

## INVITATION FOR TENDER FOR SUPPLY OF EQUIPMENT

Quotations are invited in separate sealed covers (for Technical and Commercial bids of Items 1 and 2 given below) from eligible suppliers or their direct Indian agents for the supply of the following software items.

### **Software for Development and Validation of Engine Management System for a Plug-in Hybrid Electric Vehicle**

SN.	Equipment
1	<b>Dynamic Real-time Engine Simulation Software in MATLAB Simulink Environment comprising the three subitems</b> <b>A. Real-time Engine Simulation Platform (RESP)</b> <b>B. Experimentally Validated Engine Model (EVEM)</b> <b>C. Calibrated Engine Management System (CEMS)</b>
2	<b>Real-time Engine Management System Software (REMSS) in MATLAB Simulink Environment</b>

Please send offers, ALONG WITH DESCRIPTIVE CATALOGUE/ BROCHURE. The validity of the bid should be at least four months (120 days) or more from the date of the opening of this tender. Please ensure that your quotation reaches not later than **06.07.2018 at 15:00 Hrs** at the following address:

**Prof. Siddhartha Mukhopadhyay**  
**Professor, Department of Electrical Engineering,**  
**Indian Institute of Technology Kharagpur – 721 302, West Bengal, India**

**Table 1**

*Note :*

- A. The detailed technical specifications for the above items are given in Annexures 1, 2 and 3*
- B. Please send offers, along with descriptive documents Manuals/Brochure etc. The validity of the bid should be at least 120 days or more from the date of the opening of this tender. Please ensure that your quotation reaches not later than **06.07.2018 at 15:00 Hrs** at the address given in the table below.*
- C. For Item 1, all parts, namely 1A, 1B, 1C should be quoted for. However, individual price for each part should be mentioned.*
- D. Earnest Money Deposit (EMD) of **Rs. 50,000/- for each item (Item 1 and Item 2)** is to be deposited in the form of Accounts Payee Demand Draft in favour of IIT Kharagpur, payable at Kharagpur, India. Any bid which is not accompanied with an EMD shall be summarily rejected. Earnest money deposited will be forfeited if the tenderer withdraws or amends its tender or impairs or derogates from the tender in any respect within the period of validity of its tender. For unsuccessful bidders the EMD Draft shall be returned within 60 days of awarding of the tender. For the successful bidder it would be adjusted with the final payment after delivery. No interest will be paid on the EMD of the unsuccessful bidders in cases where the EMD Draft is returned.*

Tender Reference	<b>IIT/SRIC/EE/HEV/SM/18-19/EQ-36Dated: 15.06.2018</b>
Price of Tender Document	<b>NIL</b>
Last Date and Time for submitting the tender document	<b>06.07.2018 at 15:00 Hrs (Indian time)</b>
Time and Date of Opening of Technical bids	<b>06.07.2018 at 16:00 Hrs (Indian time)</b>
Place of Opening Tender	<b>Department of Electrical Engineering.</b>
Address of Communication and Tender Submission	<b>Professor Siddhartha Mukhopadhyay, Dept. of Electrical Engg., IITKharagpur – 721 302, West Bengal, India</b>
Contact Telephone Numbers	<b>+91- 3222 - 283066</b>
E-mail	<b>smukh@ee.iitkgp.ac.in</b>

## Annexure 1 :Technical specifications for Item 1A, 1B, 1C

Complete dynamic model of a working engine is to be simulated in real-time using a Hardware-in-loop (HIL) Simulator (HIL Simulator platform including hardware and system software to be provided for validation) using the DRESS. Overall Item 1 involves three components.

- 1A. Real-time Engine Simulation Platform (RESP)
- 1B. Experimentally validated Engine Model (EVEM)
- 1C. Calibrated Engine Management System (CEMS)

**Item 1A :Real-time Engine Simulation Platform (RESP) :** The following are its necessary features.

### *Gasoline Spark Ignition Engine :*

Engine configuration	2 cyl.,3cyl. ,4cyl with 2valves/cyl
Emission norms	BS IV
Fuel	Petrol
Fuel Injection	MPFI
<i>Control System Technological Features</i>	
Torque based Electronic Throttle Control	
Variable Valve Timing and Spark Ignition Angles	
Exhaust Gas Recirculation	
Turbo charging	
Electric water pump	
Electric Thermostat	
Electric power steering	
Alternator	
Thermal management	
Upstream and downstream Lambda monitoring	
Wide band lambda sensor	
Compatible with hybrid powertrain interface	
Variable environments ( $P_{amb}$ , $T_{amb}$ , Humidity)	

### *Components of Dynamic Engine Model:*

Models of following main components should be simulated including all relevant thermal quantities (temperature, pressure, flow rates, thermal energy functions of fuel, air, exhaust, coolant and lubricant streams etc. for each component, as needed), mechanical quantities (torque, speed, force, displacement, acceleration and energy functions etc. of piston, crankshaft including load, friction and brake quantities), Chemical quantities (In-cylinder combustion kinetics, emission, catalytic conversion). Dynamic simulation involving state space or input-output differential equation models is desired. Models may be lumped (0-D). If map-based models are used, these must be mentioned in technical document.

*All physical quantities (including those to be exchanged with REMSS) computed during simulation should be available for display or analysis by external matlab components using a data dashboard unit.*

### *Engine Components*

1. Air system
  - a. Intake Manifold and Intake Runner
  - b. Throttle using ETC

- c. Turbocharger and intercooler with waste gate actuator
- d. Air flow, temperature and pressure Sensors
- 2. Cylinder system
  - a. Instantaneous pressure and temperature dynamics, heat loss
  - b. Valves : to support VVT
  - c. Ignition : Knock modeling with effect of ignition angle
  - d. Oil lubrication
  - e. Piston, Crankshaft and Camshaft dynamics
  - f. Starter relay
- 3. Exhaust system
  - a. Exhaust manifold : Dew Point Temperature, Exhaust Gas Temperature and Pressure
  - b. EGR System
  - c. Catalytic converter (map based) with O<sub>2</sub> heater relay
  - d. Wideband Lambda Sensors upstream and downstream
  - e. Cooling system including coolant flow, fan and relay
  - f. Fuel system including fuel pump with relay and injectors (MPFI)
- 4. Power relay
- 5. Auxiliary Load systems
  - a. Alternator
  - b. Power steering
  - c. Airconditioning, Electric thermostat
  - d. Lights
  - e. Wiper, Electric water pump
  - f. HEV power train transient load during various operating modes
- 6. Should be able to simulate Drive, Regeneration, Charging and Idle modes.
- 7. Appropriate inertia, friction etc. should be considered wherever appropriate.

The simulator will accept the following inputs and compute the following outputs:

**A. *Inputs (from ECU or HIL simulation platform running REMSS):***

- 1. Start of Injection
- 2. Injection Duration and Injection Phasing
- 3. Pedal Command
- 4. Throttle Position Command
- 5. Spark Timing
- 6. Spark Phasing
- 7. Intake Cam Open Command (VVT)
- 8. Engine Speed
- 9. Crank Angle
- 10. Ambient pressure and temperature (User Input)
- 11. Ignition ON/Cranking (User Input)

***Outputs (to ECU or HIL simulation platform running REMSS):***

- 1. Engine Speed Response
- 2. Intake Valve Opening Response
- 3. Intake Manifold pressure
- 4. Intake Manifold temperature
- 5. Accelerator pedal position
- 6. Coolant Temperature

7. Throttle Position
8. Mass Air Flow
9. Crank Position Sensor/Engine RPM
10. Camshaft sensor
11. Ambient Pressure
12. Ambient Temperature
13. O<sub>2</sub>- Sensor Upstream
14. O<sub>2</sub>- Sensor Downstream
15. Ignition Current feedback

The RESP should be able to execute in non-real-time mode (for MIL) on standard Desktops and Laptops running on Windows 10 under the Matlab/Simulink environment. It should also be possible to compile a configured engine model using RESP and compile and load the same in object form using appropriate tools, on to the OPAL-RT HIL Simulator Platform as well as the HP6 board for execution in real-time.

#### **Item 1B :Experimentally Validated Engine Model (EVEM)**

- i. Full set of parameters for a real engine shall be provided to simulate the engine using the RESP of Item 1A above. Documents (technical report/research publications etc.) providing evidence of validation of engine simulation data with experimental data are needed.
- ii. All relevant parameter data for the engine model necessary to simulate and validate all functional specifications of Item 2 should be included. A tool is to be supplied to upload all parameters of the EVEM, in an automated manner, into the RESP, to simulate the engine.

#### **Item 1C :Calibrated Engine Management System (CEMS)**

- i. A fully functional and Calibrated Engine Management System (CEMS), which need not be open source and can be supplied in object code form, calibrated for the above engine of item 1B, which provides satisfactory performance with respect to the above engine model in the sense of typical industry standard performance parameters of commercially available ICE vehicles in terms of fuel economy, emission, torque-speed-efficiency characteristics.
- ii. It should be possible to co-execute the EMS in real-time with the experimentally validated engine model of the real engine using the ESP and the model parameter set running on the HIL simulator.
- iii. The EMS should have all required functional features and be reasonably well calibrated so as to meet the BS-IV performance standards or its equivalent international standard, in closed loop HIL simulation with the EVEM realized on the ESP
- iv. It should be possible to validate and compare all functionality of the REMSS software being acquired under Item 2 of this tender using the CEMS of Item 1C running in closed loop with the engine model realized using the RESP (Item 1A) and EVEM (Item 1B) under various test operating conditions.

## **Annexure 2 : Technical specifications for Item 2**

### **Overall Requirements:**

- a. The software (including all its strategies/algorithms) shall be configurable for various engine model configurations. For example, the software shall be configurable for 2, 3 and 4 cylinder engines.
- b. Accelerator pedal 1 sensor and pedal 2 sensors to be read. Arbitration between pedal 1 and pedal 2 to be made with default value substitution when both pedal 1 and pedal 2 are not working. Pedal value to be communicated to VCU for torque split calculation.
- c. Based on VCU request based on torque split calculation, torque set point is calculated based on :
  - i. Torque request : internal (loads) and external (VCU)
  - ii. Torque losses : friction, pumping, torque limiters
  - iii. Torque fast path and slow path calculations
- d. Based on torque set point and target AFR, Air and Fuel requirements are estimated
- e. Torque based strategies
  - i. Air strategy including ETC/stepper motor control, Waste gate actuator control, EGR valve control, and VVT
  - ii. Fuel strategy including injector control, fuel pulse width and timing
  - iii. Ignition strategy including spark timing control
- f. RMESS should realize the following protection functions
  - i. Engine states definition and transition
  - ii. Engine shutdown based on : i. Engine speed limiter; ii. Coolant temperature; iii. Oil temperature; iv. Oil pressure
  - iii. Engine speed limiter
- g. RMESS should realize the following control functions
  - i. Power latch relay control
  - ii. Starter motor relay control
  - iii. Crank and starter control
  - iv. MAF estimation based on Air density; MAF arbitration in case of MAF sensor error or No MAF configuration
  - v. ETC and Stepper Motor control : Based on torque set point and lambda calculations, ETC and stepper motor position is commanded
  - vi. Waste gate actuator control based on base maps and correction maps
  - vii. Low idle speed calculations and idle speed stability control based on lambda and MAF
  - viii. Fuel pump relay control
  - ix. Fuel injector control : Quantity and start of injection and corrections. Based on fuel quantity, the number of cylinders and firing order, injector phasing is commanded. Should have a phase sensor less strategy for systems where phase sensor is omitted.
  - x. Ignition coil control and spark timing based on base maps and correction maps. To support both wasted and non-wasted mode sparking with interfaces to the control strategies.
  - xi. Cooling fan on/off control
  - xii. Lambda sensor on/off heating control
- h. Outputs to ETAS INCA embedded monitoring tool for real vehicle level tests

- i. Engine speed
  - ii. coolant temperature
  - iii. oil temperature
  - iv. fuel levels
  - v. High engine speed
- i. The software should be implemented fully in Matlab/Simulink2018a or later versions. Code developed under other platforms and interfaced using FMU methods must not be used. The full source code should be open and modifiable by IIT Kharagpur in future without technical or legal hindrances.
- j. It should be possible to compile, link, load the RMESS by tool chains, on the HP6 board developed by TML as well as the OPAL-RT HIL platform for validation by real-time and non-real-time execution in closed loop with the .
- k. It should perform reasonably in performance benchmarking with the RESP and the CEMS to be provided (as discussed under the technical specifications for Item 1B and 1C).

### Detailed functional requirements

No.	EMS Functionalities
<b>Air Management</b>	
1	Estimation of atmospheric pressure
2	Manifold pressure and mass flow sensor signal processing
3	Estimation of air flow
4	Estimation of various gas flows into the intake manifold : purge, EGR, turbocharger
5	Estimation of air flow to cylinder based on measured and corrected inputs with VVT
6	Dynamic correction of inputs for estimating air flow
7	Estimation of cylinder intake air temperature
8	Prediction of the intake manifold state at next inlet stroke. With fuel enrichment at conditions. $\lambda = 1$
9	Prediction of the engine speed at next inlet stroke with acceleration. Enrichment at all conditions. $\lambda = 1$
10	Gas flow estimation from the purge
11	Estimation of total air flow through the throttle
12	Calculation of flow through the EGR valve
13	Stepper or ETC position management based on various engine and vehicle state
14	Management of Stepper or ETC position during : 1. ignition ON; 2. Cranking; 3. power up, power down, relearning; 4. closed loop idle; 5. catalyst warm up; 6. deceleration
15	Stepper or ETC position compensation for idling stability
16	Management of Stepper or ETC position for loads: alternator, power steering and auxiliaries
17	Adaptation of Stepper or ETC position
18	Modelling of the catalyst temperature
19	Torque based control of air strategy
20	Charge motion control valve strategy
21	Secondary Air Injection strategy
<b>Fuel Management</b>	
1	Torque based control of fuel strategy

2	Engine Oil Temperature model based on engine speed, vehicle speed, manifold pressure, throttle position and coolant temperature for improved drag torque estimate, enabling torque loss adaptation and lambda adaptation.
3	Calculation and adaptation of torque based on throttle position
4	Recognition and learning of gearbox ratio and Gear engaged calculation.
5	Tip in/Tip out correction
6	Calculation of vehicle state and their transition during cranking, running, and stall
7	Determination engine state during running, such as idle, normal, full load, overspeed, acceleration, deceleration etc.
8	Identifying the idle state of the engine. Calculation of idling speed for various engine states depending on water temperature, oil temperature, gear engaged, electrical loads, air conditioning, power steering, catalyst heating, canister purge etc.
9	Detection of an anti-flood request
10	Correction related to the ambient air density variations to all the strategies linked to mass or calculated air flow rate of air.
11	Injection cut off and reinstatement management
12	Idle entry and exit management for deceleration fuel cut off
13	Estimation of the torque consumed by air conditioning, cooling fans, alternator, auxiliaries
14	Definition and detection of transient phases
15	Transient fuelling
16	Short term and long term adaptive fuel trimming
17	Estimation of the fuel concentration in the purge
18	Calculation of the fuel flow to be injected
19	Calculation of injector pulse width based on the air flow estimation; Correction based on injector timing profile and fuel tank pressure. Injection phasing in terms of start and end angles.
20	Calculation of fuel enrichment based on engine state
21	Fuelling during cranking, wall wetting
22	VVT strategy for IVO and IVC operations
23	Fuel air ratio correction for anti knock and restart
24	Cylinder pressure management
25	Direct injection strategy
26	Wideband lambda sensor processing and related strategy for controlling Lambda
27	Full lambda map adaptation (not single additive and single multiplicative corrections)
28	Dynamic lambda control with downstream O <sub>2</sub> sensor adapting +P term or switch delay
29	Post injection with ability to inject on an open inlet valve if required
30	Individual cylinder injection correction to improve idle stability with charge differences
31	Heater and dew point control for quicker lambda sensor light up for closed loop lambda control
32	Restart injection control (for repeated starts without engine warming between starts)
33	Engine speed limiting
<b>Ignition Management</b>	
1	Calculation of spark advance in running engine (Levels 1 and 2), torque correction, static efficiency degradation etc., spark advance maximum and minimum limitation
2	Torque based control of ignition strategy



3	Ignition management during transients : Tip-in/out correction of spark advance
4	Air and spark advance loop correction during idling, cranking, purge cycle, cold start for fast catalyst light off, deceleration, elevated inlet/coolant temperature, knocking
5	Air and spark advance loop correction based on load : airconditioning, power steering, cooling fans, alternator, auxiliaries
6	Catalyst heating through ignition timing control
7	EGR advance correction
8	Multi spark control
10	Ignition dwell calculation, closed loop dwell time control, dwell current management
11	Generation of knocking signals for anti knocking strategies
<b>Additional Functionalities</b>	
1	Engine position management: In case of start up and CAM sensor failure, detection of phase for sequential injection.
2	Catalyst health diagnosis
3	Ageing monitor for upstream and downstream lambda sensors
4	Exhaust gas temperature estimation
5	Stepper or ETC motor referencing after ECU reset because of low battery
6	Digital control of other actuators like buzzer, LED etc.
7	Anti theft or immobilizer strategy
<b>Additional functionality for others subsystems</b>	
1	ABS strategy
2	Power steering status capturing and processing
3	Engine Start Stop and Integrated Starter Generator for Torque Assist/Boost
4	Airbags strategy
5	ESP strategy
6	Automatic Climate Control
7	Adaptive Cruise Control
8	Interfaces for other systems like OBD2, VCU, BMS, ABS, MCU, ADAS, Alternator, Fuel system, CAN, AC, Instrument/Data Cluster (to be defined), Accelerator pedals
9	Actuator interfaces : Fuel injector, Stepper/ETC motor driver, Power latch/Cooling fan/fuel pump relays, wastegate, inlet/exhaust/ EGR/purge valves , Ignition coil(to be defined)
<b>Diagnostic Functionality(Monitoring,DTC/Freeze frame/Blink Code/MIL generation, Handling)</b>	
1	All electrical short circuit and open circuit faults, supply voltage faults
2	ECU reset, Coherence of the different memories of the ECU
3	Sensor faults : intake manifold pressure, temperature, flow; throttle position; coolant/air temperature; oil level, temperature, pressure,condition; vehicle speed; cam position; upstream/downstream O2; compressor pressure; crank angle; battery voltage
4	Faults in AC, fuel system, ignition coil, fuel injectors, stepper/ETC motor
5	Misfire detection and limp home strategy
6	Advanced IVHM interface (to be defined)

### **Annexure 3 :Administrative and Commercial Points**

**The following points are in addition to the general terms and conditions listed as Annexure 4.**

**For ALL items**

1. Items 1 and 2 shall be processed independently. Quotes for Item 2 should clearly mention if there is any assumption made regarding development, calibration or validation with respect to the software under Item 1, that it is supposed to use.
2. Bids MUST be submitted in separate sealed covers, for Technical and Commercial offers of Item 1 and Item 2, from eligible suppliers or their direct Indian agents for supply of the above items of software.
3. Quotation will be accepted only from OEM and/or authorized distributors with technical support provider in India. The supplier must have should have sound technical know-how and experience as evidenced from supply of such software, in last three years, to three clients which may be major institutions or major industries in India or abroad. User list and satisfactory letters from three or more such clients should be provided.
4. The technical bid should contain the technical specifications and a report indicating compliance of each of the items quoted for with respect to each item in the specifications as per attached sheet (Annexure 7). Additional documents to explain functionality, design, algorithmic quality, comparative performance assessment etc. be provided for proper assessment. During the phase of Technical Qualification of the bids, including assessment of compatibility of the software with OPAL-RT HIL simulator and TML HP6 Board in terms of being compiled, loaded and executed on these platforms, the bidders may be required to participate in this process for clarifications, demonstrations etc. Free evaluation license for Item 1A, 1B and 1C should be provided during this phase for up to 90 days.
5. Price bid should contain separate price quotes for each item (1A, 1B, 1C and 2) in Table 1. All components of the price (cost, freight, tax etc.) must be mentioned separately.
6. The software are meant to be used for a funded research project (75% by Govt. of India and 25% by industry) under UAY scheme of Govt. of India (scheme guide lines attached as Annexure 6). Price for university usage for academic and research purposes (as opposed to usage for direct commercial product development by a commercial organisation for profit) should be quoted.
7. Warranty, Maintenance and Support period: 3 years from the date of installation, commissioning and acceptance at IIT KGP. This component should be quoted separately.

**For Items 1A, 1B, 1C**

1. Delivery period: Within 30 days from the date of receipt of order/contract.
2. Scope of supply includes delivery at IIT KGP, installation, commissioning and demonstration of functionality of the item(s) and free training to IIT Kharagpur personnel for 5 days. Guest House accommodation shall be provided by IIT Kharagpur for up to two engineers during training.
3. Minimum system configurations for execution on Desktops/Laptops (in real/non-real time MIL/SIL modes) and guarantee of real-time simulation on OPAL-RT HIL platform should be mentioned. The OPAL-RT system configuration is given in Appendix 5.
4. 5 user Network based Licence should be provided for Item 1A, 1B and 1C, each. Licences should be valid for 3 years at least with possibility to renew with upgrade to latest version for another 3 years at special price (to be mentioned), as applicable. However, this renewal price shall not form a commercial basis to award this item of the tender.

5. Acceptance tests are to be demonstrated by real-time simulation on the OPAL-RT HIL platform at IIT Kharagpur after installation. 100% payment shall be made within 30 days of acceptance.

## **For Item 2**

1. Item 2 shall involve custom development of the open source REMSS in the following sequence.
  - (i) The supplier shall provide (i) an SRS document; (ii) a Design document (iii) a Test and Approval plan document (for Design Approval, Unit Level Approval and Integrated System Approval) within 20 days of placement of PO. IIT Kharagpur shall finalise and approve the same within 20 days of receipt with interactions with the supplier. This is called Phase 1 of duration 40 days.
  - (ii) Item 1A, that is the RESP shall be provided to the supplier of Item 2 within 30 days of receipt of the same for REMSS code development using non-realtime MIL simulation on Desktop/Laptop computer. If it cannot be provided, IIT Kharagpur shall provide an alternate HEV modeling tool and a set of model parameters for development of the REMSS within 40 days of placement of order for Item 2. This activity shall continue in parallel with Phase 1.
  - (iii) Supplier shall develop and calibrate the full REMSS including all modules over the next 120 days after clearance of the documents mentioned in point (i) above. Progress should be reported every week in electronic or physical meetings. Modules developed shall be transferred to IIT Kharagpur for study and unit level testing. IIT Kharagpur shall provide unit level approval for each unit within 20 days of receiving the same. This is termed Phase 2 of duration 120 days.
  - (iv) After all units are approved at the unit level, the HILs platform and the RESP configured using the EVEM shall be provided for the integrated validation and calibration of REMSS through real-time simulation (MIL/SIL/PIL/HIL) by the OPAL-RT platform. The supplier shall complete this in 30 days. Local shared AC accommodation shall be provided by IIT Kharagpur during this period for up to two engineers at its Guest House. IIT Kharagpur shall provide Integrated System Approval within 20 days of receiving the Integrated System Validation Report following the Test and Approval plan. This is termed Phase 3 of duration 50 days.
  - (v) The performance of the REMSS benchmark shall be studied, benchmarked against the CEMS to be acquired under Item C and reported by the supplier. This is termed Phase 4 of duration 30 days.
  - (vi) The total product specification, design, development, test, validation and approval process would be completed within 240 days of placement of PO.
  - (vii) The payment schedule shall be as follows.
    - a. 20% within 20 days after completion of Phase 1.
    - b. 25% after 60 days from the start of Phase 2 following the end of Phase 1.
    - c. 25% after completion of Phase 2.
    - d. 20% after completion of Phase 3.
    - e. 10% after completion of Phase 4.
2. Item 2 is to be supplied as fully open source code in the Matlab/Simulink environment. It does not lead to any IPR of the supplier in the form it is supplied. It may be freely modified by both the supplier and IIT Kharagpur subsequent to supply and may be incorporated partly or fully in other software products to be developed by them which may lead to IP rights for both parties in future without any prejudice.

## **Annexure 4 :GENERAL TERMS & CONDITIONS**

PLEASE SPECIFICALLY INDICATE THE FOLLOWING POINTS IN YOUR QUOTATIONS AND COMPLY THE TERMS AS MENTIONED HEREUNDER:-

1. TENDER ARE INVITED COMPLYING THE REQUIREMENT FOR TENDER AS DETAILED IN THE TENDER SPECIFICATION TO BE SUBMITTED IN THE COMPANY'S / FIRM'S LETTERHEAD NEATLY PRINTED / TYPED DULY SIGNED BY AUTHORIZED PERSON WITH THE SEAL OF THE BIDDERS. ALL ENVELOPS CONTAINING THE TENDER SHOULD BE PROPERLY SEALED. SEPARATE ENVELOPS SHOULD BE USED FOR TECHNICAL AND PRICE BID AND INDICATION TO THEIR EFFECT MAY PLEASE BE SUPERSCRIBED ON THE ENVELOP.

### **THE FOLLOWING DOCUMENTS ARE REQUIRED FROM THE INDIAN AGENTS OF FOREIGN FIRMS:**

1.1 FOREIGN PRINCIPAL'S PROFORMA INVOICE INDICATING THE COMMISSION PAYABLE TO THE INDIAN AGENT AND NATURE OF AFTER SALES SERVICE TO BE RENDERED BY THE INDIAN AGENT.

1.2 COPY OF THE AGENCY AGREEMENT WITH THE FOREIGN PRINCIPAL INDICATING THE NATURE OF AFTER SALES SERVICES, PRECISE RELATIONSHIP BETWEEN THEM AND THEIR MUTUAL INTEREST IN THE BUSINESS.

2. TECHNICAL CATALOGUE/LEAFLET SHOULD BE ENCLOSED WITHOUT FAIL. PROVIDE COMPLIANCE STATEMENT WITH RESPECT TO THE TECHNICAL SPECIFICATIONS MENTIONED ABOVE.
3. PLEASE CONFIRM WHETHER YOU ARE AUTHORISED TO QUOTE ON BEHALF OF YOUR PRINCIPALS AND IF SO, PLEASE ENCLOSE A COPY OF SUCH AUTHORISATION WITH YOUR QUOTATION.
4. **PRICE BIDS FOR FOREIGN FIRMS:** PRICES ARE TO BE QUOTED ON 'EX-WORKS' DULY PACKED OR ON "FCA/FOB" INTERNATIONAL PORT" BASIS AND ALSO INCLUDING AGENCY COMMISSION PAYABLE TO YOUR INDIAN AGENTS, IF ANY SHOWING CLEARLY THE FOLLOWING BREAK UP:-

- I) EX-WORKS PRICE
- II) PACKING & FORWARDING
- III) FREIGHT
- IV) ANY OTHER RELEVANT EXPENSES.
- V) TAXES PAYABLE BY THE INSTITUTE

INSURANCE WILL BE PAID BY OUR INSTITUTE SEPARATELY AND SHOULD NOT FORM PART OF THE QUOTED PRICE.

**PRICE BIDS FOR INDIAN FIRMS:** PRICES ARE TO BE QUOTED ON F.O.R., IIT KHARAGPUR, ON DOOR DELIVERY BASIS CLEARLY SHOWING THE BREAK UP.

5. **PERIOD OF VALIDITY:** BIDS SHALL REMAIN VALID FOR ACCEPTANCE FOR A PERIOD OF 120 DAYS FROM THE DATE OF OPENING.
6. INDIAN AGENTS ADDRESS AND PERCENTAGE OF AGENCY COMMISSION INCLUDED IN ABOVE F.O.B./EX-WORKS PRICE. (THIS WILL BE PAID TO THE INDIAN AGENTS IN INDIAN RUPEES ONLY AND NOT IN FE). PLEASE ENCLOSE COPY OF AGENCY AGREEMENT ENTERED

INTO WITH YOUR PRINCIPALS INDICATING THE NATURE OF AFTER SALES SERVICES OF INDIAN AGENTS, PRECISE RELATIONSHIP & MUTUAL INTEREST IN THE BUSINESS.

7. **MEASUREMENTS/WEIGHT:** NETT/GROSS OF THE CONSIGNMENT. IN CASE OF AN ORDER, YOU SHALL USE AIR WORTHY PACKAGE (AS APPLICABLE) DULY CERTIFIED WITH DOCUMENTS – PLYTO – SANITARY CERTIFICATE (AS PER QUARANTINE ORDER 2003).
8. **SCOPE OF SUPPLY:** SHOULD INCLUDE FREE INSTALLATION AND COMMISSIONING
9. **PAYMENT TERMS FOR FOREIGN FIRMS**

**The offer will be made on a single currency and only one PO will be issued for the entire scope of the supply.**

- A) 90% PAYMENT THROUGH SIGHTDRAFT/FORIGN DEMAND DRAFT/LC (EXCEPTIONAL CASES)/SWIFT TELE TRANSFER AFTER RECEIPT OF STORE IN GOOD ORDER AND CONDITION AND 10% AFTER SUCCESSFUL INSTALLATION & COMMISSIONING.
- B) BANK CHARGES ON LC/SD (WITHIN INDIA APPLICANT ACCOUNT AND OUTSIDE INDIA TO BENEFICIARY ACCOUNT).

**PAYMENT TERMS FOR INDIAN FIRMS**

- A) PAYMENT AS MENTIONED IN THE BODY OF THE TENDER (DIFFERENT FOR ITEMS 1A, 1B, 1C AND ITEM 2) THROUGH CROSSED ACCOUNT PAYEE CHEQUE / ELECTRONIC TRANSFER AFTER RECEIPT OF STORE IN GOOD ORDER & CONDITION AND SUCCESSFUL INSTALLATION & COMMISSIONING.
  - B) ENSURE MENTIONING
    - i) BANK DETAILS OF THE BENEFICIARY, GST NO. AND PAN NUMBER
    - ii) FULL NAME AND ADDRESS OF THE BENEFICIARY ON WHOM ORDER HAS TO BE PLACED
10. WHETHER ANY EXPORT LICENCE IS REQUIRED FROM YOUR GOVERNMENT, IF SO, PLEASE CONFIRM WITH DETAILS.
  11. COUNTRY OF ORIGIN OF THE GOODS IS TO BE MENTIONED.
  12. THE INSTITUTE SHALL PROVIDE THE CONCESSIONAL CUSTOMS DUTY AND EXCISE DUTY EXEMPTION CERTIFICATE AS PER GOVT. NOTIFICATION NO. 51/96 CUSTOMS DATED: 23.07.1996 AND CENTRAL EXCISE DUTY EXCEMPTION IN TERMS OF GOVT. NOTOFICATION NO. 10/97 – CENTRAL EXCISE DATED: 01.03.1997 AS AMENDED FROM TIME TO TIME.
  13. **LIQUIDATED DAMAGES:** THE STORES SHOULD BE DELIVERED / DISPATCHED TO DESTINATION AND READY FOR OPERATION NOT LATER THAN THE DELIVERY DATE SPECIFIED. IT THE SUPPLIER FAILS TO DELIVER ANY OR ALL THE STORES OR PERFORM THE SERVICE BY THE SPECIFIED DATE, LIQUIDATED DAMAGES AT 1% PER MONTH OR PART THEREOF IN RESPECT OF THE VALUE OF STORES WILL BE DEDUCTED FROM THE CONTRACT PRICE SUBJECT TO A MAXIMUM OF 5%. ALTERNATIVELY, THE ORDER WILL BE CANCELLED AND THE UNDELIVERED STORES PURCHASED FROM ELSEWHERE AT THE RISK AND EXPENSE OF SUPPLIER.
  14. **PATENT RIGHTS:** THE SUPPLIER SHALL INDEMNIFY THE PURCHASE AGAINST ALL THIRD PARTY CLAIMS OF INFRINGEMENT OF PATENT, TRADEMARK OR INDUSTRIAL DESIGN RIGHTS ARISING FROM USE OF THE GOODS OR ANY PART THEREOF IN INDIA.

15. ONLY THOSE BIDDERS WHO'S BIDS HAVE BEEN TECHNICALLY FOUND ACCEPTABLE WILL ONLY BE INVITED FOR PARTICIPATION IN THE PRICE BID.
16. THOSE BIDDERS WHO DO NOT RECEIVE ANY COMMUNICATION FOR PARTICIPATION IN PRICE BID OPENING MEETING MAY PRESUME THAT THEIR BID HAS NOT BEEN ACCEPTED BY THE INSTITUTE.
17. CONDITIONAL OFFER WILL NOT BE ACCEPTED.
18. LATE TENDERS I.E. TENDER RECEIVED AFTER THE DUE DATE AND TIME OF SUBMISSION AS MENTIONED ABOVE SHALL NOT BE ACCEPTED.
19. BIDDERS TO ENCLOSE THE FOLLOWING DOCUMENTS:-
  - A) INCOME TAX RETURN (3 YRS) AND LATEST SALES TAX RETURN (GST No.), AND PAN NO.
  - B) BANKER'S SOLVENCY CERTIFICATE
  - C) SUMMARY OF AUDITED STATEMENT OF ACCOUNTS FOR THE LAST THREE YEARS TO BE ENCLOSED AND FINANCIAL HIGHLIGHTS AND THE KEY PERFORMANCE DURING THE LAST THREE QUARTERS TO BE ENCLOSED AS PER FORMAT:-

COMPANY'S KEY PERFORMANCE

DESCRIPTION	JAN. TO MARCH	APRIL TO JUNE	JULY TO SEPT.
GROSS REVENUE			
PROFIT BEFORE TAX			
PROFIT AFTER TAX			
RETURN ON INVESTED			
CAPITAL (ROIC)			

- D) CUSTOMER SATISFACTION CERTIFICATE FROM ONE SUCH ORGANIZATION IS TO BE ATTACHED WITH THE TECHNICAL BID AND PRICE BID.
- E) NAME AND ADDRESS OF MINIMUM THREE CLIENTS TO WHOM SUCH EQUIPMENT HAVE BEEN SUPPLIED SHOULD BE MENTIONED.
20. **WARRANTY / GUARANTEE:** THIS COMPREHENSIVE WARRANTY / GUARANTEE SHALL REMAIN VALID FOR **36 MONTHS** AFTER THE GOODS (OR ANY PORTION THEREOF AS THE CASE MAY BE) HAVE BEEN DELIVERED AND COMMISSIONED TO THE FINAL DESTINATION.
21. THE INSTITUTE DOES NOT BIND ITSELF TO OFFER ANY EXPLANATION TO THOSE BIDDERS WHO'S TECHNICAL BID HAS NOT BEEN FOUND ACCEPTABLE BY THE EVALUATION COMMITTEE OF THE INSTITUTE.
22. ALL TENDERS (UNLESS OTHERWISE SPECIFIED) ARE TO BE SUBMITTED / HANDED OVER TO **PROF. SIDDHARTHA MUKHOPADHYAY, PROFESSOR, DEPT. OF ELECTRICAL ENGG., INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR - 721 302** AND ACKNOWLEDGEMENT TO BE OBTAINED.

## **IMPORTANT**

1. IIT Kharagpur authority may accept or reject any or all the bids in part or in full without assigning any reason and does not bind itself to accept the lowest bid. The Institute at its discretion may change the quantity / upgrade the criteria / drop any item or part thereof at any time before placing the Purchase Order.
2. Promptly make arrangements for repair and / or replacement of any damaged item (s) irrespective of settlement of claim.
3. In case of any dispute, the decision of the Institute authority shall be final and binding on the bidders.
4. For any query pertaining to this bid document correspondence may be addressed to **Prof. Siddhartha Mukhopadhyay**), at the address mentioned above.

### **LAST DATE FOR SUBMISSION OF SEALED BIDS: 06.07.2018**

- 1) Please Note that the Institute remains closed during Saturdays & Sundays and all specified government holidays.
  - 2) Fax, e-mail Tender will not be accepted.
  - 3) The General Terms and Conditions as stated above relate to supply of stores / equipment /assets etc. and for specific service other terms and conditions of the Institute will apply.
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