भारतीय प्रौद्योगिकी संस्थान खड़गपुर
खड़गपुर - 721 302, भारत
Indian Institute of Technology Kharagpur
Kharagpur - 721302, India

सह-संकायाध्यक्ष
Associate Dean
सीई एंड टी / CE & T

Date: 13-05-2025

To,
Girish N Bhaviyavar
Senior Faculty/DGM
HAL Management Academy (HMA)
Bengaluru, 560037

Dear Sir/Madam,

Sub: Revised Quotation for course on Thermal Design & Management of Electronic Equipment for Defence Applications

In reference to email dated 06/05/2025 sent to Associate Dean (CE&T), IIT Kharagpur and your recent correspondence with Prof. Anandaroop Bhattacharya at IIT Kharagpur, we hereby enclose the course details and revised price quotation for the course on "Thermal Design and Management of Electronic Equipment for Defence Applications" at HAL Management Academy (HMA). The course will be taught by Prof. Anandaroop Bhattacharya of Mechanical Engineering Department.

With regards,

Authorized Signature with Name

& Seal of the Agency/Institution
Prof. Haimanti Banerji
Associate Dean
(CE & T)
IIT Kharagpur 721302

PHONE : +91 3222-282033 / 282111 ***E-mail :*** adeancet@adm.iitkgp.ac.in

Sub: "Thermal Design & Management of Electronic Equipment for Defence Applications" course at HAL Management Academy (HMA)

Duration: 2 days (approx. 12 hours including test and evaluation)

Sl. No.	Item
Day 1	**Fundamentals of Electronic Packages** 1. Electronic packaging – definitions and terminology 2. First Level Packaging a. Chip and chip carrier, lead-frame packages b. Plastic and ceramic packaging c. Peripheral and Area array packages d. Interconnection types and methods (wire bonds, solder joints, TSVs) e. Flip Chip packaging 3. Advanced Packaging and Heterogeneous Integration a. Multi-chip Modules b. 3D Stacked Dies Packages c. System in package (SIP) vs. System on chip (SOC) d. Heterogeneous Integration and Chiplets **Thermal Technologies and Design** 1. Heat Transfer fundamentals 2. Thermal Resistance 3. Cooling technologies – air cooling, liquid cooling, refrigeration, two-phase flows **Heat Sink Design and calculations – focus on avionics systems** **Heat pipes and vapour chambers – theory and calculations**
Day 2	**Thermal Interface Materials** a. Interface resistance b. Types of TIMs c. Measurement and characterisation d. Reliability assessment **Package and board level heat flow paths** a. Understanding heat transfer paths b. Resistance network c. Heat dissipation estimation for at component, board and system level. **Transient Heat transfer** a. Transient heat transfer b. Resistance – Capacitance network c. Heat dissipation estimation for at component, board and system level. **Special Topics** 1. Heat Transfer enhancement techniques at sub-zero and high operational temperatures 2. MIL grade fans 3. Recent advances in cooling techniques **Test and evaluation**

Sl. No.	Item	Amount in INR *(Excluding taxes, GST and duties)*
1.	**Total Price for Program** inclusive of professional fee (honorarium), course material charges, Institute administrative charges and other miscellaneous charges	150,000/- **(Rupees One Lakh and Fifty Thousand only)**

Note: Total Price mentioned above is exclusive of Travelling, Boarding, Lodging, Taxes (including GST) and Duties

PAN Number: AAAJI0323G

GST Number: 19AAAJI0323G1ZM

Applicable GST: 18%

13/5/25

Authorized Signature with Name

& Seal of the Agency/Institution

Prof. Haimanti Banerji
Associate Dean
(CE & T)
IIT Kharagpur 721302

Date: 13/05/2025

Place: Kharagpur, West Bengal