

temperature, vibration, strain, chemical, etc. The unique salient proportions of fabricating the FBG sensors using RRCAT facility are: specialized custom-built sensors, independence from foreign source, and cost-effective solution.

During last few months, the demand for 100 number of customized FBGs has been received from M/s Lab to Market Innovations Private Limited (L2M), Bengaluru for a project pertaining to advanced safety systems of Indian railways. The required specifications of the FBGs are grating length of 5 mm, reflectivity of more than 80%, FWHM between 0.4 to 0.6 nm, Bragg wavelengths of 1534 nm, 1537 nm, 1540 nm, 1543 nm, 1546 nm, 1549 nm, 1554 nm and 1559 nm. These sensors are being used by L2M for appropriate wheel impact load detection (WILD) system, which are attached to the railway track to measure strain caused by the movement of wheels over the sensor zone. The information gathered from these sensors are being used to build systems for estimated load on the axle, axle count and quality of wheel.

Utilization of RRCAT fabricated FBG is an ongoing process and the demands received from ISRO and IITs/NITs are under processing for sensor development and validation.

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N.3: Design and development of 650 MHz, 40 kW solid state RF amplifier and its shipment to Fermilab, USA

As a part of its R&D phase deliverables to Fermilab, USA (FNAL) for use in PIP II (Proton Improvement Plan II), design and development of 40 kW solid state RF amplifier at 650 MHz was taken up at RRCAT under the framework of Indian Institution Fermilab collaboration. Last year, 36 kW/650 MHz, solid state RF amplifier developed at RRCAT was sent to FNAL and after its successful installation, testing and joint acceptance, this new development was carried out with modified design requirements from Fermilab. The 40 kW RF amplifier is modular in design using 64 way combining/dividing architecture using 2 kW RF power amplifying modules as basic RF power units, having four RF amplifier slices of 500 W each on a common cold plate. Various RF components developed and used in this 40 kW amplifier includes; 34 RF power modules, 66 RF directional sensors, 2 sets of 64-port radial dividers and combiners, 2 phase shifters, one two-port high power combiner, 2 high power line sections, and 3 high power directional couplers. All of these RF components were developed indigenously and most of them were mass produced in local industry after their suitable technology transfer as per DAE norms. After rigorous testing of 40 kW RF amplifier, for different RF parameters such as RF power, gain, wall-plug efficiency, linearity, bandwidth, group-delay, pulse characteristics, spectral purity, etc., it was shipped to FNAL in Dec. 2021.



Photographs of the 40 kW, 650 MHz solid state RF amplifier (left) and snapshot of the measured RF power during rugged testing at RRCAT with 50 Ohms RF load (right).

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N.4: Trade Apprenticeship Scheme at RRCAT

RRCAT has initiated a Trade Apprenticeship Scheme at RRCAT (TASAR) under National Apprenticeship Promotion Scheme (NAPS). This scheme is successfully training ITI passed students by providing them access to the modern engineering infrastructure under the guidance of experienced and knowledgeable engineers and technicians. This scheme is helping the organization by providing semi-skilled technical manpower.

Encouraged by success of the program in technical field, apprenticeship in non-technical trade has also been introduced this year with first batch consisting of nine apprentices in stenographer and secretarial assistant trade. Their one year apprenticeship commenced on 1st September 2021 at IRPSU, Administration and Accounts Division.



Apprentice being trained at Accounts Division.

Fourth batch of apprentices in technical trades was also started from 1st October 2021. Although the selection process of the apprentices was completed in March 2020, the training could not be started on scheduled time due to pandemic.

In this batch, 23 apprentices in electronics, electrical, mechanical, civil and construction trades have been inducted. They are now receiving on-the-job training in various Divisions/Sections of RRCAT.



Apprentice carrying out electronic assembly and wiring.



Apprentice performing welding jobs at DMTD.

Hostel facility in RRCAT guest house has been extended to all twelve female apprentices of technical as well as non-technical trades. The male apprentices have been provided shared accommodation in vacant B-type quarters to help them in tiding over extraordinary situations arising due to the COVID-19 pandemic.

Efforts are being made towards providing dormitory accommodation to all TASAR apprentices of upcoming batches by extending RRCAT's existing infrastructure. This will help the apprentices on focusing more on the practical training and will also make TASAR more attractive to the aspirants.

On 11th Nov., 2021, senior officials -Regional Director, Smt. Anita Srivastava, Assistant Director, Ms. Akansha Pandey and Deputy Director, Shri V. Babu from Regional Directorate of Skill Development & Entrepreneurship (RDSDE), Bhopal visited RRCAT and appreciated the progress of TASAR programme and assured to extend all possible help to RRCAT. During the last week of December 2021, All India Trade Test (AITT) -111 in all trades was conducted by Directorate General of Training, Ministry of Skill Development and Entrepreneurship and it was attended by apprentices of previous TASAR batches.

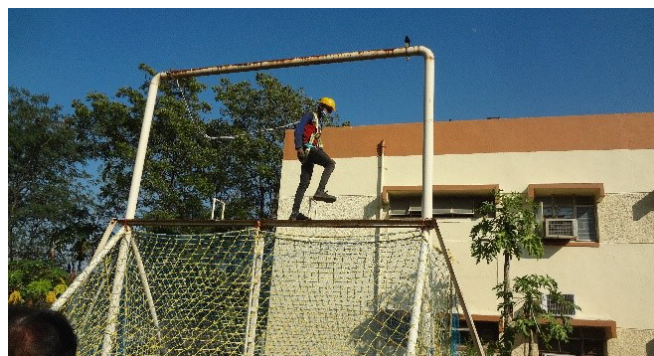
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N.5: Industrial safety in RRCAT

The Fire and Safety Cell, RRCAT is putting all possible efforts to ensure that the safe work environment prevails in the Centre and that everyone at the Centre adheres to safe work. In order to meet the objectives, safety inspections are carried out at various levels along with other mandatory safety measures. The primary goal is to analyze and remove job hazards to avoid potential accidents, while working in any plant or laboratory. It may not be always possible to spot and remove all the unsafe conditions or unsafe practices at once, frequent safety inspections are undertaken to cover an optimum check on unsafe actions and conditions.

At present, internal safety inspection teams for accelerator and laser area both, safety review sub-committees for EAG, PAG, LGB, MSG and TDSG and Apex Safety Committee (ASC) of RRCAT are regularly monitoring and reviewing the safety compliance and implementation of various safety related measures. The internal safety inspection committees for accelerator buildings and laser laboratories are also regularly visiting. Committees observe the industrial safety aspects and give recommendations to improve safety, wherever necessary. These safety inspections are carried out in the presence of Building Safety Officer and Deputy Building Safety Officer of the respective buildings, and the reports are submitted to ASC.

A separate Construction Safety Committee is also working to look into safety concerns at construction sites. The committee ensured that every worker, who was involved at construction site, was trained to use Personal Protective Equipment (PPE), like full body harness, helmet, shoes and gloves, etc. This committee also conducted physical test for the labours, working at height and height passes were issued to the successful candidates.



Physical test for issuing of height passes to construction labour.

All other safety review sub-committees at RRCAT checked the safety issues related to design, modification, operation and maintenance works etc., and gave their recommendations to improve safety features and ensured the compliance for shortcomings, if found. All the recommendations and reports were put up for review and approval of ASC of RRCAT. ASC also reviewed the recommendations of AERB inspection team for the relevant period.