Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(TT/APM)OLD/SEM-3/TT-306/2011-12

2011
APPLIED MECHANICS

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) Normalising operation is carried out in

   a) air b) furnace

   c) water d) oil.

   ii) Mild Steel belongs to the which of the following categories ?

   a) Low carbon steel

   b) Medium carbon steel

   c) High carbon steel

   d) Alloy steel.

   iii) The elastic stress-strain behaviour of rubber is

   a) linear b) non-lineaar

   c) plastic d) unpredictable.

   iv) Time dependent recoverable deformation under load is called ..... deformation.

   a) elastic b) inelastic

   c) elastic after-effect d) viscoelastic.

v) Brittle fracture is more dangerous than ductile fracture because

a) No warning sign

b) Crack propagates at very high speeds

c) No need for extra stress during crack propagation

d) All of these.

vi) The point on the cam with maximum pressure angle is known as the

a) cam centre b) pitch point

c) trace point d) prime point.

vii) The ratio number of teeth and pitch circle diameter is called

a) cam centre b) pitch point

c) trace point d) prime point.

viii) The angular velocities of two pulleys connected by crossed belt or open belt, are

a) directly proportional to their diameters

b) inversely proportional to their diameter

c) directly proportional to square of their diameters

d) inversely proportional to square of their diameters.

ix) The speed variations of the engine caused by the fluctuation of engine turning moment are controlled by

a) governor b) shoe brake

c) fly wheel d) fuel injection valve.

x) Considering the safe design, the friction clutch should be designed

a) assuming uniform wear

b) assuming uniform pressure

c) assuming any criteria, either uniform pressure or uniform wear.

d) assuming uniform pressure for high torque and uniform wear for low torque.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain the eutectic and eutectoid reactions in the Fe-C binary phase diagram.
3. Briefly explain the differences between hardness and hardenability.
4. Write the purposes of normalising. Differentiate normalising from full annealing.
5. Explain the phenomenon 'slip' in belt. Discuss its effect on velocity ratio of a belt drive.
6. Define the term 'balancing'. Explain the necessity of balancing of rotating parts for high speed engines.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Write a note on visco-elastic properties of materials, showing schematic plots of variation of stress with strain and strain with time. 6

   b) Draw T-T-T diagram for eutectoid steel and explain the effect of cooling rate on the transformation products and hardness obtained. 9

8. a) Define Creep. Explain the mechanism of creep. Draw a typical 'creep test' curve showing different stages of elongation for a long time high temperature creep test and show how creep rate is determined. 2 + 3 + 5

   b) Enumerate different methods of improving fatigue resistance of materials. 5

9. Draw the profile of a cam operating a knife edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return ?

10. a) Write the applications of a Hooke's joint . With neat sketch, describe the working of a Hooke's joint. 2 + 5

    b) Two 20° involute spur gears mesh externally and give a velocity ratio of 3. Module is 3 mm and the addendum is equal to 1.1 modules. If the pinion rotates at 120 rpm, determine (i) the number of teeth on each wheel to avoid interference (ii) the number of pairs of teeth in contact. 8

11. a) Draw and explain the turning moment diagram for a four-stroke cycle I.C. engine neglecting the effect of inertia of the connecting rod. 6

    b) A flat belt, 8 mm thick and 100 mm wide transmits power between two pulleys, running at 1600 m/min. The mass of the belt is 0.9 kg/m length. The angle of lap in the smaller pulley is 165° and coefficient of friction between the belt and pulley is 0.3. If the maximum permissible stress in the belt is 2 MPa, find (i) maximum power transmitted and (ii) initial tension in the belt. 9

12. Write short notes on any *three* from the following : 3 × 5

    a) Mechanism of brittle fracture in materials

    b) Interference in involute gears

    c) Centrifugal clutch

    d) Classification of Engineering materials.