

## Ten days Faculty Internship Program Report

I, **Babalu kumar** (Asst. Professor, ME Dept., I.E.T. Agra) done my 10 days (**21st May - 30th May 2019**) faculty internship in field of “Composite structure and functionally graded material analysis” under the esteemed supervision of **Prof. Ramji Manoharan** (Mechanical Engineering, IIT Hyderabad). This internship report stresses on the work experience that I have gathered as an Internee.

### **Introduction to CFC's and FGM's**

Carbon fiber reinforced polymers are advanced composite materials used in a wide range of applications, from aerospace to automotive to sports equipment. When bound with plastic polymer resin, carbon fiber creates a composite material that is extremely strong, durable and lightweight. These are just a few reasons why carbon fiber is favored by engineers and designers for manufacturing.

Functionally graded materials are defined as an in-homogeneous material whose physical properties vary throughout the volume, either randomly or strategically, to achieve desired characteristics (or) functionality. FGMs different from traditional composites in that their material properties vary continuously, where as in composites material properties changes at each laminate interface.

On the first day of internship Ramji sir introduce me with P.hD. research Scholars Mr. Naresh and Miss. Isha Paliwal and they explained that the optics lab is involved with application of optical techniques for whole field stress/strain analysis of any structural components. Here we can do Material Characterization, Fundamental fracture studies and Applied Photoelasticity for Composite. Next two days they explain about the Solid mechanics Equipment's, which are given below

1. **TQ STR5 (4 Point Bending stress in beam):** In this experiment Strain gauges and a digital strain bridge measure the strains in the beam by which bending stress is find out.
2. **STR12 (Buckling of struts):** In this experiment Buckling load of a pinned-end strut, The effect of end conditions on the buckling load is find out.
3. **SM1006 (Creep machine):**This machine show the three stages of creep, the effect of temperature on creep, Material failure (fracture) due to creep, Plastic and elastic limits and creep recovery.
4. **SM1008 (Diaphragm):** It shows the change of shape and strains in the surface of a circular diaphragm when it is under eccentric loading. It also teaches the use of strain gauges, Radial and circumferential strains, the cross-section of a diaphragm under pressure.

5. SM 1009 (**strain gauge trainer**): It shows how to measure strain in different ways and compare displayed strain with theoretical strain for different materials and structures. It shows strain in the commonly accepted reading of microstrain ( $\mu\epsilon$ ).
6. SM1090 (**Rotating fatigue machine**): It helps to find fatigue load and no. of cycles to failure. Basic tests on (aluminum specimens only), high cycle fatigue tests (all specimens).
7. SM1011 (**Thick cylinder**): It shows the strains in the walls of a thick-walled cylinder when it is under stress from an internal pressure. The thick cylinder also teaches, Stress and strain distribution in the walls of a thick cylinder, How to predict the stress and strain in a thick cylinder.
8. SM1007 (**Thin cylinder**): It shows the strains in the surface of a thin-walled cylinder when it is under stress from an internal pressure. The thin cylinder also teaches a biaxial stress system, the use of strain gauges, Young's modulus, Poisson's Ratio.
9. **Universal Testing Machine**: Tensile test, Brinell hardness test, Deflection of a coil spring, Deflection of a leaf spring, Deflection of beams.

Next two days I am Visited to the central workshop at ordinance factory and see the working of heavy duty machines like Radial Drilling machine, Universal milling machine, Precision Surface Grinding , High Precision Lathe, CNC Lathe and 5 Axis CNC VMC Machine. In the central workshop I also see the experiment on Wire EDM machine, SIM machine used for Nano structure detection, Pneumatic and hydraulics lab, injection molding machine, TIG and MIG welding Machine, CNC plasma cutting machine, Cylindrical and radial grinding machine and laser cutting machine.

On last day of central workshop, I see how to manufacture 8 layers Carbon Fiber composite plates by vacuum technique, the steps are: first we cut the carbon sheets according to our requirement of plate size, after that clean the platform and apply the wax on the platform surface to avoid the sticking of the plate on surface. Cover the working area with two sided seal tape and mix resin and hardener in same amount according to the requirement of number of layers in plates. Apply carbon fiber sheets layer by layer and apply resin and hardener mixture between them after that apply perforated sheet and then apply breathers and over that we apply apply vacuum bagging film. Here we create vacuum by using catch pot. Left this arrangement for 24 hours and finally we got a CFC's plate.

Next three days Sir give me the basic idea's how we done composite structure analysis by using Abaqas Software. **Abaqus** is a software suite for finite element analysis and computer-aided engineering. It is a software application used for both the modeling and analysis of mechanical components and assemblies and visualizing the FEA results. Prof. Ramji M also suggest me for my Collaborated Research Scheme proposal topic i.e. "Stress analysis of FGM plate under mechanical" for how to make FGM plate by Friction stir Process and cladding process.

I successfully completed 10 days faculty internship program in IITH. I express my sincere thanks to my internship supervisor **Prof. Ramji Manoharan** (Mechanical Engineering, IIT Hyderabad).

For providing me his invaluable guidance, support, supervision and useful suggestions throughout my internship work. A grateful acknowledgement also goes to TEQIP-III for giving me this great opportunity. It has been a great learning opportunity for me as well as my professional and Research carrier. I also express my sincere thanks to the **Director, IET, Agra** for allowing me to use the needed facilities under TEQIP-III for availing this opportunity. I am also thankful to the authority of IIT Hyderabad for providing laboratory, library and computer facility. I would also like to thank to **Mr. Naresh & Miss.Isha Paliwal (PhD Scholars)** for their invaluable suggestions, helpful discussions and never ending support with lab work in a very positive environment.

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