

MANIPAL INSTITUTE OF TECHNOLOGY

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV 2017

SUBJECT: AUTOMOTIVE MATERIALS AND STRUCTURES [AAE 5101]

REVISED CREDIT SYSTEM (16/11/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.
- **1A.** What are Kevlar fibers? How are they produced? Discuss with a relevant **(03)** diagram.
- **1B.** What are the functions of piston rings? Explain centrifugal casting method of **(04)** manufacturing of piston rings.
- 1C. An Al alloy piston is machined to a diameter of 80mm and the temperature during this operation is 293 K. Calculate the increase in area of piston top when the piston reaches 543 K under engine running conditions. Assume a coefficient of linear expansion for Al= 22X10⁻⁶/K.
- **2A.** What is case hardening? Explain any two techniques in use for hardening of **(03)** crank shafts.
- 2B. Find the nominal gas speed past a poppet valve of an engine having 150mm (03) bore and 200mm stroke at 2100 rpm. There are two inlet valves per cylinder having a port diameter of 40mm and a lift of 12mm., which opens 14 degrees earlier to TDC and closes 48 degrees late after BDC. Coefficient of discharge= 0.6. Find the flow rate through each inlet valve.
- 2C. Explain vacuum bagging method of fabricating polymer matrix composites. (04)

3A.	What are the advantages of metal matrix composites? Explain the stages involved in squeeze casting infiltration method for producing aluminum matrix composites.	(03)
3B.	Differentiate between fatigue strength and fatigue limit of materials.	(02)
3C.	List the assumptions made before developing methods by which structural properties of composites are assessed.	(02)
3D.	What is hemming process? Sketch the recommended geometry for outer panel.	(03)
4A.	Derived the equation for longitudinal strength for fiber reinforced composite lamina.	(06)

- **4B.** What is tailored blank process? List its advantages. **(04)**
- 5A. A glass/epoxy specimen weighing 0.98 gram was burnt and the weight of remaining fibers was found to be 0.49 gram. Densities of glass and epoxy are 2.4 gm/ml and 1.20 gm/ml respectively. Determine the density of composite in the absence of voids. If actual density of the composite was measured to be 1.50 gm/ml, what is void fraction?
- **5B.** For the SMA, explain the thermal hysteresis by showing the phase change. **(05)**