K. K. Wagh Institute of Engineering Education & Research, Nashik

Department of Electronics & Telecommunication Engineering

AY: 2019-20

Industrial Visit Report

Name of Industry Visited:	GMRT (Giant Metrewave Radio Telescope)
Address of Industry Visited:	A/P- Khodad, Tal- Junnar, Dist- Pune, Maharashtra
Date of Industrial Visit:	6th March 2020
Target Participants:	students of SE (Electronics)
Number of Participants:	45 students of BE (Electronics) + 2 staff members
Name of Course for which Industrial Visit Organized:	Analog Communication
Name of Visit Coordinator:	Prof. Puja .P.Patil
Outcome of Industrial Visit:	Students will be able to elaborate structure, operation & applications of GMRT. (This outcome is mapping to PO1, PO2, PO3, PO5, PO6)

About Visited Industry:

NCRA has set up a unique facility for radio astronomical research using the metre wavelengths range of the radio spectrum, known as the Giant Metrewave Radio Telescope (GMRT), it is located at a site about 80 km north of Pune. GMRT is one of the most challenging experimental programmes in basic sciences undertaken by Indian scientists and engineers.

GMRT consists of 30 fully steerable gigantic parabolic dishes of 45 m diameter each spread over distances of upto 25 km. The number and configuration of the dishes was optimized to meet the principal astrophysical objectives which require sensitivity at high angular resolution as well as ability to image radio emission from diffuse extended regions. 14 of the 30 dishes are located more or less randomly in a compact central array in a region of about 1 sq km. The remaining 16 dishes are spread out along the 3 arms of an approximately`Y'-shaped configuration over a much larger region, with the longest interferometric baseline of about 25 km.

The large size of the parabolic dishes implies that GMRT will have over three times the collecting area of the Very Large Array (VLA) in New Mexico, USA which consists of 27 antennas of 25 m diameter and is presently the world's largest aperture synthesis telescope operating at centimetre wavelengths. At 327 MHz, GMRT will be about 8 times more sensitive than VLA because of the larger collecting area, higher efficiency of the antennas and a substantially wider usable bandwidth because of the low level of man-made radio interference in India.

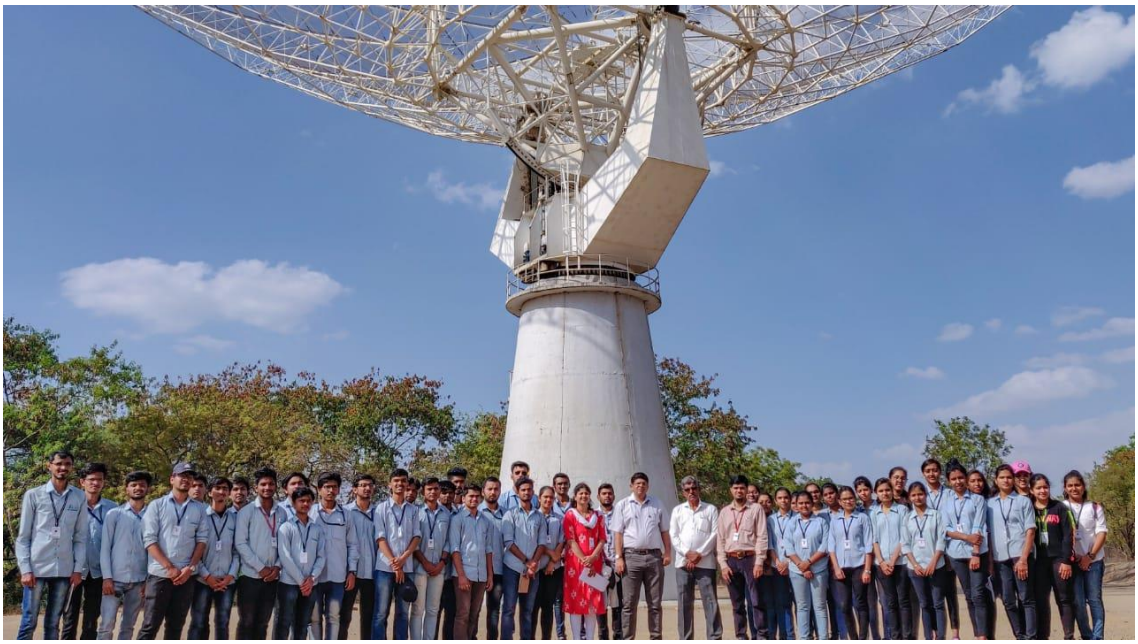
GMRT is an indigenous project. The construction of 30 large dishes at a relatively small cost has been possible due to an important technological breakthrough achieved by Indian Scientists and Engineers in the design of light-weight, low-cost dishes. The design is based on what is being called the **`SMART'** concept - for **S**tretch **M**esh **A**ttached to **R**ope **T**russes.

The dish has been made light-weight and of low solidity by replacing the conventional back-up structure by a series of rope trusses (made of thin stainless steel wire ropes) stretched between 16 parabolic frames made of tubular steel. The wire ropes are tensioned suitably to make a mosaic of plane facets approximating a parabolic surface. A light-weight thin wire mesh (made of 0.55 mm diameter stainless steel wire) with a grid size varying from 10 X 10 mm in the central part of the dish to 20 X 20 mm in the outer parts, stretched over the rope truss facets forms the reflecting surface of the dish. The low-solidity design cuts down the wind forces by a large factor and is particularly suited to Indian conditions where there is no snowfall in the plains. The overall windforces and the resulting torques for a 45-m GMRT dish are similar to those for only a 22-m dish of conventional design, thus resulting in substantial savings in cost.

Apart from the novel low-cost design of the parabolic dishes, the instrument has state-of-the-art electronics systems developed indigenously and consisting of the following main sub units.

- Antenna feeds at 6 different frequency bands between 50 MHz and 1500 MHz, having good polarization characteristics as well as simultaneous multiband operation.
- Low-noise amplifiers, local oscillator synthesizers, mixers, IF amplifiers.
- Optical fibres linking the entire array with the CEB. These are used both for the telemetry signals and local oscillator phase reference communication between the CEB and each antenna base.
- A digital 2,30,000-channel FX-type correlator providing upto 128 spectral channels and covering a maximum bandwidth of 32 MHz

Photos of Industrial Visit:



Prof.Puja.P.Patil
Industrial Visit Coordinator