 IEC 61869-9 Sampled Value Messaging

The simulator shall be capable of providing a minimum of one IEC 61869-9 sampled value data streams (with up to 24 channels of voltage or current) to protection and control equipment. The sampled values shall be provided at 80 samples per cycle for a single data stream.

It shall be possible to use dedicated FPGA-based hardware to transmit a minimum of sixteen IEC 61869-9 sampled value data streams (with up to 24 channels of voltage or current) simultaneously.

6.5 IEEE C37.118 PMU Data Stream Output

The simulator shall be capable of simulating and providing synchrophasor data stream output for a minimum of twenty four (24) Phasor Measurement Units (PMU's) with individually assignable frame-rates of up to 50/60 frames per second.

6.6 SCADA Interface

The simulator shall be capable of acting as a slave unit for communication with SCADA equipment using the DNP 3.0 or IEC 60870-5-104 protocol. The system shall communicate with one DNP/ IEC 60870-5-104 master and accommodate the following minimum communication capacity:

- Binary simulation status (i.e. breaker position)
  1024 (scan rate 1000 Hz)
- Binary simulation control (i.e. breaker commands)
  512 (scan rate 1000 Hz)
- Analogue status (i.e. output from simulator)

500 (scan rate 4 Hz)

- Analogue control (i.e. input to simulator)

100 (scan rate 4 Hz)

7 INSTALLATION AND TRAINING

The proposal should include on-site installation and one-week training conducted by experienced engineers. The training should encompass all hardware and software modules including third party modules supplied as part of the simulator. If this cost is not included with the supply, please itemize the additional cost or clearly state non-availability of the service and the reason for the same.

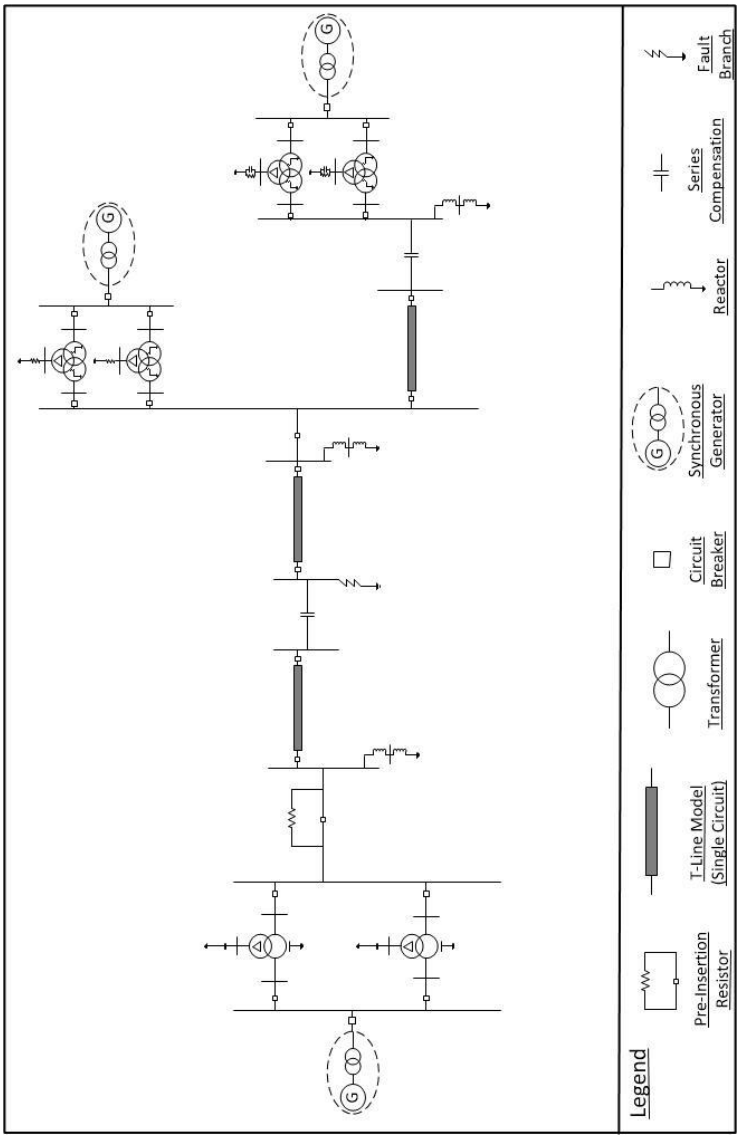
8 TECHNICAL SUPPORT

The simulator should include unlimited technical support on hardware and software for at least 4 years. The technical support should cover all the software and hardware supplied as part of the simulator irrespective of whether the software or hardware was manufactured by the simulator vendor or purchased from third parties. If this cost is not included with the supply, please itemize the additional cost or clearly state non-availability of the service and the reason for the same. The simulator vendor shall demonstrate their expertise for supporting third party software and hardware, now and in the future.

9 SOFTWARE MAINTENANCE AND UPGRADE

The simulator should include unrestricted upgrade (all releases including major and minor releases) and maintenance (patches and fixes) for the lifetime of the simulator. The upgrade and maintenance should cover all the software modules supplied as part of the simulator whether the software module was manufactured by the simulator vendor or purchased from third parties. Please identify third party software/modules and provide details (such as transferable contracts from original manufacturer) to support vendor's ability to offer maintenance, upgrade coverage and guarantee compatibility for the requested period. The Institute shall request contact information of existing client sites to verify the history of satisfactory execution of such extended maintenance on vendor developed and third party products. If this cost is not included with the supply, please state non-availability of the service and the reason for the same.

Appendix-1



A complete set of tender documents* may be Download by prospective bidder free of cost from the website http://eprocure.gov.in/eprocure/app. Bidder has to make payment of requisite fees (i.e. Tender fees (if any) and EMD) online through RTGS/NEFT only.

Terms & Conditions Details

Sl. No.	Specification
1.	**Due date**: The tender has to be submitted on-line before the due date. The offers received after the due date and time will not be considered. No manual bids will be considered.
2.	**Preparation of Bids**: The offer/bid should be submitted in two bid systems (i.e.) Technical bid and financial bid. The technical bid should consist of all technical details along with commercial terms and conditions. Financial bid should indicate item wise price for the items mentioned in the technical bid in the given format i.e Financial Bids to be submitted in PDF format. The Technical bid and the financial bid should be submitted Online.
3.	**EMD (if applicable)**: The tenderer should submit an EMD amount through RTGS/NEFT. The Technical Bid without EMD would be considered as UNRESPONSIVE and will not be accepted. The EMD will be refunded without any interest to the unsuccessful bidders after the award of contract. Refer to Schedule (at page 1 of this document) for its actual place of submission.
4.	**Refund of EMD**: The EMD will be returned to unsuccessful Tenderer only after the Tenders are finalized. In case of successful Tenderer, it will be retained till the successful and complete installation of the equipment.
5.	**Opening of the tender**: The online bid will be opened by a committee duly constituted for this purpose. Online bids (complete in all respect) received along with EMD (if any) will be opened as mentioned at "Annexure: Schedule" in presence of bidders representative if available. Only one representative will be allowed to participate in the tender opening. Bid received without EMD (if present) will be rejected straight way. The technical bid will be opened online first and it will be examined by a technical committee (as per specification and requirement). The financial offer/bid will be opened only for the offer/bid which technically meets all requirements as per the specification, and will be opened in the presence of the vendor's representatives subsequently for further evaluation. The bidders if interested may participate on the tender opening Date and Time. The bidder should produce authorization letter from their company to participate in the tender opening.
6.	**Acceptance/ Rejection of bids:** The Committee reserves the right to reject any or all offers without assigning any reason.
7.	**Pre-qualification criteria:** (i) Bidders should be the manufacturer / authorized dealer. Letter of Authorization from original equipment manufacturer (OEM) on the same and specific to the tender should be enclosed. (ii) An undertaking from the OEM is required stating that they would facilitate the bidder on a regular basis with technology/product updates and extend support for the warranty as well. (Ref. Annexure-II) (iii) OEM should be internationally reputed Branded Company. (iv) Non-compliance of tender terms, non-submission of required documents, lack of clarity of the specifications, contradiction between bidder specification and supporting documents etc. may lead to rejection of the bid. (v) In the tender, either the Indian agent on behalf of the Principal/OEM or Principal/OEM itself can bid but both cannot bid simultaneously for the same item/product in the same tender. (vi) If an agent submits bid on behalf of the Principal/OEM, the same agent shall not submit a bid on behalf of another Principal/OEM in the same tender for the same item/product.
8.	**Performance Security**: The supplier shall require to submit the performance security in the form of irrevocable bank guarantee issued by any Indian Nationalized Bank for an amount which is stated at page #1 of the tender document within 21 days from the date of receipt of the purchase order/LC and should be kept valid for a period of 60 days beyond the date of completion of warranty period.

9.	**Force Majeure:** The Supplier shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that, it's delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure. • For purposes of this Clause, "Force Majeure" means an event beyond the control of the Supplier and not involving the Supplier's fault or negligence and not foreseeable. Such events may include, but are not limited to, acts of the Purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes. • If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such conditions and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.
10.	**Risk Purchase Clause**: In event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from the other source on the total risk of the supplier under risk purchase clause.
11.	**Packing Instructions**: Each package will be marked on three sides with proper paint/indelible ink, the following: i. Item Nomenclature ii. Order/Contract No. iii. Country of Origin of Goods iv. Supplier's Name and Address v. Consignee details vi. Packing list reference number
12.	**Delivery and Documents:** Delivery of the goods should be made within a maximum of 08 to 16 weeks from the date of placement of purchase order and the opening of LC. Within 24 hours of shipment, the supplier shall notify the purchaser and the insurance company by cable/telex/fax/e mail the full details of the shipment including contract number, railway receipt number/ AAP etc. and date, description of goods, quantity, name of the consignee, invoice etc. The supplier shall mail the following documents to the purchaser with a copy to the insurance company: 1. 4 Copies of the Supplier invoice showing contract number, goods' description, quantity 2. unit price, total amount; 3. Insurance Certificate if applicable; 4. Manufacturer's/Supplier's warranty certificate; 5. Inspection Certificate issued by the nominated inspection agency, if any 6. Supplier's factory inspection report; and 7. Certificate of Origin (if possible by the beneficiary); 8. Two copies of the packing list identifying the contents of each package. 9. The above documents should be received by the Purchaser before arrival of the Goods (except where the Goods have been delivered directly to the Consignee with all documents) and, if not received, the Supplier will be responsible for any consequent expenses.
13.	**Delayed delivery:** If the delivery is not made within the due date for any reason, the Committee will have the right to impose penalty 1% per week and the maximum deduction is 10% of the contract value / price.
14.	**Prices**: The price should be quoted in net per unit (after breakup) and must include all packing and delivery charges. The offer/bid should be exclusive of taxes and duties, which will be paid by the purchaser as applicable. However the percentage of taxes & duties shall be clearly indicated.

	The price should be quoted without custom duty and excise duty, since IIT Delhi is exempted from payment of Excise Duty and is eligible for concessional rate of custom duty. Necessary certificate will be issued on demand. **In case of imports, the price should be quoted on FOB/FCA origin Airport Basis only.** Under special circumstances (eg. perishable chemicals), when the item is imported on CIF/CIP, please indicate CIF/CIP charges separately upto IIT Delhi indicating the mode of shipment. IIT Delhi will make necessary arrangements for the clearance of imported goods at the Airport/Seaport. Hence the price should not include the above charges. **At any circumstances, it is the responsibility of the foreign supplier to handover the material to our forwarder at the origin airport after completing all the inland clearing. No Ex- Works consignment will be entertained.** "In case of **CIF/CIP** shipments, kindly provide the shipment information at least 2 days in advance before landing the shipment along with the documents i.e. invoice, packing list, forwarder Name, address, contact No. in India to save penalty/demurrage charges (imposed by Indian Customs) . Otherwise these charges will be recovered from the supplier/Indian Agent."
15.	**Notices:** For the purpose of all notices, the following shall be the address of the Purchaser and Supplier. **Purchaser: Prof. B.K Panigrahi, Room no. II-134** **Electrical Engineering Department** Indian Institute of Technology Hauz Khas, New Delhi - 110016. **Supplier:** (To be filled in by the supplier) **(All supplier's should submit its supplies information as per Annexure-II).** _____ _____
16.	**Progress of Supply**: Wherever applicable, supplier shall regularly intimate progress of supply, in writing, to the Purchaser as under: 1. Quantity offered for inspection and date; 2. Quantity accepted/rejected by inspecting agency and date; 3. Quantity dispatched/delivered to consignees and date; 4. Quantity where incidental services have been satisfactorily completed with date; 5. Quantity where rectification/repair/replacement effected/completed on receipt of any communication from consignee/Purchaser with date; 6. Date of completion of entire Contract including incidental services, if any; and **7.** Date of receipt of entire payments under the Contract (In case of stage-wise inspection, details required may also be specified).
17.	**Inspection and Tests:** Inspection and tests prior to shipment of Goods and at final acceptance are as follows: • After the goods are manufactured and assembled, inspection and testing of the goods shall be carried out at the supplier's plant by the supplier, prior to shipment to check whether the goods are in conformity with the technical specifications attached to the purchase order. Manufacturer's test certificate with data sheet shall be issued to this effect and submitted along with the delivery documents. The purchaser shall be present at the supplier's premises during such inspection and testing if need is felt. The location where the inspection is required to be conducted should be clearly indicated. The supplier shall inform the purchaser about the site preparation, if any, needed for installation of the goods at the purchaser's site at the time of submission of order acceptance. • The acceptance test will be conducted by the Purchaser, their consultant or other such person nominated by the Purchaser at its option after the equipment is installed at purchaser's site in

	the presence of supplier's representatives. The acceptance will involve trouble free operation and ascertaining conformity with the ordered specifications and quality. There shall not be any additional charges for carrying out acceptance test. No malfunction, partial or complete failure of any part of the equipment is expected to occur. The Supplier shall maintain necessary log in respect of the result of the test to establish to the entire satisfaction of the Purchaser, the successful completion of the test specified. • In the event of the ordered item failing to pass the acceptance test, a period not exceeding one weeks will be given to rectify the defects and clear the acceptance test, failing which the Purchaser reserve the right to get the equipment replaced by the Supplier at no extra cost to the Purchaser. • Successful conduct and conclusion of the acceptance test for the installed goods and equipment shall also be the responsibility and at the cost of the Supplier.
18.	**Resolution of Disputes**: The dispute resolution mechanism to be applied pursuant shall be as follows: • In case of Dispute or difference arising between the Purchaser and a domestic supplier relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Indian Arbitration & Conciliation Act, 1996, the rules there under and any statutory modifications or re-enactments thereof shall apply to the arbitration proceedings. The dispute shall be referred to the Director, Indian Institute of Technology (IIT) Delhi and if he is unable or unwilling to act, to the sole arbitration of some other person appointed by him willing to act as such Arbitrator. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to this order. • In the case of a dispute between the purchaser and a Foreign Supplier, the dispute shall be settled by arbitration in accordance with provision of sub-clause (a) above. But if this is not acceptable to the supplier then the dispute shall be settled in accordance with provisions of UNCITRAL (United Nations Commission on International Trade Law) Arbitration Rules. • The venue of the arbitration shall be the place from where the order is issued.
19.	**Applicable Law:** The place of jurisdiction would be New Delhi (Delhi) INDIA.
20.	**Right to Use Defective Goods** If after delivery, acceptance and installation and within the guarantee and warranty period, the operation or use of the goods proves to be unsatisfactory, the Purchaser shall have the right to continue to operate or use such goods until rectifications of defects, errors or omissions by repair or by partial or complete replacement is made without interfering with the Purchaser's operation.
21.	**Supplier Integrity** The Supplier is responsible for and obliged to conduct all contracted activities in accordance with the Contract using state of the art methods and economic principles and exercising all means available to achieve the performance specified in the contract.
22.	**Training** The Supplier is required to provide training to the designated Purchaser's technical and end user personnel to enable them to effectively operate the total equipment.
23.	**Installation & Demonstration** The supplier is required to done the installation and demonstration of the equipment within one month of the arrival of materials at the IITD site of installation, otherwise the penalty clause will be the same as per the supply of materials. In case of any mishappening/damage to equipment and supplies during the carriage of supplies from the origin of equipment to the installation site, the supplier has to replace it with new equipment/supplies immediately at his own risk. Supplier will settle his claim with the insurance company as per his convenience. IITD will not be liable to any type of losses in any form.
24.	**Insurance:** For delivery of goods at the purchaser's premises, the insurance shall be obtained by the supplier in an amount equal to 110% of the value of the goods from "warehouse to warehouse"

	(final destinations) on "All Risks" basis including War Risks and Strikes. The insurance shall be valid for a period of not less than 3 months after installation and commissioning. **In case of orders placed on FOB/FCA basis, the purchaser shall arrange Insurance. If orders placed on CIF/CIP basis, the insurance should be up to IIT Delhi.**
25.	**Incidental services:** The incidental services also include: • Furnishing of 01 set of detailed operations & maintenance manual. • Arranging the shifting/moving of the item to their location of final installation within IITD premises at the cost of Supplier through their Indian representatives.
26.	**Warranty**: (i) Warranty period shall be (as stated at page #2 of this tender) from date of installation of Goods at the IITD site of installation. The Supplier shall, in addition, comply with the performance and/or consumption guarantees specified under the contract. If for reasons attributable to the Supplier, these guarantees are not attained in whole or in part, the Supplier shall at its discretion make such changes, modifications, and/or additions to the Goods or any part thereof as may be necessary in order to attain the contractual guarantees specified in the Contract at its own cost and expense and to carry out further performance tests. The warranty should be comprehensive on site. (ii) The Purchaser shall promptly notify the Supplier in writing of any claims arising under this warranty. Upon receipt of such notice, the Supplier shall immediately within in 02 days arrange to repair or replace the defective goods or parts thereof free of cost at the ultimate destination. The Supplier shall take over the replaced parts/goods at the time of their replacement. No claim whatsoever shall lie on the Purchaser for the replaced parts/goods thereafter. The period for correction of defects in the warranty period is 02 days. If the supplier having been notified fails to remedy the defects within 02 days, the purchaser may proceed to take such remedial action as may be necessary, at the supplier's risk and expenses and without prejudice to any other rights, which the purchaser may have against the supplier under the contract. (iii) The warranty period should be clearly mentioned. The maintenance charges (AMC) under different schemes after the expiry of the warranty should also be mentioned. The comprehensive warranty will commence from the date of the satisfactory installation/commissioning of the equipment against the defect of any manufacturing, workmanship and poor quality of the components. (iv) After the warranty period is over, Annual Maintenance Contract (AMC)/Comprehensive Maintenance Contract (CMC) up to next two years should be started. The AMC/CMC charges will not be included in computing the total cost of the equipment.
27.	**Governing Language** The contract shall be written in English language. English language version of the Contract shall govern its interpretation. All correspondence and other documents pertaining to the Contract, which are exchanged by the parties, shall be written in the same language.
28.	**Applicable Law** The Contract shall be interpreted in accordance with the laws of the Union of India and all disputes shall be subject to place of jurisdiction.
29.	**Notices** • Any notice given by one party to the other pursuant to this contract/order shall be sent to the other party in writing or by cable, telex, FAX or e mail and confirmed in writing to the other party's address. • A notice shall be effective when delivered or on the notice's effective date, whichever is later.
30.	**Taxes** Suppliers shall be entirely responsible for all taxes, duties, license fees, octroi, road permits, etc.,

	incurred until delivery of the contracted Goods to the Purchaser. However, VAT in respect of the transaction between the Purchaser and the Supplier shall be payable extra, if so stipulated in the order.
31.	**Duties** IIT Delhi is exempted from paying custom duty under notification No.51/96 (partially or full) and necessary "Custom Duty Exemption Certificate" can be issued after providing following information and Custom Duty Exemption Certificate will be issued to the shipment in the name of the Institute, (no certificate will be issued to third party): The procured product should be used for teaching, scientific and research work only. a) Shipping details i.e. Master Airway Bill No. and House Airway No. (if exists) b) Forwarder details i.e. Name, Contact No., etc. IIT Delhi is exempted from paying Excise Duty and necessary Excise Duty Exemption Certificate will be provided for which following information are required. b) Quotation with details of Basic Price, Rate, Tax & Amount on which ED is applicable c) Supply Order Copy d) Proforma-Invoice Copy.
32.	**Agency Commission**: Agency commission if any will be paid to the Indian agent in Rupees on receipt of the equipment and after satisfactory installation. Agency Commission will not be paid in foreign currency under any circumstances. The details should be explicitly shown in Tender even in case of Nil commission. The tenderer should indicate the percentage of agency commission to be paid to the Indian agent.
33.	**Payment**: (i) For imported items Payment will be made through irrevocable Letter of Credit (LC) Cash Against Documents (CAD)/Against delivery/after satisfactory installation by T.T. Letter of Credit (LC) will be established in favour of foreign Supplier after the submission of performance security. The letter of credit (LC) will be established on the exchange rates as applicable on the date of establishment. For Imports, LC will be opened for 100% FOB/CIF value. 80% of the LC amount shall be released on presentation of complete and clear shipping documents and 20% of the LC amount shall be released after the installation and demonstration of the equipment at the INST site of installation in faultless working condition for period of 60 days from the date of the satisfactory installation and subject to the production of unconditional performance bank guarantee as specified in Clause 8 of tender terms and conditions. (ii) For Indigenous supplies, 100% payment shall be made by the Purchaser against delivery, inspection, successful installation, commissioning and acceptance of the equipment at IITD in good condition and to the entire satisfaction of the Purchaser and on production of unconditional performance bank guarantee as specified in Clause 9 of tender terms and conditions. (iii) Indian Agency commission (IAC), if any shall be paid after satisfactory installation & commissioning of the goods at the destination at the exchange rate prevailing on the date of negotiation of LC documents, subject to DGS&D registration for restricted items. (iv) All the bank charges within India will be borne by the Institute and outside India will be borne by the Supplier.
34.	**User list:** Brochure detailing technical specifications and performance, list of industrial and educational establishments where the items enquired have been supplied must be provided. (Ref. Annexure-III)
35.	**Manuals and Drawings** (i) Before the goods and equipment are taken over by the Purchaser, the Supplier shall supply operation and maintenance manuals. These shall be in such details as will enable the Purchaser to operate, maintain, adjust and repair all parts of the works as stated in the

	specifications. (ii) The Manuals shall be in the ruling language (English) in such form and numbers as stated in the contract. (iii) Unless and otherwise agreed, the goods equipment shall not be considered to be completed for the purposes of taking over until such manuals and drawing have been supplied to the Purchaser.
36.	**Application Specialist**: The Tenderer should mention in the Techno-Commercial bid the availability and names of Application Specialist and Service Engineers in the nearest regional office. (Ref. to Annexure-III)
37.	**Site Preparation**: The supplier shall inform to the Institute about the site preparation, if any, needed for the installation of equipment, immediately after the receipt of the purchase order. The supplier must provide complete details regarding space and all the other infrastructural requirements needed for the equipment, which the Institute should arrange before the arrival of the equipment to ensure its timely installation and smooth operation thereafter. The supplier shall visit the Institute and see the site where the equipment is to be installed and may offer his advice and render assistance to the Institute in the preparation of the site and other pre-installation requirements.
38.	**Spare Parts** The Supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Supplier: ii. Such spare parts as the Purchaser may elect to purchase from the Supplier, providing that this election shall not relieve the Supplier of any warranty obligations under the Contract; and iii. In the event of termination of production of the spare parts: iv. Advance notification to the Purchaser of the pending termination, in sufficient time to permit the Purchaser to procure needed requirements; and v. Following such termination, furnishing at no cost to the Purchaser, the blueprints, drawings and specifications of the spare parts, if requested. Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spares for the Goods, such as gaskets, plugs, washers, belts etc. Other spare parts and components shall be supplied as promptly as possible but in any case within six months of placement of order.
39.	**Defective Equipment**: If any of the equipment supplied by the Tenderer is found to be substandard, refurbished, un-merchantable or not in accordance with the description/specification or otherwise faulty, the committee will have the right to reject the equipment or its part. The prices of such equipment shall be refunded by the Tenderer with 18% interest if such payments for such equipment have already been made. All damaged or unapproved goods shall be returned at suppliers cost and risk and the incidental expenses incurred thereon shall be recovered from the supplier. Defective part in equipment, if found before installation and/or during warranty period, shall be replaced within 45 days on receipt of the intimation from this office at the cost and risk of supplier including all other charges. In case supplier fails to replace above item as per above terms & conditions, IIT Delhi may consider "Banning" the supplier.
40.	**Termination for Default** The Purchaser may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, terminate the Contract in whole or part: i. If the Supplier fails to deliver any or all of the Goods within the period(s) specified in the order, or within any extension thereof granted by the Purchaser; or ii If the Supplier fails to perform any other obligation(s) under the Contract. iii If the Supplier, in the judgment of the Purchaser has engaged in corrupt or fraudulent practices in competing for or in executing the Contract. ● For the purpose of this Clause: i. "**Corrupt practice**" means the offering, giving, receiving or soliciting of anything of

	value to influence the action of a public official in the procurement process or in contract execution. ii. "**Fraudulent practice**" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition;'" • In the event the Purchaser terminates the Contract in whole or in part, the Purchaser may procure, upon such terms and in such manner, as it deems appropriate, Goods or Services similar to those undelivered, and the Supplier shall be liable to the Purchaser for any excess costs for such similar Goods or Services. However, the Supplier shall continue the performance of the Contract to the extent not terminated.
41.	**Shifting**: After 1-2 years once our new Academic Block will be ready, the supplier has to shift and reinstall the instrument free of cost (if required).
42.	**Downtime:** During the warranty period not more than 5% downtime will be permissible. For every day exceeding permissible downtime, penalty of 1/365 of the 5% FOB value will be imposed. Downtime will be counted from the date and time of the filing of complaint with in the business hours.
43.	**Training of Personnel:** The supplier shall be required to undertake to provide the technical training to the personnel involved in the use of the equipment at the Institute premises, immediately after completing the installation of the equipment for a minimum period of one week at the supplier's cost.
44.	**Disputes and Jurisdiction**: Any legal disputes arising out of any breach of contract pertaining to this tender shall be settled in the court of competent jurisdiction located within New Delhi.
45.	**Compliancy certificate**: This certificate must be provided indicating conformity to the technical specifications. (Annexure-I)

COMPLIANCE SHEET

TECHNICAL SPECIFICATION

S. No.	Technical Specification	**COMPLIANCE Y/N**
	<u>INTRODUCTION</u> The Power System Simulator must be a digital system able to perform electromagnetic transient simulations continuously in real time (frequency range DC to ~3kHz). Since one of the main purposes of the simulator will be to test physical controllers and protection devices, it must be equipped with sufficient analogue and digital input and output facilities as well as have the ability for high level communication capabilities (e.g. IEC 61850, IEEE C37.118, IEC 60870, DNP3, etc.). In addition to testing protective relays and control devices, the simulator will also be used for general power system studies and power system training as well as Power Hardware In-the-Loop (PHIL) testing.	
1	**REAL TIME** For the purpose of this specification, real time simulation shall be interpreted as hard real time simulation as per the following definition –	
a	The calculation time for the entire power system model, including the time required for communication and servicing of I/O, is completed with respect to real world time in less than the timestep selected for a particular simulation case.	
b	Each simulation timestep is equidistant from the next with respect to real world time.	
2	**SIMULATION ALGORITHM**	
2.1	**Nodal Analysis** The real time simulation must use nodal analysis to solve the main circuit node voltages and branch current as outlined by Dr. Herman Dommel in his famous paper published in the IEEE Transactions on Power Apparatus and Systems (Volume: PAS-88, Issue 4) in 1969 and implemented in EMTP, PSCAD, etc. The nodal approach finds the solution of the node voltages by solving the equation [V] = [I] x [Y]-1 where Y is the corresponding admittance matrix of the network. The solution requires the inversion or decomposition of the Y matrix. The superiority of this simulation methodology has been identified particularly when the network solution used is able to decompose the Y matrix every simulation timestep. It facilitates the inclusion of continuously variable admittance elements which is advantageous for embedding component models into the main network	

	solution to avoid the need for numerical interfaces.	
2.2	**Real Network Solution** The impedance matrix used for the nodal analysis must be reformulated from the admittance matrix every timestep (i.e. the admittance matrix must be decomposed or otherwise inverted every timestep). Furthermore the size of the admittance matrix which is decomposed every timestep must be a minimum of 300 x 300 elements. Therefore 300 single-phase main circuit nodes must be allowed in one tightly coupled subsystem (i.e. no decoupling elements are allowed within the subsystem) and continuously varying admittance elements must be permitted at and between each and every node. It shall be possible to include no fewer than 500 single-phase switches within each subsystem (i.e. network solution). These requirements allow the maximum flexibility for the complex network simulations anticipated.	
3	**HARDWARE** The simulator must be modular in design to allow future expansion and upgrading of the system. The basic module of the simulator must perform three functions:	
i)	Computation (i.e. solution) of the power and control system algorithms	
ii)	Ethernet communication to allow control of the simulator via a standard computer workstation	
iii)	Dedicated, high speed communication to allow expansion of the simulator using additional modules	
3.1	**Computational Units** The power and control system computation within each module shall be performed by a multicore RISC processor housed on a printed circuit board. The processor cores shall not be dedicated to simulating specific models and the function of each core shall be completely defined by software. To prevent adverse effects caused by communication restrictions, it shall be possible to connect high accuracy, 16-bit digital to analogue and analogue to digital converters, plus digital input and output, directly to the computational units.	
3.2	**Ethernet Communication** The basic simulator module shall have ability to connect directly to a 100/1000BaseT Ethernet Local Area Network (LAN) so that it can be accessed remotely by a large group of users. It shall also be possible via the simulator software and the Ethernet communication to control, monitor and interact with simulations during execution. This is a key aspect of	

	the simulator, allowing the user to "operate" the simulated power system in a manner similar to that of a real power system (i.e. the simulator operator must have continuous communication with and control of the simulator during real time simulations).	
3.3	**Global Time Synchronization** It shall be possible for the simulation timestep to be synchronized to a 1 Pulse Per Second (1PPS), IEEE 1588 or IRIG-B time reference signal provided by an external device (i.e. GPS clock). Synchronization of the simulation timestep to an external time reference is necessary for Phasor Measurement Unit (PMU) benchmark testing and it is advantageous for IEC 61850-9-2 sampled value output. The simulation of a constant phase angle shall not drift whatsoever over time with respect to the external GPS reference signal and shall exhibit a jitter not larger than 1 microsecond.	
3.4	**Expandability** It shall be possible to expand the simulator by adding additional modules to the system. Dedicated communication shall be used between simulator modules so that the simulation timestep is not affected in a negative way. Additionally, if multiple modules are used in the simulator, a precision optical communication channel shall be used to ensure absolute synchronization of computation in all modules. To facilitate future expansion for large scale real time simulations, it shall be possible to extend the simulator capacity to accommodate up to twelve thousand three-phase buses (equivalent to approximately thirty six thousand single-phase nodes). It is well understood that to enable real time simulation of large scale systems that the electrical network is broken into smaller parts called subsystems. The simulator design shall allow direct communication between all subsystems for maximum flexibility and efficiency of the hardware usage.	
3.5	**Input / Output Capabilities** The simulator shall provide the following minimum input/output capabilities:	
A	**Analogue Output** (high resolution / optically isolated) - a minimum of 12, 16-bit analogue output channels shall be available on the simulator to facilitate connection to external devices. These outputs shall meet the following minimum specifications: usable dynamic range ~ 400:1 (based on 100kHz BW limited signal & 28db SNR) output voltage range +/- 10 Volts	

	For standard simulations operating with timesteps in the range of 50 microseconds, the analogue output signal shall be oversampled at a rate of 1 microsecond. The analogue output shall be equipped with a "watch dog" circuit to ensure the output voltage is set to zero within 1 millisecond of a simulation being stopped. The zeroing of the d/a output shall be within 1 millisecond regardless of how the simulation is terminated, either intentional or accidental.	
B	**Analogue Input** (high resolution / optically isolated) - a minimum of 12, 16-bit analogue input channels shall be available on the simulator to facilitate importing analogue signals from external sources. These inputs shall meet the following specifications: usable dynamic range ~ 400:1 (based on 100kHz BW limited signal & 28db SNR) input voltage range +/- 10 Volts	
C	**Digital Input** (optically isolated) - a minimum of 64 optically isolated digital input channels shall be available to allow the connection of multiple external devices to the system. At least 60 of the 64 digital inputs shall be capable of providing a digital input timestamp with an accuracy of 250 nanoseconds or better. 4) GPS synchronization to IRIG-B, 1PPS, or IEEE 1588 time sources. 5) The simulator shall have overall capability for Ethernet protocol-based communications (GOOSE, PMU, DNP3, SV, TCP/UDP, Playback, IEC 104) IEEE C37.118 PMU output, IEC 61850 GOOSE messaging, and TCP/UDP protocols must be included in the scope of supply. **Two protocols must be able to operate simultaneously.** The minimum capability of each protocol is described elsewhere in the document. It shall be possible to locate any and all of the I/O described above up to 75 metres away from the simulator processing elements. The data transfer shall be facilitated via optical fibre connection(s). Remote location of the I/O components is necessary to minimize the distance electrical signals are transmitted to equipment under test which in some cases must be physically removed from the simulator processing elements.	
4.0	**SIMULATION REQUIREMENTS**	
4.1	**Simulator Capacity and Simulation Timestep** The simulator shall be capable of representing, in real time with a digital timestep of less than 20 microseconds, the power system defined in Appendix 1.	
4.2	**Numerical Stability**	

	The simulator shall be capable of simulating the systems shown in Appendix 1 continuously in real time for a minimum duration of twelve (12) hours with a maximum simulation timestep of around 20 microseconds. The operator shall manually apply faults at random times during the test to ensure the numerical stability and continuous operation of the system.	
4.3	**Power Electronic Simulation**	
4.3.1	**Line Commutated Power Electronic Converters** The simulator shall be capable of representing line commutated power electronic converter (i.e. HVDC, SVC, TCSC) with an effective firing accuracy of 1 microseconds or better. The accuracy shall be maintained at all times and regardless of whether the firing pulses are generated internally by a simulated controller or externally by a physical controller. Furthermore it is required that these converters be solved as embedded parts of the main network solution and not as isolated subsystems. This is important to ensure maximum numerical stability and the proper representation of harmonics. These models shall also allow the representation of internal faults.	
4.3.2	**Voltage Source Converter (VSC) Based Power Electronic Schemes**	
4.3.2.1	**VSC Subnetworks** VSC based power electronic schemes typically operate with higher frequency switching, particularly when driven by Pulse Width Modulation (PWM) control. Depending on the power level and application, PWM frequencies typically range from approximately 1 – 10 kHz and the dynamics of these schemes cannot be accurately represented using a timestep in the range of 25-50 microseconds. Therefore the simulator shall have the ability to represent the VSC schemes as special subnetworks that operate with timesteps in the range of 1-4 microseconds. It shall be possible to interface the VSC subnetworks to the main simulation so that the interaction of the VSC with a large scale network can be represented and studied. The VSC subnetworks shall be freely configurable through the simulator's standard graphical user interface and able to include a minimum of 30 nodes and 36 switching devices (an IGBT – Back Diode pair shall count only as one device). In addition to the power electronic components, it shall also be possible to include the following elements in the VSC subnetworks; transformers, transmission lines, cables, permanent magnet synchronous machines, double fed induction machines, breakers, filters, etc. It shall also be possible to interconnect multiple VSC subnetworks via traveling wave transmission line or cable models. Travel times	

	as low as the on VSC subnetwork timestep (i.e. 1-4 microseconds) shall be allowed. The interconnection of subnetworks via traveling wave models will be exploited to expand the network represented with timesteps in the range of 1-4 microseconds.	
4.3.2.2	**Testing of External Controls for 2- and 3-Level Converters** The subnetworks containing the VSC's are required to accurately represent converter behavior with switching for PWM frequencies in the order of <10 kHz for 3-level converters and >40 kHz for 2-level converters. The VSC converter models shall be capable of testing the firing pulse controllers (i.e. averaging models are not acceptable) for 2- and 3-level bridges. Therefore the simulator's analogue output and digital input hardware must be respectively capable to send out and read new values every subnetwork timestep (i.e. in the range of 1-4 microseconds) and the loop delay must be minimized	
5	**SOFTWARE**	
5.1	**Graphical User Interface** All aspects of the simulator operation, from construction of simulation cases, to operation of the simulator, to post analysis of results must be controlled by a single Graphical User Interface (GUI). The GUI shall consist of modules for the following functions: 1) Circuit Construction - a module to allow the construction of simulation circuits. It shall be possible to use predefined modules from a library of components to assemble new simulation cases. It shall be possible to construct the diagram in either three-line or single-line diagram format and it shall be possible to toggle between the two different views of the same circuit. 2) Transmission Line and Cable Constants – a module to calculate the traveling wave and pi-section parameters for transmission lines and cables. It shall be possible to input the physical parameters of transmission lines and cables to calculate the parameters. Alternatively for overhead transmission lines it shall be possible to input positive and zero sequence data for 3 and 6 conductor transmission lines to calculate the parameters. 3) Simulator Operation – a module for operation of the simulator and the retrieval of simulation results. This module shall allow simulation cases to be started and stopped. The operation of the power system (i.e. changing of set-points and breaker operations), fault applications, monitoring of system status (e.g. RMS voltages and currents), and the retrieval of details simulation results (similar to a fault recorder) must be possible without interrupting the simulation (i.e. while it is running). 4) Storing of Results - it shall be possible to save simulation	

	results directly from the GUI in ASCII, jpg, emf (vector format), pdf or COMTRADE format. 5) Post analysis of simulation results	
5.2	**Batch Mode Operation** Software shall be provided to allow the user to program a series of simulations to run automatically (i.e. batch mode). The batch mode software shall be capable of nested looping (e.g. if, for and while) to allow adaptive algorithms to be used during automatic operation. The batch mode software shall also be capable of recording key results in ASCII format and selectively printing or storing simulation results. The batch mode software shall have the ability to embed text and simulation results (in jpg or emf format) directly into Microsoft® Word™ documents. The batch mode software will be used to conduct automated relay testing where many hundreds or thousands of cases may be simulated during a day.	
5.3	**Power System Models** A minimum of the following power system models shall be available for the simulator: - Traveling wave and pi-section multi-phase (max. 18 conductors), coupled transmission line and cable models. It shall be possible to embed breakers in each end of the transmission line models with a maximum of 6 conductors. The nodes introduced by the breakers shall be solved by the transmission line model and shall not count as part of those solved by the main network solution. - A phase domain frequency dependent transmission line model shall be available to represent a minimum of 12 coupled conductors. - Transformers with 2 or 3 windings and autotransformers with an optional tertiary winding. It shall be possible to include saturation with hysteresis, and online tap changers in the models. It shall also be possible to represent the transformers with internal turn-to-turn and winding to ground faults. - Synchronous machines (standard and permanent magnet). The synchronous machine models must be solved as part of the main network and are not allowed to be numerically interfaced to the network solution. The synchronous machine model shall optionally allow the unit transformer and/or stator side breaker to be embedded as part of the model so the transformer secondary nodes or breaker nodes do not reduce the number available in the network	

	solution (i.e. if breaker and/or transformer are embedded to the machine model, no extra nodes need be counted as solved by the network solution). Also, the possibility of initialization of the machine based on the load flow results, as well as entering the machine parameters in both "R & X" and "impedance and time constant" formats, and inclusion/exclusion of magnetic saturation and saliency must be provided. A synchronous machine model must be available that will allow a true stator-ground fault. The machine model must also be solved as part of the main network and is not permitted to be interfaced or decoupled from the network solution. It shall be represented in the network solution as continually varying admittance elements. The model shall also make the field winding available as power system nodes to allow faults to be placed on the field. - Multi-phase synchronous machines. A multi-phase synchronous machine model with access to the neutral point and both ends of the stator windings must be available. Modelling of the machine with any number of phases (up to 12 phases) including ones that are not a multiple of 3, such as 5, 7 or 11 must be possible. Disabling/enabling damper windings must also be available. Multi-phase (3-12) control components (e.g. ABC to DQ transformation) must also be available for use. - Induction machines (squirrel cage and double fed) - DC machines - Voltage sources with definable equivalent impedances, source magnitude, frequency and phase - Passive Resistive, Inductive and Capacitive components (including various filter configurations) - Circuit breakers & fault switches - Bus arrestors - Series capacitors with ZnO arrestors and bypass switches - Thyristor Controlled Series Capacitors (TCSC) with ZnO arrestors and bypass switches - HVDC valve groups for transmission and back-to-back schemes. The HVDC valve groups shall include 6-pulse and 12-pulse configurations. The 12-pulse configurations shall be fed from a 3-winding transformer with an option to include a 4th winding for the freely configurable connection of filters and or reactive power compensation. The valve group models shall support internal valve faults and shall be solved as part of the main network solution. It	

	is not acceptable that the valve groups are numerically decoupled from the network solution or interfaced to the network solution. - Filter bank model to allow multiple banks of up to 12 switchable filters to be added to simulations without reducing the number of switches or nodes available in the main network solution - Static VAR Compensators (SVC) including TCR and TSC branches. The TCR and TSC branches shall be embedded in the network solution as continuously variable conductance elements. - Instrument transformers including current transformers (CT), inductive voltage transformers (PT), and capacitive voltage transformers (CVT) with full support for saturation and hysteresis loop modeling - Voltage Source Converters: STATCOM, UPFC, SSSC, VSC-based HVDC, DFIG wind generation, etc. - COMTRADE and ASCII Playback. It shall be possible to playback COMTRADE, or ASCII, data files as large as 4 GB. The switches representing HVDC, SVC, and TCSC thyristor valves must be embedded in the main network solution and not solved as independent subsystems.	
5.4	**Control System Models** A minimum of the following control system components shall be available for the simulator: • User-Input - Slider, switch, button, dial, etc. • Constants – integer, floating point, PI • Data conversion- deg-rad, rad-deg, int-float, float-int • Math functions – gain, exp, log, ln, ex, xy, sqrt, inverse, abs, sum, multiply, divide, max, min, etc. • Complex math functions – multiply, divide, add, subtract, etc. • Trigonometric functions – sin, arcsin, cos, arcos, tan, arctan, arctan2 • Standard control blocks - deadband, pulse generator, edge detector, time, counter, ramp, ramp limits, limiters, phase-locked loop (PLL), flip-flops, fourier transform, integrator, lead-lag, wash-out, lookup table, non-linear gains, etc. • Logic functions – and, or, nor, bit shift functions, bit -> word, if-then-else, etc. • Meters – real and reactive power, RMS (single- and three-phase), angle difference, frequency • Signal processing – sample & hold, down sampler, moving	

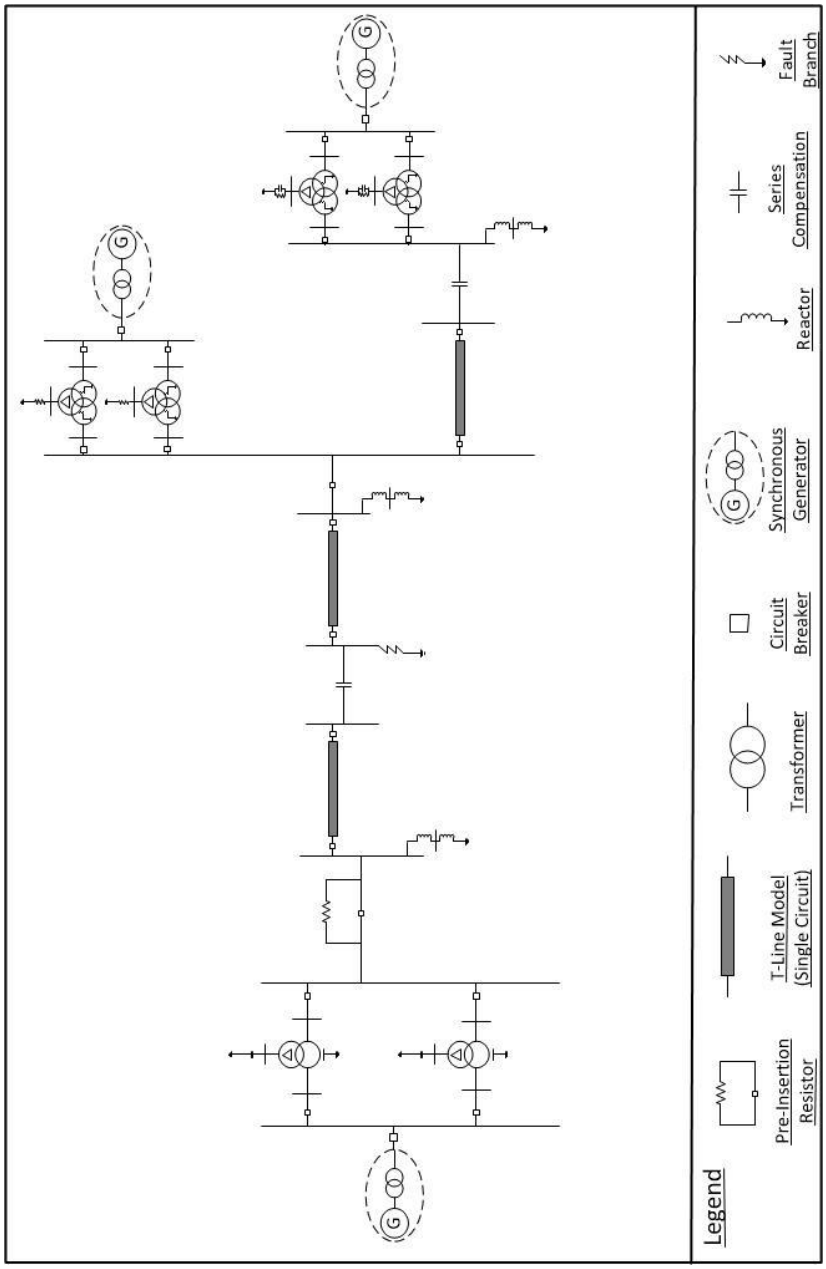
	average, FIR, DFT, ABC-DQ0, DQ0-ABC, ABC-αβ, αβ-ABC, vector rotator, etc. • Generator controls – exciters (IEEE Type 1 to 5, AC1 to 4, ST1 to 3, X1, X2, 2A, SCRX, DC2, IVO, etc.), governors (IEEE Type 1-3, IVO, European BBGOV1, Gas turbine, steam turbine, hydro turbine, etc.), power system stabilizers (PSS2A, IEEEST, IEE2ST) • On-Load Tap Changer control	
A	**Relay models** – as a minimum the following relay models **must be available in the software library (inbuilt)** - line distance protection - differential protection - generator protection - overcurrent protection	
B	**Software Phasor Measurement Unit (PMU) – model (inbuilt)** • The **library of the software must contain both P and M type PMU devices** which shall be represented with selectable reporting rates from 1 – 240 frames per second. **The software PMU must comply with IEEE C37.118.1-2011 (Measurement compliancy).** This will operate in a manner similar to commercial PMU devices. • Further, it should comply with IEEE C37.118.2-2011 synchrophasor **data transfer standard.**	
5.5	**User Defined Models** It shall be possible for the user to create power and control system models for the simulator to run in real time together with standard models provided by the supplier. The facility provided shall allow custom icon graphics and input menus to be created for the new component. Furthermore the facility shall allow high level programming (for example C code) of the real time simulation algorithm and the facility shall include all necessary compilers.	
5.6	**Load Flow Initialization** The software shall include a load flow calculation which can be used to initialize the simulation components before the real time electromagnetic transient simulation is begun.	
5.7	**PSS/E Conversion** It shall be possible for the simulator to import and convert PSS/E data for simulation in real time. Once converted, the PSS/E system must also be available in picture format for modification.	
5.8	**PSCAD Conversion** It shall be possible for the simulator to import and convert PSCAD network data for simulation in real time.	
5.9	**Processor Allocation Details**	

	It shall be possible to view the processor allocation details showing loading of processors or cores with various component used in the simulation case. The allocation chart or table should show control system components and power system component separately.	
5.10	**Testing of Physical PMUs** The software should be equipped with tools or utilities for testing hardware PMUs based on according to the IEEE C37.118-1.2011 and C37.118.1. The tools or utilities shall gather measurements made by the hardware PMU (Total Vector Error, Frequency Error, Rate of Change of Frequency Error, and Rate of Change of Frequency) and compare them to theoretical values.	
5.11	**Software Licensing** The software shall be provided with a site license so that it is possible to install all software included with the simulator supply on any number of desktop or laptop computers. If a site license cannot be provided a minimum of twenty independent licenses shall be provided for all software provided with the simulator.	
6	**COMMUNICATION PROTOCOLS** The simulator can be utilized to model modern Smart Grid and Distributed Generation scenarios and as such must be able to provide high level Ethernet based communication as a minimum via the protocols described below.	
6.1	**Generic Socket Communications** The simulator shall be able to both send and receive generic UDP/TCP packets via an Ethernet based socket connection to external equipment (e.g. computer or controller).	
6.2	**IEC 61850 GOOSE Messaging** The simulator shall be able to both publish and subscribe to IEC 61850 GOOSE formatted messages for binary (e.g. trip and breaker status) and analogue signals. The simulator shall be able to publish and subscribe to GOOSE messages and be able to act as a minimum of 4 separate Intelligent Electronic Devices (IEDs). Each of those IEDs shall be able to publish and subscribe to a minimum of 32 points, either Boolean or floating point, plus quality bitmaps for each point (64 points if quality bitmaps are not required). This totals 256 points for publishing and 256 points for subscribing. The simulator shall also be able to subscribe to **GOOSE messages from a minimum of 16 separate IED's.** It shall further be possible to manipulate the quality bits, "test" bit and "needs commissioning" bit of the GOOSE messages to test the response of the external protection and control devices.	
6.3	**IEC 61850-9-2 Sampled Value Messaging** The simulator shall be capable of providing a minimum of two IEC	

	61850-9-2 sampled value data streams (i.e. two sets of 4 x voltage and 4 x current channels) to protection and control equipment. The sampled values shall be provided at 80 or 256 samples per cycle for a single data stream. It shall be possible to manipulate the quality bits of the sampled value messages to test the response of the external protection and control devices. It shall also be possible to subscribe to a minimum of one IEC 61850-9-2 sampled values data stream at 80 or 256 sample per cycle as input to a simulation.	
6.4	**IEC 61869-9 Sampled Value Messaging** The simulator shall be capable of providing a minimum of one IEC 61869-9 sampled value data streams (with up to 24 channels of voltage or current) to protection and control equipment. The sampled values shall be provided at 80 samples per cycle for a single data stream. It shall be possible to use dedicated FPGA-based hardware to transmit a minimum of sixteen IEC 61869-9 sampled value data streams (with up to 24 channels of voltage or current) simultaneously.	
6.5	**IEEE C37.118 PMU Data Stream Output** The simulator shall be capable of simulating and providing synchrophasor data stream output for a minimum of twenty four (24) Phasor Measurement Units (PMU's) with individually assignable frame-rates of up to 50/60 frames per second.	
6.6	**SCADA Interface** The simulator shall be capable of acting as a slave unit for communication with SCADA equipment using the DNP 3.0 or IEC 60870-5-104 protocol. The system shall communicate with one DNP/ IEC 60870-5-104 master and accommodate the following minimum communication capacity: - Binary simulation status (i.e. breaker position) 1024 (scan rate 1000 Hz) - Binary simulation control (i.e. breaker commands) 512 (scan rate 1000 Hz) - Analogue status (i.e. output from simulator) 500 (scan rate 4 Hz) - Analogue control (i.e. input to simulator) 100 (scan rate 4 Hz)	
7	**INSTALLATION AND TRAINING** The proposal should include on-site installation and one-week training conducted by experienced engineers. The training should encompass all hardware and software modules including third party modules supplied as part of the simulator. If this cost is not included with the supply, please itemize the additional cost or	

	clearly state non-availability of the service and the reason for the same.	
8	**TECHNICAL SUPPORT** The simulator should include unlimited technical support on hardware and software for at least 4 years. The technical support should cover all the software and hardware supplied as part of the simulator irrespective of whether the software or hardware was manufactured by the simulator vendor or purchased from third parties. If this cost is not included with the supply, please itemize the additional cost or clearly state non-availability of the service and the reason for the same. The simulator vendor shall demonstrate their expertise for supporting third party software and hardware, now and in the future.	
9	**SOFTWARE MAINTENANCE AND UPGRADE** The simulator should include unrestricted upgrade (all releases including major and minor releases) and maintenance (patches and fixes) for the lifetime of the simulator. The upgrade and maintenance should cover all the software modules supplied as part of the simulator whether the software module was manufactured by the simulator vendor or purchased from third parties. Please identify third party software/modules and provide details (such as transferable contracts from original manufacturer) to support vendor's ability to offer maintenance, upgrade coverage and guarantee compatibility for the requested period. The Institute shall request contact information of existing client sites to verify the history of satisfactory execution of such extended maintenance on vendor developed and third party products. If this cost is not included with the supply, please state non-availability of the service and the reason for the same.	

Appendix-1



I have also enclosed all relevant documents in support of my claims, (as above) in the following pages.

Signature of Bidder

Name: _____

Designation: _____

Organization Name: _____

Contact No. : _____

ANNEXURE-II

<< Organization Letter Head >>

DECLARATION SHEET

We, _____ hereby certify that all the information and data furnished by our organization with regard to this tender specification are true and complete to the best of our knowledge. I have gone through the specification, conditions and stipulations in details and agree to comply with the requirements and intent of specification.

This is certified that our organization has been authorized (Copy attached) by the OEM to participate in Tender. We further certified that our organization meets all the conditions of eligibility criteria laid down in this tender document. Moreover, OEM has agreed to support on regular basis with technology / product updates and extend support for the warranty.

The prices quoted in the financial bids are subsidized due to academic discount given to IIT Delhi.

We, further specifically certify that our organization has not been Black Listed/De Listed or put to any Holiday by any Institutional Agency/ Govt. Department/ Public Sector Undertaking in the last three years.	NAME & ADDRESS OF THE Vendor/ Manufacturer / Agent
1 Phone	
2 Fax	
3 E-mail	
4 Contact Person Name	
5 Mobile Number	
6 TIN Number	
7 PAN Number	
(In case of on-line payment of Tender Fees) 8 UTR No. (For Tender Fee)	
(In case of on-line payment of EMD) 9 UTR No. (For EMD)	
10 Kindly provide bank details of the bidder in the following format: a) Name of the Bank	
b) Account Number	
c) Kindly attach scanned copy of one Cheque book page to enable us to return the EMD to unsuccessful bidder	

(Signature of the Tenderer)

Name:

Seal of the Company

Annexure-III

List of Govt. Organization/Deptt.

List of Government Organizations for whom the Bidder has undertaken such work during last three years (must be supported with work orders)		
Name of the organization	**Name of Contact Person**	**Contact No.**

Name of application specialist / Service Engineer who have the technical competency to handle and support the quoted product during the warranty period.		
Name of the organization	**Name of Contact Person**	**Contact No.**

Signature of Bidder

Name: _____

Designation: _____

Organization Name: _____

Contact No. : _____

Bid Submission

Online Bid Submission:

The Online bids (complete in all respect) must be uploaded online in **two** Envelops as explained below:-

Envelope – 1 (Following documents to be provided as single PDF file)			
Sl. No.	**Document**	**Content**	**File Types**
1.	Technical Bid	Compliance Sheet as per Annexure - I	.PDF
2.		Organization Declaration Sheet as per Annexure - II	.PDF
3.		List of organizations/ clients where the same products have been supplied (in last two years) along with their contact number(s). (Annexure-III)	.PDF
4.		Technical supporting documents in support of all claims made at Annexure-I (Annexure-IV)	.PDF
Envelope – 2			
Sl. No.	**Document**	**Content**	
1.	Financial Bid	Price bid should be submitted in PDF format.	.PDF

<Department/Centre Name>
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016

Date: XX/XX/XXXX

Subject: Purchase of <Item> (Following format is used for imported items)

S. No.	Currency	Description and Specification of the Item	Qty. in Units	Unit Price (a)	Agency Commission (If applicable) (b)	Discount (c)	Ex-works price (d=a+b-c)	Packing + Handling + DOC + Inland Freight + FCA Charges (e)	FOB/FCA Airport Price (f=d+e)	Insurance + Freight (g)	CIF Price (f+g)
1											

Note: At any circumstances, it is the responsibility of the foreign supplier to hand over the material to our forwarder at the origin airport after completing all the inland clearing. No Ex-works consignment will be entertained.

For indigenous items please quote as per following format.

S. No.	Description and Specification of the Item	Qty. in Units	Unit Price in Rs.	GST%	Total Price in Rs.
1.					
2.					

Note: The above financial template should be strictly followed. Any deviation from the above template (in terms of description and specification of the item) may lead to cancellation of the tender.