

# *Energy Systems Engineering*

## **M.TECH ADMISSIONS (Written Test Paper 2002)**

Sample Questions for the test

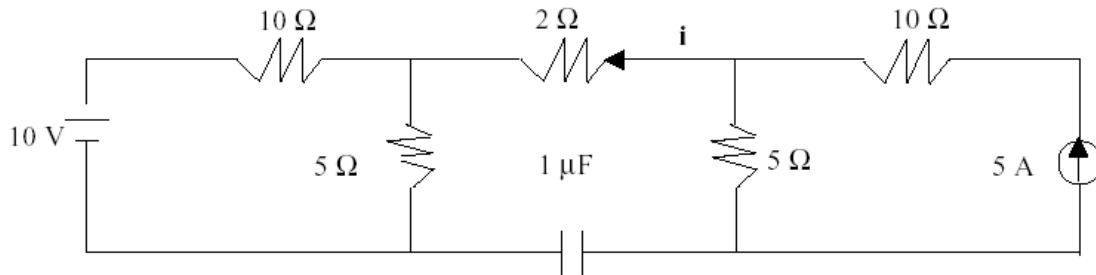
1. Fill in the blanks: [15]

1. \_\_\_\_\_ is the most common material used for photovoltaic solar cell.
2. \_\_\_\_\_ and \_\_\_\_\_ are the units of energy and power in SI system, respectively.
3. Velocity of a fluid at the center of a circular pipe is given as 10 m/s. Velocity at the inside surface of the pipe is \_\_\_\_\_ m/s.
4. In a cantilever beam, maximum stress occurs at the \_\_\_\_\_ of the beam.
5. Power factor of a purely capacitive load is \_\_\_\_\_.
6. Because of \_\_\_\_\_ effect, temperature can be measured in a thermocouple.
7. \_\_\_\_\_ is one of the gases responsible for green house effect.
8. \_\_\_\_\_ is one of the pollutants responsible for depletion of ozone gas in the upper atmosphere.
9. Calorific value of Indian coal with 40% ash is about \_\_\_\_\_.
10. The ratio of kinematic viscosity to dynamic viscosity is \_\_\_\_\_.
11. With increase in air velocity, drying rate of cut onion will \_\_\_\_\_.
12. Some solar water heaters do not require pump for circulating water. Water circulates in such water heaters due to \_\_\_\_\_ principle.
13. Power in wind is directly proportional to the cube of its \_\_\_\_\_.
14. \_\_\_\_\_ can be used as an alternative fuel in diesel engine.
15. \_\_\_\_\_ cycle is the basic thermodynamic cycle used in steam power plant.

2. A resistance R is connected to a current source; the power consumed is 125W. The same resistance is connected to a voltage source whose magnitude is same as the current source.

The power consumed now is 5W. Calculate the magnitude of current source and value of R. [4]

3. In the circuit shown in the following figure, find the current I in the 2Ω resistor. [3]



4. Determine the maximum of the function  $f(x) = \ln x - 3x^2$ . [3]
5. Solve:  $\sin x + 3 \cos x = 2\sqrt{2}$  [4]
6. Sketch the following functions: [2+3]
1.  $y = f(x)$  where  $f(x)$  is described by the differential equation  $f'(x) = \frac{d f(x)}{dx}$
  2.  $y = f(x)$  for  $10 \geq x \geq 0$  where it is given that  $f(x)$  is continuous and has a maximum at  $x=1$ , a minimum at  $x=6$ , and an point of inflection at  $x=3$ . It is also known that  $f(x)$  is differentiable every where except at  $x=8$ .
7. A 10 μF capacitor is charged to 30 V. An uncharged capacitor of 20 μF is then connected in parallel to the charged 10 μF capacitor. Find the steady state voltage across the parallel combination of the capacitors, assuming the capacitors are to be loss less. [3]
8. An inventor claims to have invented a novel heat engine that absorbs 200kJ of heat from a reservoir at 127°C and 300 kJ of heat from a reservoir at 600K. Additionally, this process rejects 350kJ of heat at 27°C and provides a network output. Is this process feasible from the first law of thermodynamics? What is the network output? Is this process is feasible from the second law of thermodynamics? [5]
9. Evaluate the integration  $\int_C xdy - ydx$ , over each of the two paths, (i)  $y = x^2$  and (ii)  $y = 3x-2$ , connecting points A(1,1) and B(2,4) [3]