Roll No ....

ME-114
B.E. (All Branches), I Year I Semester
Examination, December 2015
Choice Based Credit System (CBCS)
Fundamentals of Mechanical Engineering

Time : Three Hours

Maximum Marks : 60

Note : Attempt any five questions. All questions carry equal marks. Assume suitable data if required. Use of steam table is permitted.

1. a) Discuss working principle of arc welding along with details of equipments required and advantages and disadvantages of the process.

   b) What are the major components of a lathe machine? Enlist various machine operations that can be carried out on lathe machine.

2. a) Discuss various types of flames that may be produced in gas welding along with the cases where each one of them will be suitably used.

   b) Compare spark ignition and compression ignition internal combustion engines and discuss merits, demerits and applications of each one of them. Also draw cycles on which each one of them work.

3. a) The following data was recorded during a test run made on a single cylinder, four stroke engine having a compression ratio of 6.

   Bore and stroke = 10 cm and 12.5 cm respectively.

   Dead load and spring balance reading = 60 N and 20 N.

   Effective radius of brake drum = 40 cm

   Fuel consumption = 1.2 kg/hr

   Calorific value of fuel = 42500 kJ/kg

   If the engine turns 2000 rev/min and the indicated mean effective pressure is 0.25 MPa, determine its

   i) Indicated power and brake power

   ii) Mechanical, overall and relative efficiencies

   b) Derive expression for efficiency of Rankine cycle? How this cycle is different form Carnot cycle?

4. a) A compound spring has two close coiled helical steel springs connected in series; each spring has 12 coils at a mean diameter of 2 cm. Find the diameter of the wire in one of the springs if the diameter in the other spring is 0.25 cm and the stiffness of the composite spring is 1 kg/cm. Estimate the greatest load that can be carried by the composite spring and the corresponding extension for a maximum shearing stress of 1800 kg/cm^2. Take modulus of rigidity $N = 0.82 \times 10^6$ kg/cm^2.

b) What are the different types of gears used for power transmission? Draw a simple train of gear and establish relation between speed of driver and follower wheel with number of teeth on each of them.

5. a) Give Kelvin-Planck and Clausius statements of second law of thermodynamics. Justify that violation of Kelvin-Planck statement leads to violation of Clausius statement and vise versa.

b) Differentiate between boiler mountings and accessories. Enlist various mountings and accessories that are used in locomotive boiler and write purpose of each one of them.

6. a) Explain the working principle of Bell Coleman air refrigeration system. Also find coefficient of performance.

b) Draw a stress-strain curve for a ductile material and explain following.

   i) Proportionality limit

   ii) Elastic limit

   iii) Upper and lower yield points

   iv) Plastic deformation

   v) Ultimate limit

   vi) Breaking point stress

   vii) Proof stress

7. a) Explain following phenomenon related to plastic deformation of materials.

   i) Slip

   ii) Twinning

b) Explain the schematic arrangement for carrying out any one of the following tests in detail along with the formulae used for calculations and merits and demerits of test:

   i) Izod impact test

   ii) Rockwell hardness test

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