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Indian Institute of Technology Kanpur
National Centre for Flexible Electronics

Tender Ref. No.	SCDT/FLEXE/2023-2024/02
Name of Tender	Purchase of Silvaco TCAD Omni Bundle
Bid submission start date	02.06.2023 04:00 hrs
Bid submission end date	12.06.2023 17:00 hrs
Bid opening date	13.06.2023 15:00 hrs

Sealed quotations **(Technical and Financial separately)** from prospective vendors are invited by National Centre for Flexible Electronics, IIT Kanpur for the purchase of Silvaco TCAD Omni Bundle with the following technical specification.

I. TECHNICAL SPECIFICATIONS OF THE SOFTWARE

1. Process simulation capability

Sr No.	Item	Description	Vendor's remark
1.1	Semiconductor Fabrication Technologies	This software shall be capable of fast and accurate simulation of all critical fabrication processes used in modern semiconductor technologies including: • RF Devices: HEMT, FET, HBT, FET, BJT, JFET, IGBT, SOI, TFT, Fin-FET etc. • Multiple Gate FETs (MuGFETS): FinFET, FlexFET, Gate-All-Around (GAA) FETs, etc. • IR detector and Sensor devices • Solar cells • Primarily focused on compound semiconductors	

1.2	Processes	It should possess advanced physical models for following processes: • Doping diffusion including rapid thermal annealing (RTA) • Ion implantation • Oxidation with stress effects • Physical etching and deposition, e.g. CVD, PVD, plasma etching, RIE, etc. • Epitaxy and stress formation and strain/stress engineering • Optical lithography These process models shall be capable of • Interactive visualization of 2D structures and distributions as well as 1D cross-sections • Run-time extraction of process parameters • Optimization of process flow and calibration of process models • Easy creation and modification of process flow input decks including automatic control of layout GDS2 mask sequences	
1.3	Process Materials	It should be capable of providing process simulation for variety of materials used in the semiconductor industry like Silicon, III-V, III-N, II-VI, IV-IV but not limited to: • Silicon Carbides (SiC), Compound Semiconductors, e.g. GaN, AlGaN, GaAs, AlGaAs, InGaAs, InP etc. • Silicon, Silicon Germanium (SiGe). • All Schottky and Ohmic contact metals and dielectric/insulating materials used in Semiconductor Nano electronics device technology.	

2. Device simulation Capabilities

Sr No.	Item	Description	Vendor's remark
2.1	Device simulation capability	The device simulation software should be capable of: • Analyzing and characterizing the electrical, optical, and thermal performance of various devices in 2D and 3D. • Fully integrated with process simulation software, comprehensive visualization package and extensive database of examples. • Material parameters and physical models for a wide range of Silicon, III-V, III-N, II-VI, IV-IV like compound semiconductor materials and polymer/organic based technologies. • Compatible with smartSPICE and other device simulators (SPICE)	

3. Modules:

Sr No.	Item	Description	Vendor's remark
3.1	Physics based Models	• It should cater Physics based models like drift-diffusion, energy balance transport equations, surface/bulk mobility, recombination, impact ionization and tunneling models. • The capabilities of all the physical models should be extended to deep submicron devices. • The models should be capable to calculate all measurable electrical parameters which include gate and drain characteristics, sub-threshold leakage, substrate currents, and punch through voltage, breakdown behavior, kink and snapback effects, low temperature and high-temperature operation, RF/AC parameters and intrinsic switching times. • Boltzmann and Fermi-Dirac statistics with band gap narrowing. • Interface to Drift-diffusion and energy balance transport models with advanced mobility models. • Trap dynamics for DC, transient and AC. Models for Shockley-Read-Hall, optical and Auger recombination, impact ionization, band-to-band tunneling, and Ohmic and Schottky contacts. • DC, AC/RF and transient device characteristics can be simulated. • Calculated DC characteristics include threshold voltage, gain, leakage, punch through voltage and breakdown behavior. • Calculated RF characteristics include cut-off frequency, s-, y-, h- and z parameters, maximum available gain, maximum stable gain, maximum frequency of oscillation and stability factor. • Inclusion of Models for graded and abrupt heterojunctions and simulates binary structures such as MESFETS, HEMT's etc. DC, AC/RF and time-domain solutions for general nonplanar homojunction and heterojunction semiconductor device structures. • It should have provision for Monte Carlo simulation • Interface provision that allows user-defined, composition dependent, models and material parameters. • This module should be capable for both 2D and 3D device simulation.	
3.2	Material Library	• It shall cover materials as per para 1.3 • Library of binary, ternary and quaternary semiconductors as well as other important	

		advanced materials along with material parameters. • Built-in materials library that contains parameters for all well-known semiconductor materials.	
3.3	Thermal Effect Simulation	• It should be able to model heat generation, heat flow, lattice heating, heat sinks, and effects of local temperature on physical constant. • It should provide an ideal environment for design and optimization of power devices. • Applications include characterization of device design, thermal failure analysis and heat sink designs. • This module should be capable for both 2D and 3D device simulation.	
3.4	Optoelectronics Device Simulation	• It should be able to model light absorption and photo generation in non-planar semiconductor devices. • It should account for arbitrary topologies, internal and external reflections and refractions, polarization dependencies and dispersion. • Optical transfer matrix method and EM wave method for coherence effects in layered devices. • It should be applicable to a wide array of device technologies including CCDs, solar cells, photodiodes, photoconductors, avalanche photodiodes, Metal-Semiconductor-Metal photodetectors, phototransistors, microlens coupled detector. • This module should be capable for both 2D and 3D device simulation.	
3.5	Circuit simulation	• It should contain physically-based devices in addition to compact analytical models • It should be compatible to small and large signal analysis of RF devices. • It should contain Compact analytical models for high power circuits including variety of devices such as diode, HEMT, bipolar, thyristor, GTO, MOS and IGBT devices. • This module should be capable for both 2D and 3D device simulation.	
3.6	Noise simulation	• It should be capable of analyzing small-signal noise generated within semiconductor devices. • It should be capable of characterizing small-signal noise sources and extract figure of merit for circuit design. • This module shall preferably be capable for noise device simulations	

3.7	Quantum Mechanical effect simulation	• It should provide a set of models for simulation of various effects of quantum confinement and quantum transport of carriers in semiconductor devices • It should allow quantum mechanical calculation of bound state energies and associated carrier wave functions self consistently with electrostatic potential • Should associate with Schrodinger solvers with Non-Equilibrium Green Function (NEGF) Approach in order to model ballistic quantum transport in 2D or cylindrical devices with strong transverse confinement • This module should be capable for both 2D and 3D device simulation.	
3.8	User defined Models & Library elements	• It should have capability of user defined physical models & material parameters via standard language interface (e.g. C, C++, etc.) • It should have capability of user defined functions such as doping, composition fraction, defect, density of state, temperature and composition dependent band parameters, mobility, recombination and generation models at run-time.	

4. Other interactive tools

Sr No.		Description	Vendor's remark
4.1	Run time interactive tool	• It should have numerous simulator specific and general debugger style tools, such as powerful extract statements, GUI based process input, line by line runtime execution and intuitive input syntactical error messages. • Should support .str file format for model generation	
4.2	Graphical display and analysis tool	This tool should have following capabilities: • A powerful tool is required to visualize 1D and 2D/3D structures produced by TCAD simulators. • It should provide visualization and graphic features such as pan, zoom, views, labels, and multiple plot support. • Plotting engine should support all common 1D and 2D/3D data views including: 2D/3D contour data, 2D/3D meshed data, smith charts and polar charts. Exports data in many common formats (jpg, png, bmp, SPICE raw file, and CSV) for use in reports or by third party tools. • The simulation result (xy-type) data generated by the software should be in the format compatible for direct export to spreadsheet like MS excel.	

5. **Other terms and conditions:**

Sr No.	Item	Description	Vendor's remark
5.1	Software compatibility	Software shall preferably be compatible with following workstation/hardware specification • Processor: Dual Intel Xeon E5-2667v4 3.2 2400 8C 1st CPU or Intel i5 / i7 with CPU or equivalent x86 64bit processor • Chipset: Intel H8/Q8 series • RAM: 128GB DDR4-2400 (8x16GB) Reg RAM or 16/32/64 GB or even higher • Hard Disk: 512GB PCIe SSD drive and 3 * 2 TB SATA HDD • Graphics Card: NVIDIA Quadro M 5000 8GB graphic card • OS: Linux - RHEL 7 with subscription (64-bit) or CentOS 7 (64-bit) • Support unlimited cores • TCAD should support .uds file format for model generation link	
5.2	Software license	All modules and sub modules of software should have time based license. Supplier shall provide software up gradation support as and when applicable within the warranty period	
5.3	Software Version	The offered software should be of latest version. The same should clearly be mentioned in detail.	
5.4	Support documents	The offer should be properly supported with relevant technical leaflets, catalogues as well as application notes demonstrating the claims of the quote. Publications by other agency using the offered software may also be indicated/provided.	
5.5	Compliance	Point by point compliance for all RFP specification should be provided with clear indication of compliance/non- compliance unambiguously.	

Terms and Conditions:

1. Evaluation will be done on the basis of technical specifications as per our tender notice.
2. Financial bids will be open only for those, who meets all technical specification.
3. Quotation should carry proper certifications like proprietary certificate, authorization certificate from manufacturer, etc.
4. All prices should be F.O.R IIT-Kanpur, inclusive of 3-yr SW maintenance support.
5. Payment terms will be 100% payment within 30 days from the date of delivery and installation.
6. Validity of quotation should be at least for 60 days.
7. Maximum educational discounts should be applied.
8. The delivery period should be 4 weeks.
9. Delivery must be completed within the period mentioned in tender document from the date of receipt of the order. Penalty @ 1% per week or part thereof subject to a maximum of 10% of

the delivery price will be deducted from the balance payment if supply is not completed within stipulated period.

10. The indenter reserves the right to withhold placement of final order. The right to reject all or any of the quotations and to split up the requirements or relax any or all of the above conditions without assigning any reason is reserved.
11. Incomplete tender or tender not conforming to any or all the above terms and conditions will be rejected.

for

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