IIT PALAKKAD	भारतीय प्रौद्योगिकी संस्थान पालक्काड **Indian Institute of Technology Palakkad** अहलिआ एकीकृत कैम्पस, कोझ़िपारा Ahalia Integrated Campus, Kozhipara पालक्काड- 678557 Palakkad – 678 557	दूरभाषसंख्या/ Phone no:04923 226300/586 ईमेल/Email: purchase@iitpkd.ac.in

TENDER FOR INVITING QUOTATIONS

TENDER NO: IITPKD/ELE/AA/120/2017 **DATE: 16.02.2018**

DUE DATE OF THE TENDER: 03.03.2018 AT 3.30 PM

Sir,

On Behalf of Indian Institute of Technology Palakkad quotations are invited for "TCAD Software for Teaching and Research" confirming to the specification in the Annexure.

1. **Preparation of Bids**: - The tenders should be submitted **under two-bid system** (i.e.) Technical bid and Financial bid. The technical bid should consist of all technical details along with commercial terms and conditions. **No prices should be included in technical bid.** Financial Bid should indicate item – wise prices for the items mentioned in the technical bid. The technical bid and the Financial should be put **in separate cover** and sealed. Both sealed covers should be put into a bigger cover.

2. The Quotations duly sealed and superscribed on the envelope **with the reference No. and due date, should be addressed to the undersigned so as to reach him on or before the due date stipulated above. Fax and Email quotation are not acceptable.**

3. The price should be quoted per unit and packing and delivery charges should be indicated separately. The offer/bids should be exclusive of Taxes and Duties, which will be paid by the purchaser as applicable. However the percentage and of taxes and duties as on date should be clearly indicated.

4. The Quotations should be valid for **sixty days** from the due date and the period of delivery required should also be clearly indicated.

5. **Local Firms**: Quotations should be for free delivery to this Institute. If Quotations for Ex-Godown delivery charges should be indicated separately.

6. Firms outside Palakkad: Quotations should be for **F.O.R. at IIT Palakkad**. If F.O.R. consignor station, freight charges by passenger train / lorry transport must be indicated. If Ex-Godown, packing, forwarding and freight charges must be indicated.

7. Goods should be supplied carriage paid and insured. Goods shall not be supplied without an official supply order.

8. **Custom Duty:** Custom Duty which will be paid at a concessional rate against duty exemption certificate.

9. **GST** : Concessional **GST@5%** will be paid extra as per **GOI Notification No.47/2017 Dated : 14.11.2017**

10. **Payment:** Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later. **Please indicate actual product cost + Taxes separately**. No advance payment will be made. The Tenderer have to furnish the bank details along with tender like Account No, Account Name, IFSC Code etc.,

11. **Submission of Bids**: Quotation should be sent to the following address "**The Registrar, Indian Institute of Technology Palakkad, Ahalia Integrated Campus, Kozhipara, Palakkad -678 557, Kerala", Phone No: 04923 226 300/ 590/586 , Email : purchase@iitpkd.ac.in**

12. **Delivery and Installation Period: The Item to be supplied and Installation has to be made within 1 week from the date of purchase order.** In case there is any deviation in the delivery schedule, liquidated damages may be enforced or penalty for the delayed supply period may be levied.

13. **Late offer**: The quotation received after due date will not be considered. Please ensure that your offer is sent well in advance to reach the Institute by the due date.

14. **Acceptance and Rejection**: I.I.T Palakkad has the right to accept the whole or any parts of the Tender or portion of the quantity offered or reject it in full without assigning any reason

Yours faithfully,

REGISTRAR, IIT PALAKKAD

Technical Specifications for TCAD Software

Overview : IIT Palakkad requires TCAD software for teaching and research in the area of process and device simulation involving semiconductor materials. Both the process and device simulation software must come from the same software company and must work together in a seamless manner.

Teaching : 2D Process and 2D Device simulation	10 licenses for 3 years
Research : 3D Process and 3D Device simulation	5 licenses for 3 years

Detailed specifications are as below :

Sl. No.	Parameter	Specifications
1.	**Process Simulation**	
A.	Supported Processes	Including but not limited to : (a) Doping diffusion including rapid thermal annealing (RTA) (b) Ion implantation with fast Monte Carlo module (c) Oxidation with stress effects (d) Physical deposition & etching e.g. CVD, PVD, plasma etching, RIE, etc. (e) Chemical Etching (f) Epitaxy (g) Strain/stress engineering (h) Optical lithography (i) Silicidation with Titanium and Cobalt
B.	Materials supported	1. Including but not limited to : (a) Silicon Carbide (SiC), (b) Compound Semiconductors, e.g. GaN, AlGaN, GaAs, AlGaAs, InGaAs, InP etc. Parameters for alloys must be automatically generated based on mole fraction. (c) Silicon, Silicon Germanium (SiGe), (d) Silicides, e.g. WSi. TiSi2, CoSi2. (e) 2D materials, e.g. Graphene, MoS2, WS2, MoSe2, WSe2 etc. (f) Ferroelectric materials (g) Common Schottky and Ohmic contact metals and dielectric/insulating materials used in Semiconductor Nano electronics device technology
		2. Material database should be user-editable . Provision for addition of user-defined material must be provided.
C.	Meshing	Minimum number of mesh points supported shall be one million (for 3D licenses) and 200 k (for 2D licenses). Vendor should provide maximum number of mesh points supported.
D.	Visualization and user interface	(a) Interactive visualization of 3D, 2D structures and distributions as well as 1D cross-sections (b) Run-time extraction of important process parameters

2.	**Device Simulation**	
A.	Device Structure Creation and Meshing	(a) Software must support ***graphical creation*** and modification of 2D and 3D device structure for device simulation. (b) Software must interface with 2D/3D process simulation tool to import structure for combined process-device simulation. (c) Generation or/and optimization of mesh as per or combination of location, device layer/region, physical and device attribute, like interface, doping density, doping type, etc. (d) Minimum number of mesh points supported shall be one million((for 3D licenses) and 200k (for 2D licenses). Vendor should provide maximum number of mesh points supported.
B.	Supported Materials	1. Including but not limited to : (a) Silicon Carbide (SiC), (b) Compound Semiconductors, e.g. GaN, AlGaN, GaAs, AlGaAs, InGaAs, InP etc. Parameters for alloys must be automatically generated based on mole fraction. (c) Silicon, Silicon Germanium (SiGe), (d) Silicides, e.g. WSi. TiSi2, CoSi2. (e) 2D materials, e.g. Graphene, MoS2, WS2, MoSe2, WSe2 etc (f) Ferroelectric materials (g) Common Schottky and Ohmic contact metals and dielectric/insulating materials used in Semiconductor Nano electronics device technology
		2. Material database should be user-editable . Provision for addition of user-defined material must be provided.
C.	Models supported	Including but not limited to : 1. Transport models: drift-diffusion, hydrodynamic, energy balance 2. Quantum effects: Schrodinger-Poisson, Density Gradient, Band to band tunneling, Fowler Nordheim and Direct tunnelling, gate leakage models. 3. Standard material-specific and calibrated models for mobility and recombination (including but not limited to Shockley-Read-Hall, optical, and Auger recombination) 4. Boltzmann and Fermi-Dirac statistics with band gap narrowing. 5. Boundary conditions : (a) Contact definition (Ohmic and Schottky) with provision to define work-function. (b) Floating device terminals with charge boundary condition must be supported. 6. Heterostructure device simulation, including mole fraction-dependent materials. Ability to include polarization charge at

		hetero-interface must be supported. 7. Impact ionization and Hot Carrier Injection 8. Self-heating and heat-sinks : heat generation, heat flow, lattice heating and effects of local temperature. 9. DC, AC and transient simulation. AC analysis must provide support for extraction of frequency, s-, y-, h- and z parameters. Support for trap dynamics must be available. 10. Noise simulation : support for small-signal noise generation and characterization within semiconductor devices.
D.	Advanced capabilities	1. Monte Carlo particle-based transport for Si and SiGe materials. 2. Mixed mode simulation : Ability to simulate circuits comprising of compact model devices in combination with physical devices. The module shall support the simulation of circuit that include upto four physical devices. The vendor should provide maximum number of devices supported. 3. Optoelectronic device simulation : (a) Modeling of light absorption and photogeneration in non-planar semiconductor devices. (b) It should account for arbitrary topologies, internal and external reflections and refractions, polarization dependencies and dispersion. (c) Optical transfer matrix method analysis for coherence effects in layered devices. (d) It should be applicable to a wide array of device technologies including CCDs, solar cells, photodiodes, photoconductors, avalanche photodiodes, MSM photodetectors, phototransistors, and optoelectronic imaging 4. User-defined models : An Interpreter which allows convenient and flexible definition of physical models and material parameters via standard language interface (e.g. C, C++, python etc.). Access to wide range of functions such as doping, composition fraction, defect density of state, temperature and composition dependent band parameters, as well as mobility, recombination and generation models must be available through this interface.
E.	Visualization and User interface	1. Interactive graphical user interface to generate and modify input deck. 2. Versatile visualization tool to support (a) Viewing of Device structure in 1D, 2D and 3D. Provide pan, zoom, views, labels, and multiple plots. Regions, layers, mesh, doping profile, field distributions, etc. must be clearly shown. (b) Importing dataset from third party software and create plots for overlay with simulation results. (c) Data probing at point, cutline and cut-planes

		(d) Mathematical operations to extract device parameters 3. Plotting engine should support all common 1D and 2D data views including: 1D x-y data, 2D contour data, 2D meshed data, smith charts and polar charts. Exports data in many common formats (jvector ps/eps/pdf, jpg png, bmp, SPICE raw file, and CSV) for use in reports or by third party tools.
3.	**Software Compatibility**	
	(a) Software must be compatible with RHEL 7.3. The proposed software should be the latest version which is technically compatible with the technical requirement presented in this document. (b) Multi-Core Processing: To ensure the efficiency, the TCAD package shall be provided with necessary licenses to utilize minimum of four cores.	
4.	**Installation, Training, Support & Updates** (a) The software needs to be installed on at least 15 desktop systems and the High Performance Computing Cluster (RHEL 7.3 based) at IIT Palakkad. (b) At least one day training to be provided. (c) Maintenance support to be provided for the period of the license. (d) Free updates of all software to be provided during period of license.	

Note :

1. **Vendor should be an authorized dealer of Original Equipment Manufacturer (OEM) or an OEM of TCAD software. Appropriate proof of authorization must be provided.**

2. **Compliance Sheet for specification and OEM brochure has to be attached along with Technical bid. Vendor has to fill the compliance sheet and mention page number for each point in the OEM brochure. Unfilled/Partially filled sheets lead to disqualification.**