Attempt any three questions
Q1. Differentiate Heat Engine, Refrigerator & Heat Pump?
Q2. Derive the formula for C.O.P. of Bell Coleman Cycle?
Q3. Explain Simple Vapour Compression Cycle with the help of T-s & p-h diagram?
Q4. Define C.O.P. & Tonne Refrigeration?
Attempt any Two questions

Q1. Write down important properties of the refrigerants. Write down chemical formula and names of Refrigerants 717 and R-134a?

Q2. Explain the working and Principle of Electrolux Refrigerator (3 fluid system) with the help of neat sketch?

Q3. Name various expansion devices in vapour compression refrigeration system and explain thermostatic expansion valve with the help of neat sketch?
Year - 3rd  I-Class Test
Subject code → ME-302 (Processes in Manufacturing)
Time - 1 hr  Date - 14-11-17

Q.1. Define following press forming operations with diagram:
   a) Stamping    b) Trimming    c) Coining  (6)

Q.2. Define rolling process of metal forming with diagram.
   Draw diagrams of two rolling mills.  (5)

Q.3. Define forging process. Explain open and close die forging with diagram.  (4)
Q.1 Define leadership and explain qualities of good leadership. (5)

Q.2 Define following terms and write down their functions and duties.
   A) HRD
   B) Purchasing (10)
I Test

ME 303

Sub: Thermal Engineering & Heat Transfer

Time: 1 hr

MM: 15

Note: - (1) Attempt all questions
(2) All questions carry equal marks.

Q. 1. Explain Ejector type of jet condenser with neat diagram.

or

Explain Barometric condenser with neat diagram.

Q. 2. Explain Downflow, two pass, surface condenser with neat diagram.

or

Explain Evaporative type of jet condenser with neat diagram.

Q. 3. Write the formula & S.I unit of the following physical quantities
(a) P (b) U (c) H (d) S (e) Q
0.1 Derive the exit velocity from the nozzle
\[ C_2 = 114.72 \sqrt{\Delta h} \]

0.2 Explain the velocity diagram of impulse turbine. Write the notations also.

0.3 Write the formula and S.I. unit of the following physical quantities:

(a) \( P \) (b) \( \mu \) (c) \( H \) (d) \( Q \) (e) \( K \)
1. Write advantage and disadvantage of CNC machines over conventional machines.
2. Give axis identification for CNC Lathe machine. OR Write short notes on Basic components of NC machine.
3. Write the meaning of any 10 Codes from following: G33, G40, G70, G71, G92, G94, M02, M04, M06, M08, M09, M10

1. Discuss the advantages of employing CNC machines over manual machines.
2. With the help of suitable figure, explain Absolute and Incremental dimensioning with reference to CNC machines.
3. What is a part programme? Discuss the steps in writing a part programme.
Q.1 Explain the following: (i) Breeder Reactor (ii) Pulverized fuel firing (iii) Principle of fluidized bed combustion (iv) Nuclear fission reaction (v) Stages in coal handling. (5)

Q.2 Sketch the layout of thermal power plant & explain all its circuit in brief. Classify & explain any one ash handling method. (5)

Q.3 Sketch & explain pressurized heavy water reactor. What is the use of heavy water in this reactor. List factors for site selection of Nuclear Plant. (5)
Q.1 Explain the following: (i) Pondage (ii) Nursery Station (iii) Micro-hydel Plant (iv) Penstock (v) Spillway (5)

Q.2 Sketch the layout of a hydroelectric power plant and explain its various elements. (5)

Q.3 Explain the flywheel energy storage system with sketch. (3)

Q.4 Sketch with proper label the layout of:
   a) Regenerative gas turbine with inter-cooling and reheat, or
   b) A diesel electric plant. (2)
1. Write different phases of Production Planning and Control.

2. A computer company sales a computer model at Rs. 40000 per piece. If the fixed cost is Rs. 1000000 and cost pr piece is Rs. 25000 determine the breakeven point and number of computers to sale for earning profit of Rs. 250000.

3. The actual sales of a company are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>45000</td>
<td>56000</td>
<td>78000</td>
<td>46000</td>
<td>75000</td>
</tr>
</tbody>
</table>

Determine sales for next three year for next three years.
Test

Sale SP = £40000 / piece
FC = £100000
CP = £25000 / pc

Let quantity to be produced = \( n \)

So \( n \times SP = FC + n \times CP \)

\[
\begin{align*}
\Rightarrow \quad n &= \frac{FC}{SP - CP} = \frac{100000}{40000 - 25000} \\
&= 66.67 \approx 67
\end{align*}
\]

Break even quantity = 67 pieces.

For profit of £250000

\[
\begin{align*}
\text{Profit} &= 9 \times SP - (FC + 2 \times CP) \\
250000 &= 2 \times 792000 - (100000 + 2 \times 25000) \\
250000 &= 2 \times (40000 - 25000) - 100000 \\
\Rightarrow \quad 9 &= \frac{250000}{15000} = 16.67 \approx 17
\end{align*}
\]

\[\text{Q.2} \]

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Sl. No.} & \text{Year} & \text{Units} & \text{Sales} & \text{A} \times \text{B} \\
\hline
1 & 2012 & 4 & 45000 & 112000 \\
2 & 2013 & 5 & 56000 & 234000 \\
3 & 2014 & 7 & 78000 & 147000 \\
4 & 2015 & 4 & 46000 & 184000 \\
5 & 2016 & 7 & 79200 & 375000 \\
\hline
\end{array}
\]

\[
\begin{align*}
\Sigma X &= 15 \\
\Sigma Y &= 189600 \\
\Sigma X \times Y &= 250000 \\
\Sigma X^2 &= 620000 \\
\Sigma Y^2 &= 950000 \\
\end{align*}
\]

\[
\begin{align*}
Y &= A \times X + B \\
\Sigma Y &= A \times \Sigma X + B \times \Sigma X \\
189600 &= A \times 15 + 58 \\
250000 &= A \times 189600 + B \times 15 \\
\end{align*}
\]

\[
\begin{align*}
A &= \frac{1847420}{189600} \approx 37.926 \\
B &= -53760
\end{align*}
\]

For 2017 \( x = 6 \) \( y = 37.926 \times 6 + 53760 = 173760 \)
II Test ME307 Session 2017-18

Time: 1 Hour
Max Marks: 15

Note: Attempt any three questions:

1. Following table shows the operation time in working days for different activities. Draw network diagram and determine critical path and slack for various activities.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Particulars</th>
<th>Time in days</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Machine Foundation</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>Electric Fitting</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>Repair of Floor</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>Installations of Machine</td>
<td>12</td>
</tr>
<tr>
<td>E</td>
<td>Procure workshop Building</td>
<td>15</td>
</tr>
<tr>
<td>F</td>
<td>White Wash</td>
<td>5</td>
</tr>
<tr>
<td>G</td>
<td>Clean up</td>
<td>2</td>
</tr>
</tbody>
</table>

2. An industrial plant with initial value of Rs. 2000000 and the salvage value of Rs. 200000 at the end of 20 years. Determine depreciation by sinking fund method at 8% compound annually.

3. Describe factors that affect in deciding plant location.

4. Write short note on:
   a. ABC analysis
   b. Travel Chart
The diagram represents the sequence of operations.

**Q. 2**

\[ D = \frac{R(C - S)}{(1 + R)^N - 1} \]

- \( R = 0.08 \)
- \( C = 200000000 \)
- \( S = 200000 \)
- \( N = 20 \) years

\[ = \frac{0.8 \cdot (200000000 - 200000)}{(1 + 0.08)^{20} - 1} \]

\[ = \frac{144000000}{3.6669} = 39334.59 \]

\( \approx 39335 \)
Q1. Explain factor of safety. What is the stress concentration? How it is relieved?

Q2. Design a cotter joint to connect two mild steel rods for a load of 28 kN. Allowable stress are 50 MPa in tension, 35 MPa in shear and 90 MPa in crushing.

OR

Two mild steel rods are joined by a knuckle joint to transmit 70 kN tensile load. Design the joint use following working stresses. Tensile stress for mild steel rod and pin = 70 MPa Shear stress for rod and pin = 60 MPa Crushing stress for rod and pin = 150 MPa
**SOLUTION**

1. Rods: \( P = \frac{A}{h} d^2 \sigma \)
   
   \[ 2800 = \frac{50}{4} d^2 \sigma \]
   
   \[ d = 26.7 \text{ mm} \quad d = 28 \text{ mm} \]

2. Crushing of collar: \( P = d_k \sigma_c \)
   
   \[ 2800 = d_k \sigma_c \]
   
   \[ d_k = 31.11 \text{ mm} \]

3. Tensile failure of spigot:
   \[ P = \frac{\pi}{4} (d_1^2 - d_k^2) \sigma_c \]
   
   \[ 2800 = \frac{\pi}{4} (d_1^2 - 31.11^2) \]
   
   \[ d_1 = 32 \text{ mm} \]
   
   \[ l = 9.72 \text{ mm} \]

4. Shear of collar: \( P = 2 b d_k \)
   
   \[ b = 41.15 \text{ mm} \quad b = 42 \text{ mm} \]

5. Tensile failure of socket:
   \[ P = \left[ \frac{\pi}{4} (d_2^2 - d_k^2) - (d_2 - d_1) \right] \sigma_c \]
   
   \[ 2800 = \left[ \frac{\pi}{4} (d_1^2 - 32^2) - (d_1 - 32) \right] \sigma_c \]

6. Shearing of spigot: \( P = 2 d_1 a \)
   
   \[ a = 12.5 \text{ mm} \]

7. Crushing of socket collar:
   \[ P = (d_4 - d_1) \sigma_c \]
   
   \[ 2800 = (d_4 - 32) \times 9.72 \times 90 \]

8. Shearing of socket collar:
   \[ P = 2 (d_4 - d_1) c \]
   
   \[ c = 12.5 \text{ mm} \]

9. Crushing of spigot collar:
   \[ P = \frac{\pi}{4} (d_3^2 - d_k^2) \sigma_c \]
   
   \[ 2800 = \frac{\pi}{4} (d_3^2 - 32^2) \]
   
   \[ d_3 = 38 \text{ mm} \]
1. Shear of spigot collar  \( P = \pi d^2 t_2 t \)

2. $88 = \pi \cdot 32 \times 1\,\text{s} \quad t_{1} = 7.9\,\text{mm} = 8\,\text{mm (say)}$

1. Length of collar  \( L = 4d = 4 \times 28 = 112\,\text{mm} \)
   \( \text{taper} 1:30 \)

**KNUCKLE JOINT**

1. **Failure of rod in tension**  \( P = \frac{\pi}{4} d^2 \alpha \)
   \[ d = 35.68\,\text{mm} \quad d = 36\,\text{mm} \]

2. **Design of knuckle pin**
   - **Shear failure**  \( P = 2 \frac{\pi}{4} d^2 \alpha t \)
   - \( 7000\,\text{N} = 2 \frac{\pi}{4} d_1^2 \times 60 \)
   \[ d_1 = 27.25\,\text{mm} \]
   
   Let  \( d_1 = d = 36\,\text{mm} \)

   max Bonding moment  \( M \)  \( \text{pin} \)

   \[ M = \frac{P}{2} \left( \frac{1}{t_2} + \frac{1}{t} \right) = \frac{70000}{2} \left[ \frac{45}{4} + \frac{27}{3} \right] = 708750\,\text{N mm} \]

   \[ M = 682 \]

   \[ 708750 = 68 \frac{32}{32} (36)^3 \]

   \[ 68 = 154.73 \quad \text{N/mm}^2 \]

   Bending stress induced in pin is greater than the permissible value. We have to increase size of pin.

   Let  \( d_1 = 48\,\text{mm} \)

   \[ M = 682 \quad 708750 = 68 \frac{32}{32} (48)^3 \]

   \[ 68 = 65.3 \quad \text{N/mm}^2 \]
3. Design of Single eye end

OD = 72 mm
ID = 48 mm
t = 45 mm

Check shear stress induced in single eye end

\[ \sigma = \frac{P \cdot 2t \cdot D}{2\pi \cdot t^2} \]

\[ 70000 = \frac{(72-48)45 \cdot 45}{2\pi \cdot 45^2} \]

\[ \sigma = 57.61 \text{ N/mm}^2 \text{ (safe)} \]

Similarly, check tensile and compressive stress in single eye end

\[ \sigma = \frac{P \cdot 2t \cdot D}{2\pi \cdot t^2} \]

\[ 70000 = \frac{(75-48)45 \cdot 45 \cdot 6}{2\pi \cdot 45^2} \]

\[ \sigma = 57.61 \text{ N/mm}^2 \text{ (safe)} \]
4. Design of fork end

\[ P = 2(75 - 48) \times 27 \text{ at } 70 \text{ MN} = 2(75 - 48) \times 27 \text{ at } 6 \]
\[ 97 = 48 \text{ N/mm}^2 \]

\[ P = 2(75 - 48) \times 6 \text{ at } 70 \text{ MN} = 2(75 - 48) \times 6 \]
\[ 6 \times 48 \text{ N/mm}^2 \]

- Assumed dimensions for fork end are correct.

**Final Dimensions of Joint ARE**

1. Dia of rod \( d = 36 \text{ mm} \)
2. O.D of single eye end and fork end = 75 mm
3. Dia of pin = \( d_i = 48 \text{ mm} \)
4. Thickness of single eye end \( b = 45 \text{ mm} \)
5. Thickness of fork end \( b = 27 \text{ mm} \)
6. Dia of pin head = O.D of collar = \( 1.5 \times d = 54 \text{ mm} \)
7. Thickness of pin head + collar = \( 0.5 \times d = 18 \text{ mm} \)
8. Dia of split pin = 3 mm
Q1. A shaft is transmitting 30 KW Power at 300 RPM. The shaft carries a central load of 1000 N and simply supported between bearing 5 m apart. Determine diameter of the shaft if allowable tensile stress and shear stress is 60 N/mm$^2$ and 40 N/mm$^2$ respectively.

Q2. A shaft is driven by a motor placed vertically below it. The pulley on the shaft is of 1.5m diameter & has belt tensions 5.4kN and 1.8kN on the tight side and slack side respectively. Both these tensions may be assumed to be vertical. If the pulley is overhung from the shaft, and the distance of the centre line of the bearing is 400mm find the diameter of the shaft. Assume maximum allowable shear stress of 44 N/mm$^2$.

OR

A shaft is transmitting 100 kW at 500 rpm. The supported length of shaft is 6 m. It carries two pulleys each weighing 2 kN supported at a distance of 2 m from each end. Determine diameter of shaft, if allowable stress is 60 MPa in tension and 40 MPa in shear.
**Solution**

**Q1**

\[ P = 30 \times 10^3 \text{ W}, \quad N = 300 \text{ rpm}, \quad W = 100 \text{ N}, \quad l = 5 \text{ m} \]

\[ q = 60 \text{ N/m}^2 \]

\[ P = \frac{2\pi NT}{60} \]

\[ T = \frac{60P}{2\pi N} = \frac{60 \times 30 \times 10^3}{2 \pi \times 300} = 954.93 \text{ Nm} \]

\[ M = \frac{WL}{4} = \frac{1000 \times 5}{4} = 1250 \text{ Nm} \]

\[ T_E = \sqrt{M^2 + T^2} = \sqrt{1250^2 + 954.93^2} = 1573 \text{ Nm} \]

\[ M_E = \frac{1}{2} \left[ M + \sqrt{M^2 + T^2} \right] = \frac{1}{2} \left[ 1250 + 1573 \right] = 1411.5 \text{ Nm} \]

\[ T_E = \frac{\pi}{16} q d^3 \]

\[ M_E = \frac{\pi}{32} q d^3 \]

\[ 1573 \times 10^3 = \frac{\pi}{16} \times 40 \times d^3 \]

\[ 1411.5 \times 10^3 = \frac{\pi}{32} \times 60 \times d^3 \]

\[ d = 58.5 \text{ mm} \]

\[ d = 62.11 \text{ mm} \]

**Larger of two values** \[ d = 62.11 \text{ mm} \]

**Q2**

\[ T_1 = 540 \text{ N}, \quad T_2 = 180 \text{ N}, \quad q = 44 \text{ N/m}^2 \]

\[ M = (540 + 180) \times 0.4 = 2880 \text{ Nm} \]

\[ T = (T_1 - T_2) R = (540 - 180) \times 0.75 = 2700 \text{ Nm} \]

\[ T_E = \sqrt{M^2 + T^2} = \sqrt{2880^2 + 2700^2} = 3947.71 \text{ Nm} \]

\[ T_E = \frac{\pi}{16} q d^3 \]

\[ 3947.71 \times 10^3 = \frac{\pi}{16} \times 44 \times d^3 \]

\[ d = 77.02 \text{ mm} \]

\[ d = 80 \text{ mm} \quad \text{ Std.} \]
\[ M = 20 \omega \times 2 = 4000 \text{ Nm} \]

\[ T = \frac{60P}{2\pi N} = \frac{60 \times 100 \times 10^3}{2\pi \times 500} = 1909.86 \text{ Nm} \]

\[ T_E = \sqrt{M^2 + r^2} = \sqrt{4000^2 + 1909.86^2} = 4432.56 \text{ Nm} \]

\[ M_E = \frac{1}{2} \left[ M + \sqrt{M^2 + r^2} \right] = \frac{1}{2} \left[ 4000 + 4432.56 \right] = 4216 \text{ Nm} \]

\[ T_{15} = \frac{4\pi}{16} \sigma d^3 \]

\[ 4432.56 \times 10 \times 8 = \frac{4\pi}{16} \times 40 \times d^3 \]

\[ d = 82.64 \text{ mm} \]

\[ M_{15} = \frac{4\pi}{32} \sigma d^3 \]

\[ 4216.3 \times 10 \times 8 = \frac{4\pi}{32} \times 60 \times d^3 \]

\[ d = 89.45 \text{ mm} \]

Larger of the two values: \( d = 89.45 \text{ mm} \)

\( d = 90 \text{ mm (say)} \)
<table>
<thead>
<tr>
<th>Question</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>What are the aims and functions of Estimating? (5)</td>
</tr>
<tr>
<td>Q2</td>
<td>Define Costing and describe the aims of Costing. (5)</td>
</tr>
<tr>
<td>Q3</td>
<td>Write short notes on the following (5)</td>
</tr>
<tr>
<td>(a) Prime Cost</td>
<td></td>
</tr>
<tr>
<td>(c) Office Cost</td>
<td></td>
</tr>
<tr>
<td>(e) Selling Price</td>
<td></td>
</tr>
<tr>
<td>(b) Factory Cost</td>
<td></td>
</tr>
<tr>
<td>(d) Total Cost</td>
<td></td>
</tr>
</tbody>
</table>

Q1. Explain Break-Even point with help of Graphical method showing Fixed cost, Variable cost, Total cost, Profit and Sales Revenue.

Q2. Describe in detail main reasons for replacement of equipments.

Q3. What is the importance of estimating material cost? Write procedure of calculations of material cost.
**Year - 3rd  I - Class Test**

**Sub. code → ME-310 (Management and Entrepreneurship)**
**Time - 1 hr  Date 18-11-2017**

Q.1. Define scientific management (SM) and its characteristics. Also define Taylor's theory of SM.  
(6)

Q.2. What do you mean by ownership. Define sole trading and partnership.  
(5)

Q.3. Define following terms:
   A) Management
   B) Organisation
   C) Administration
   D) Joint stock company  
(4)
Year: 3rd  II: Class Test

Sub. Code: ME-310 (Management and Entrepreneurship)

Time: 1 hr  Date: 19-1-2018

Q.1. Make diagram of Broach and write down functions of their parts (4)

Q.2. Make MCD and define its terminology (5)

Q.3. Explain types of chips formation with diagram (6)