

# A Constituent Institution of Manipal University

## I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING) **END SEMESTER EXAMINATIONS, NOV 2019**

## SUBJECT: AUTOMOTIVE MATERIALS AND STRUCTURES [AAE 5172]

### **REVISED CREDIT SYSTEM** (15/11/2019)

Time: 3 Hours

MAX. MARKS: 50

#### Instructions to Candidates:

✤ Answer ALL the questions.

✤ Missing data may be suitably assumed.

1A.	What are the two general methods of strengthening mechanism for the metals? Briefly explain the yield point elongation phenomenon.	(04)
1B.	Explain the crack growth stages. How the striations are formed on the surface of the fractured surface.	(04)
1C.	With a neat sketch explain the brittle and ductile fracture.	(02)

- 2A. With an example "visor for the helmet", explain the material selection (05) strategies.
- 2B. List the three basic cylinder liners. With a neat sketch explain the process of (05) producing the cast-in cylinder liner.
- 3A. What is the purpose of forming limit diagram? With a strain graph explain the (04) forming limit curve formation.
- 3B. With a stress-strain-temperature graph explain the shape memory effect. (04)
- **3C.** What is the application of forming limit diagram? (02)

- **4A.** With a neat sketch explain the steps involved in the diffusion bonding. **(04)**
- **4B.** With a neat sketch explain the polymer infiltration and pyrolysis (PIP) process **(04)** for the composite manufacturing.
- **4C.** Enumerate the differences between thermoset and thermoplastic resin. (02)
- 5A. Assume that the fibers in a composite lamina are arranged in a hexagonal array (03) as shown in the figure 1. Determine the maximum fiber volume fraction that can be picked in the arrangement.



Figure 1

- **5B.** Determine the in-plane shear modulus  $G_{12}$  of glass/epoxy composite with **(04)** properties  $G_{12f}$ = 28GPa, Gm = 1300MPa, V<sub>f</sub> = 0.6 using the strength of materials approach and the Halpin-Tsai relationship with  $\xi_2$ =1.
- **5C.** For an E-glass polyester sample, the following are the data for the resin **(03)** burnt-off rest

Weight of an empty crucible = 10.1528gm

Weight of crucible + sample before burnt-off = 10.5219gm

Weight of crucible + sample after brunt-off = 10.3221 gm

Calculate the fiber weight fraction, fiber volume fraction and density of the composite sample.

Assume  $\rho_f = 2.5 \ gm/ml$  and  $\rho_m = 1.20 \ gm/ml$