

## **ME101: BASIC MECHANICAL ENGINEERING**

### **ASSIGNMENT QUESTIONS**

#### **Engineering Materials**

1. What are Cast Irons? Describe common types of cast irons with their composition, properties and applications?
2. Explain Plain Carbon Steels with their composition, properties and application?
3. Draw Stress- Strain diagram for mild steel and explain various points. Differentiate ductile and brittle material on basis of stress- strain diagram.
4. Explain about Ceramics and Polymers.

#### **Casting**

1. What are the casting defects? Explain the causes and remedies for these defects.
2. What are the required properties of moulding sand?
3. Explain casting process with neat sketch.
4. What are the various patterns materials?

#### **Welding**

1. Describe the working principle of arc welding with neat sketch.
2. What are the functions of flux in arc welding?
- 3 What is gas welding? Explain with neat sketch of welding torch and various flames?

#### **Metal Forming**

1. Differentiate wire drawing and tube drawing with neat sketches.
2. Explain hydrostatic extrusion with a neat diagram. State its applications and limitations.
3. What is forging. Explain various forging processes.

#### **Machine Tools 1:**

1. Define the following machining parameters
  - a) Cutting speed
  - b) feed
  - c) feed velocity
  - d) Material Removal Rate
2. Explain the following lathe operations with neat sketches.
  - a) Plain turning
  - b) Facing
  - c) Knurling
  - d) Step Turning

3. A cylindrical stainless-steel rod with length  $L=150$  mm, diameter  $D_0=12$  mm is being reduced in diameter to  $D_f=11$  mm by turning on a lathe. The spindle rotates at  $N=400$  rpm, and the tool is travelling at an axial speed of  $u=200$  mm/min

Calculate:

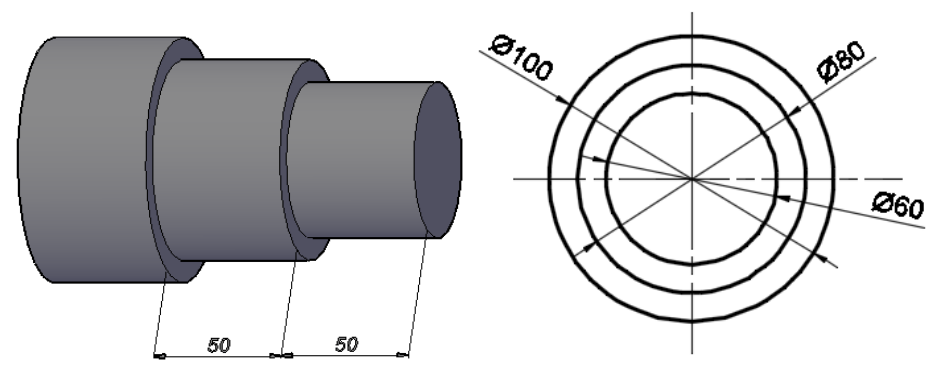
- The cutting speed  $V$  (maximum and minimum)
- The material removal rate MRR
- The cutting time  $t$
- The power required if the unit power is estimated to  $4 \text{ W.s/mm}^3$

4. The part shown below will be turned in two machining steps. In the first step a length of  $(50 + 50) = 100$  mm will be reduced from  $\varnothing 100$  mm to  $\varnothing 80$  mm and in the second step a length of 50 mm will be reduced from  $\varnothing 80$  mm to  $\varnothing 60$  mm. Calculate the required total machining time  $T$  with the following cutting conditions:

Cutting speed  $V=80$  m/min,

Feed is  $f=0.8$  mm/rev,

Depth of cut = 3 mm per pass.

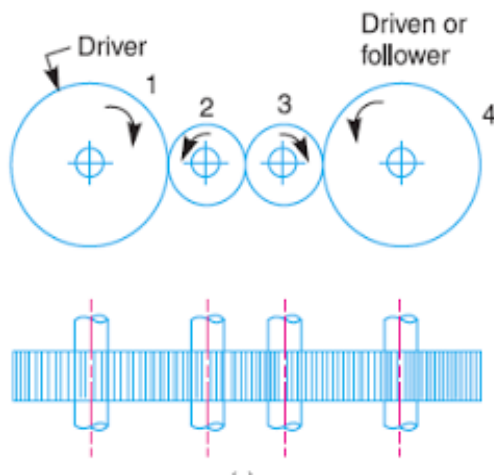


## **Machine Tools 2**

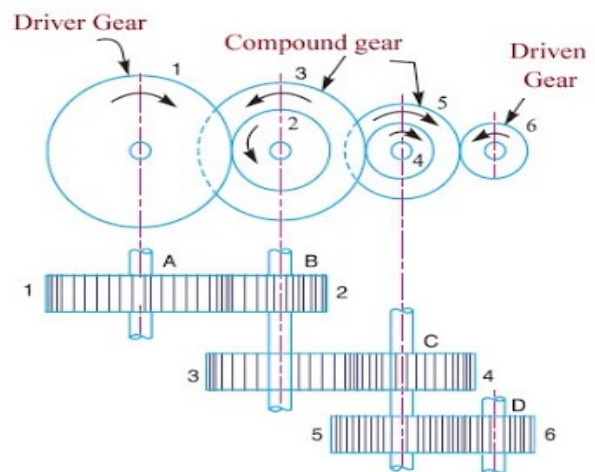
1. What are the differences between shaper and planer?
2. Differentiate up milling and down milling with neat diagrams.
3. Briefly describe the following drilling operations.  
a) Reaming   b) Counter boring   c) Trepanning   c) Tapping
4. Explain the specifications of grinding wheel.
5. Write a short note on 3D printing.
6. What are the advantages of CNC over NC?

## **Power Transmission**

1. Derive the expression for length of belt in a) open belt drive b) crossed belt drive.
2. Classify the gears and explain them with neat sketches.
3. Find the speed ratio ( $N_{\text{driver}}/N_{\text{driven}}$ ) for the following gear trains



Simple Gear Train



Compound Gear Train

## **Fasteners and Bearings:**

1. What are the types of screw fasteners and also state their applications.
2. Describe various types of screw threads with their application.
2. Classify bearings.

### **Thermodynamics:**

1. Explain the various sources of energy mentioning renewable and non- renewable sources.
2. Discuss the concept of thermal equilibrium and state Zeroth law of thermodynamics.
3. Discuss the thermodynamic system, surroundings, and universe. Also discuss various types of systems with suitable examples.
4. State first law of thermodynamics.
5. What are the heat, work and energy interactions for the following processes?  
a) Isothermal process    b) Isobaric process    c) isentropic process    d) isochoric process
6. State Kelvin – Planck and Clausius statements of second law of thermodynamics.
7. Differentiate heat engine, refrigerator and heat pump.
6. What is Carnot' s theorem? Draw Carnot cycle on  $p - v$  and  $T - s$  diagrams and also derive the expression for efficiency.
9. Define the term 'entropy'? Explain Clausius inequality?

### **IC Engines:**

1. Explain the working principle of 4- stroke petrol engine with  $p - v$  diagram.
2. Differentiate CI engine and SI engine.
3. Explain the working principle of 2- stroke engine.
4. Differentiate 4- stroke and 2- stroke engine.

### **Refrigeration:**

1. Explain working of Vapour Compression Refrigeration system with schematic and  $T - s$  diagrams.
2. What are the desirable properties of Refrigerants?
3. Define ton of refrigeration?
4. In a standard vapour compression refrigeration cycle, operating between an evaporator temperature of  $-10^{\circ}\text{C}$  and a compressor temperature of  $40^{\circ}\text{C}$ , the enthalpy of the refrigerant, Freon- 12 at the end of compression is 220 kJ/kg. Show the cycle on  $T - s$  diagram.

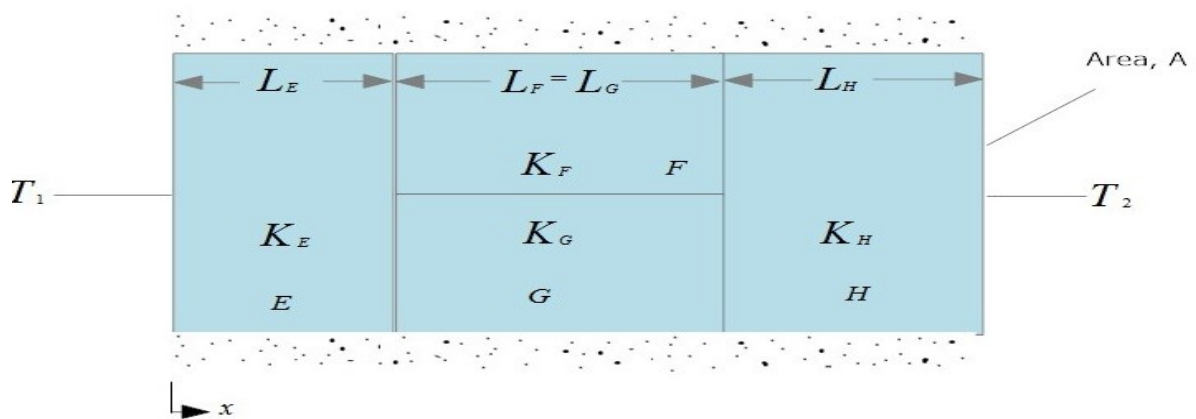
Calculate:

- i) The C.O.P of cycle.
- ii) The refrigerating capacity and the compressor power assuming a refrigerant flow rate of 1 kg/min. you may use the extract of Freon -12 property table given below:

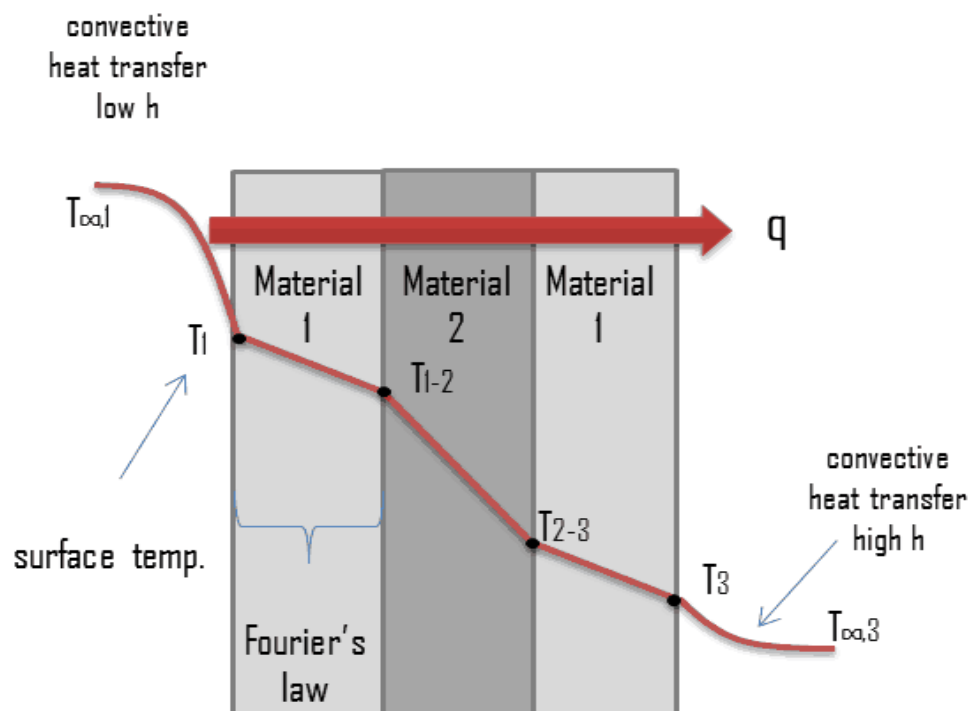
T ( $^{\circ}\text{C}$ )	P (MPa)	$h_f$ (kJ/kg)	$h_g$ (kJ/kg)
-10	0.2191	26.85	183.1
40	0.9607	74.53	203.1

### Heat Transfer:

1. Explain the following laws of heat transfer.
  - a) Fourier's law of conduction
  - b) Newtons law of cooling
  - c) Stefan Boltzmann's law
2. Find the total thermal resistance for the following system.

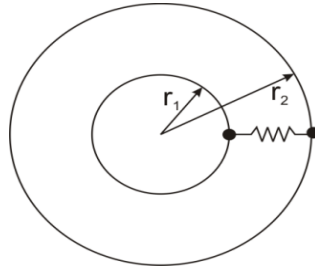


3. What is overall heat transfer coefficient? Find overall heat transfer coefficient for the following system.



4. Derive an expression for heat transfer through a cylinder. Consider only radial heat transfer.

$r_1$  – inside radius of cylinder,  $r_2$  – outside radius of cylinder,  $L$  – length of cylinder,  $k$  – thermal conductivity of cylinder material.



**Automobile Engineering:**

1. Explain various parts of an automobile chassis with a neat diagram.

2. Explain the functions of following elements of an automobile.

a) Clutch

b) Differential

c) Propeller shaft

d) Gear box