Hall Ticket Number :										

Code: 5G533

R-15

II B.Tech. I Semester Supplementary Examinations May 2018

Basic Thermodynamics

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) What do you mean by "Perpetual motion machine of first kind-PMM 1"? 5M

   b) A piston–cylinder device initially contains 0.8 m^3 of saturated water vapor at 250 kPa. At this state, the piston is resting on a set of stops, and the mass of the piston is such that a pressure of 300 kPa is required to move it. Heat is now slowly transferred to the steam until the volume doubles. Show the process on a *P-v* diagram with respect to saturation lines and determine (*a*) the final temperature, (*b*) the work done during this process, and (*c*) the total heat transfer. 9M

OR

2. a) Why only in constant pressure non-flow process, the enthalpy change is equal to heat transfer? 5M

   b) Steam flows steadily through an adiabatic turbine. The inlet conditions of the steam are 10 MPa, 450°C, and 80 m/s, and the exit conditions are 10 kPa, 92 percent quality, and 50 m/s. The mass flow rate of the steam is 12 kg/s. Determine (*a*) the change in kinetic energy, (*b*) the power output, and (*c*) the turbine inlet area. 9M

UNIT–II

3. a) A household refrigerator with a COP of 1.2 removes heat from the refrigerated space at a rate of 60 kJ/min. Determine (*a*) the electric power consumed by the refrigerator and (*b*) the rate of heat transfer to the kitchen air. 6M

   b) A heat pump is used to maintain a house at a constant temperature of 23°C. The house is losing heat to the outside air through the walls and the windows at a rate of 60,000 kJ/h while the energy generated within the house from people, lights, and appliances amounts to 4000 kJ/h. For a COP of 2.5, determine the required power input to the heat pump. 8M

OR

4. a) Using the Maxwell relations and the ideal-gas equation of state, determine a relation for $(\partial s/\partial V)_T$ for an ideal gas. 6M

   b) A house that is losing heat at a rate of 80,000 kJ/h when the outside temperature drops to 15°C is to be heated by electric resistance heaters. If the house is to be maintained at 22°C at all times, determine the reversible work input for this process and the irreversibility. 8M

UNIT–III

5. a) Determine the amount of heat, which should be supplied to 2 kg of water at 25°C to convert it into steam at 5 bar and 0.9 dry. 7M

   b) A quantity of steam at 10 bar and 0.85 dryness occupies 0.15 m^3. Determine the heat supplied to raise the temperature of the steam to 300°C at constant pressure and percentage of this heat which appears as external work.

   Take specific heat of superheated steam as 2.2 kJ/kg K. 7M

OR

6. a) Describe with a neat sketch a separating-throttling calorimeter for measuring the dryness fraction of steam. 6M

   b) The following data were obtained in a test on a combined separating and throttling calorimeter :

   Pressure of steam sample = 15 bar, Pressure of steam at exit = 1 bar,

   Temperature of steam at the exit = 150°C,

   Discharge from separating calorimeter = 0.5 kg/min,

   Discharge from throttling calorimeter = 10 kg/min.

   Determine the dryness fraction of the sample steam. 8M

UNIT–IV

7. a) Define the following terms:

   (*i*) Partial pressure (*ii*) Mole fraction (*iii*) Volume fraction of a gas constituent in a mixture. 6M

   b) A vessel of 0.35m^3 capacity contains 0.4 kg of carbon monoxide (molecular weight = 28) and 1 kg of air at 20°C. Calculate:

   (i) The partial pressure of each constituent,

   (ii) The total pressure in the vessel,

   The gravimetric analysis of air is to be taken as 23.3% oxygen (molecular weight = 32) and 76.7% nitrogen (molecular weight = 28). 8M

OR

8. a) Derive the relationship between the two principal specific heats and characteristic gas constant for a perfect gas. 6M

   b) One kg-mol of oxygen undergoes a reversible non-flow isothermal compression and the volume decreases from 0.2 to 0.08 m^3/kg and the initial temperature is 60°C. If the gas obeys Vander Waals' equation, find:

   (i) the work done during the process (ii) the final pressure. 8M

UNIT–V

9. a) What is the cut-off ratio? How does it affect the thermal efficiency of a Diesel cycle? 5M

   b) An air-standard Diesel cycle has a compression ratio of 16 and a cut-off ratio of 2. At the beginning of the compression process, air is at 95 kPa and 27°C. Accounting for the variation of specific heats with temperature, determine:

   (*i*) the temperature after the heat-addition process,

   (*ii*) the thermal efficiency, and

   (*iii*) the mean effective pressure. 9M

OR

10. a) Consider the ideal Otto, Stirling, and Carnot cycles operating between the same temperature limits. How would you compare the thermal efficiencies of these three cycles? 5M

    b) An ideal Stirling engine using helium as the working fluid operates between temperature limits of 300 and 2000 K and pressure limits of 150 kPa and 3 MPa. Assuming the mass of the helium used in the cycle is 0.12 kg, determine:

    (*i*) the thermal efficiency of the cycle,

    (*ii*) the amount of heat transfer in the regenerator, and

    (*iii*) the work output per cycle. 9M

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Hall Ticket Number :										

R-15

Code: 5GC31

II B.Tech. I Semester Supplementary Examinations May 2018

Engineering Mathematics-III

(Common to CE & ME)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Find the Rank of the matrix $\begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 3 & 4 \\ 3 & 7 & 5 & 6 \end{bmatrix}$ by reducing it to the normal form. 7M

b) Prove that the following set of equations are consistent and solve them.

$3x+3y+2z=1,\ x+2y=4,\ 10y+3z=-2,\ 2x-3y-z=5$ 7M

OR

2. If $A=\begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ Verify Cayley-Hamilton theorem. Find A^4 and A^{-1} using Cayley-Hamilton theorem. 14M

UNIT–II

3. a) Find a real root of the equation $x\log_{10}x=1.2$ which lies between 2 and 3 by bisection method. 7M

b) Find $f(2.36)$ from the following table.

x	1.6	1.8	2.0	2.2	2.4	2.6
y	4.95	6.05	7.39	9.03	11.02	13.46

7M

OR

4. Evaluate $\int_0^6 \frac{1}{1+x}\,dx$ using

(**i**) Trapezoidal rule (**ii**) Simpson's 3/8th rule and compare it with the actual value. 14M

UNIT–III

5. Solve $y'=x^2-y,\ y(0)=1$ using Taylor's series method and compute $y(0.1),\ y(0.2),\ y(0.3)\ and\ y(0.4)$ 14M

OR

6. Use Milne's method to find $y(0.8)\ and\ y(1.0)$ from $y'=1+y^2,\ y(0)=0$. Find the initial values $y(0.2),\ y(0.4)\ and\ y(0.6)$ from the Runge-Kutta Method. 14M

UNIT–IV

7. Find the half-range cosine series for $f(x) = x(2-x)$, in $0 \le x \le 2$ and hence find sum of the series $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + - - - -$ 14M

OR

8. a) Form a partial differential equation by eliminating the arbitrary function $f(x)$ and $g(y)$ from $z = y\ f(x) + x\ g(y)$ 7M

   b) Solve by the method of Separation of Variables $u_x = 2\,u_t + u$ 7M

UNIT–V

9. Prove that $u = e^{-x}\left[\left(x^2 - y^2\right)\cos y + 2xy\sin y\right]$ is harmonic and find the Analytic function whose real part is u. 14M

OR

10. Evaluate $\int_C \frac{\cos® z^2}{(z-1)(z-2)^3}\,dz$ where C is $|z| = 3$ by using Cauchy's integral formula. 14M

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Hall Ticket Number :										

R-15

Code: 5G532

II B.Tech. I Semester Supplementary Examinations May 2018

Metallurgy & Material Science

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. Explain about the effect of grain boundaries on the properties of metals.

OR

2 What is an alloy and Explain about Hume Rotherys rules?

UNIT–II

3. Give the relationship between equilibrium diagrams and properties of alloys.

OR

4. Explain Al-Cu phase diagram with neat sketch.

UNIT–III

5. Explain the structure and properties of Grey cast iron.

OR

6. Explain the structure and properties of Titanium and its alloys.

UNIT–IV

7. Explain about Annealing, Normalizing and Hardening.

OR

8. Discuss about different surface hardening methods.

UNIT–V

9. Explain about Crystalline ceramics, glasses and cermet's.

OR

10. Explain about Bessemer Converter Process with neat sketch.

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Hall Ticket Number :										

R-15

Code: 5G535

II B.Tech. I Semester Supplementary Examinations May 2018

Machine Drawing

(Mechanical Engineering)

Max. Marks: 70 Time: 4 Hours

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PART-A

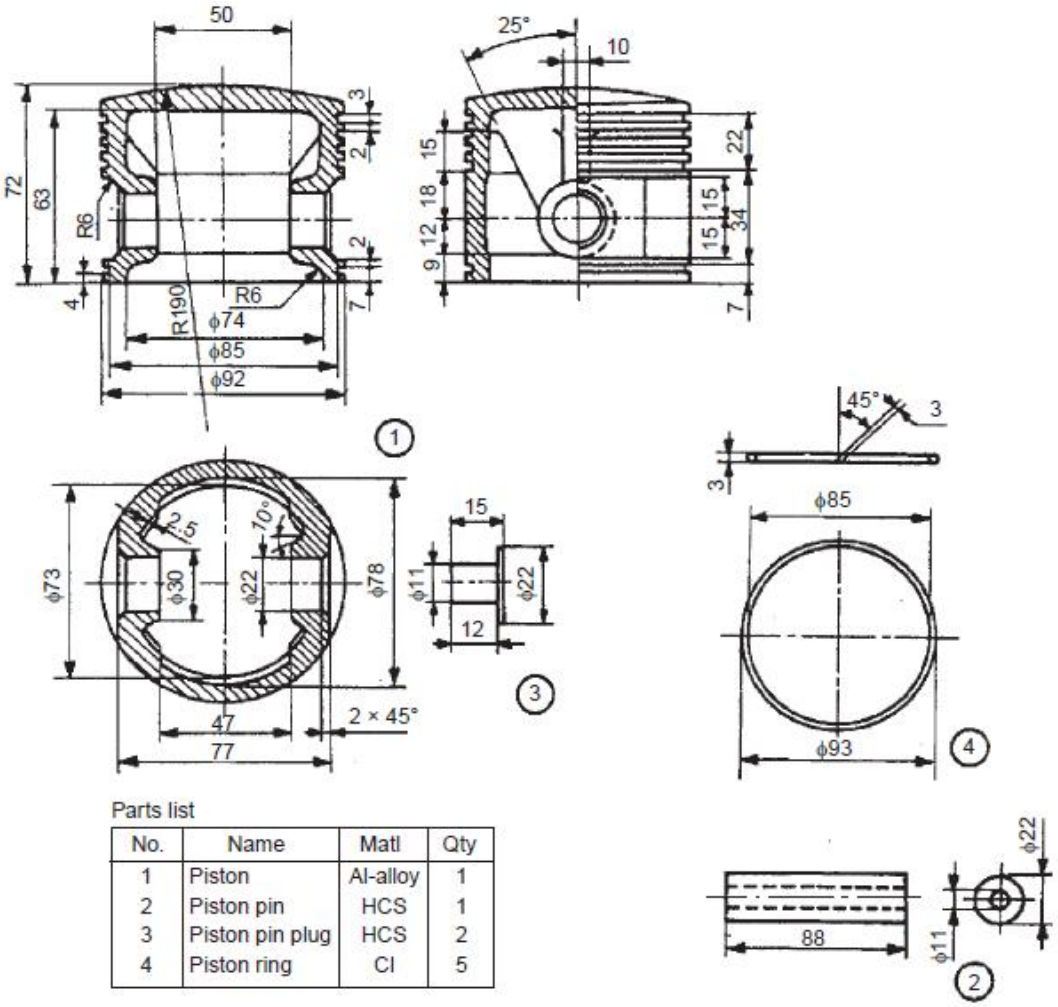
Answer any two from the following (2 x 10 = 20Marks)

1. Draw half sectional view from the front of a bushed pin type flange coupling, each of diameter 30mm.
2. Draw half sectional view from the front with left half in section of a bushed journal bearing suitable for supporting a shaft of diameter 25mm.
3. Sketch the following forms of nuts with proportions marked.
   (a) Flanged nut (b) Cap nut (c) dome nut

PART-B

Answer any one from the following (1 x 25 = 25 Marks)

4. Assemble the parts of the piston as shown in Fig. and draw the following views:
   (*i*) Sectional view from the front (*ii*) Sectional view from above.

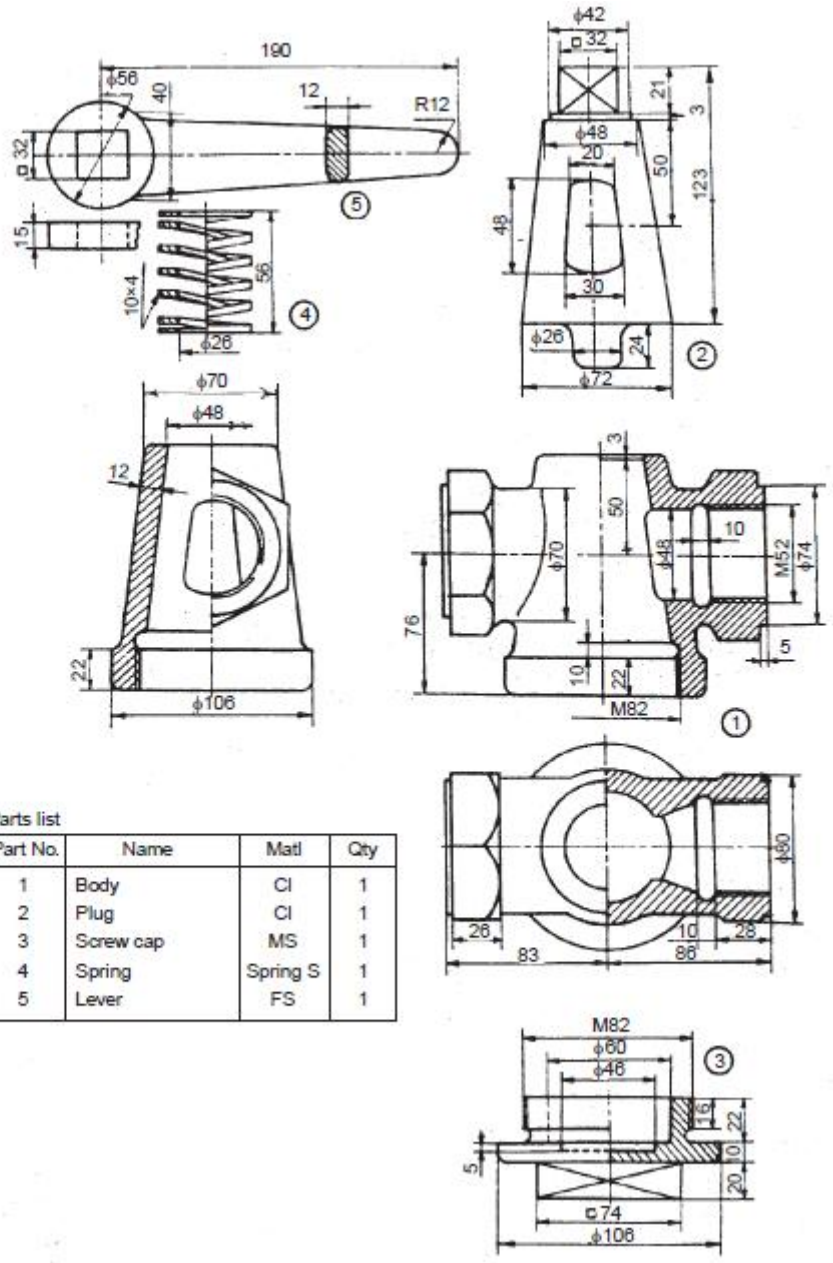


Parts list

No.	Name	Matl	Qty
1	Piston	Al-alloy	1
2	Piston pin	HCS	1
3	Piston pin plug	HCS	2
4	Piston ring	CI	5

OR

5. The details of an air cock is shown in Fig. Assemble the parts and draw (*i*) Half sectional view from the front (*ii*) View from above.



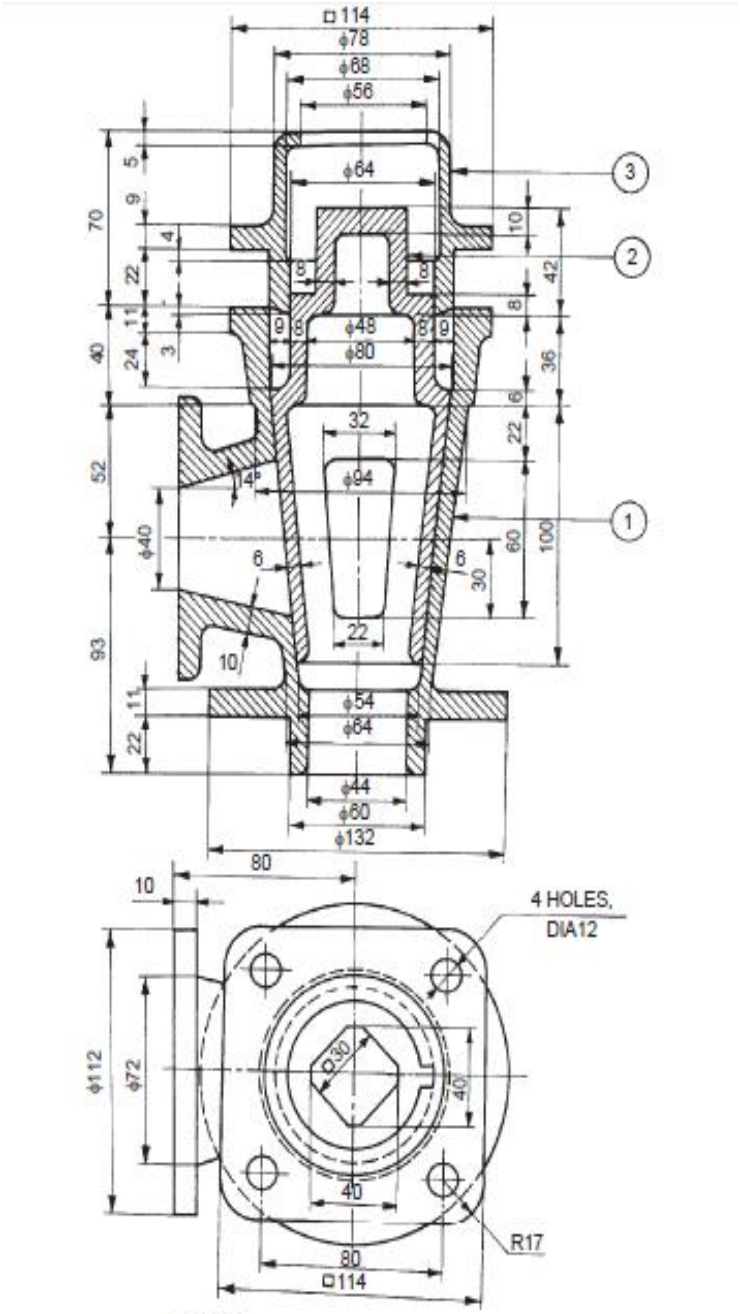
Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Plug	CI	1
3	Screw cap	MS	1
4	Spring	Spring S	1
5	Lever	FS	1

PART-C

Answer any one from the following (1 x 25 = 25 Marks)

6. Prepare the part drawings of the Blow-off cock

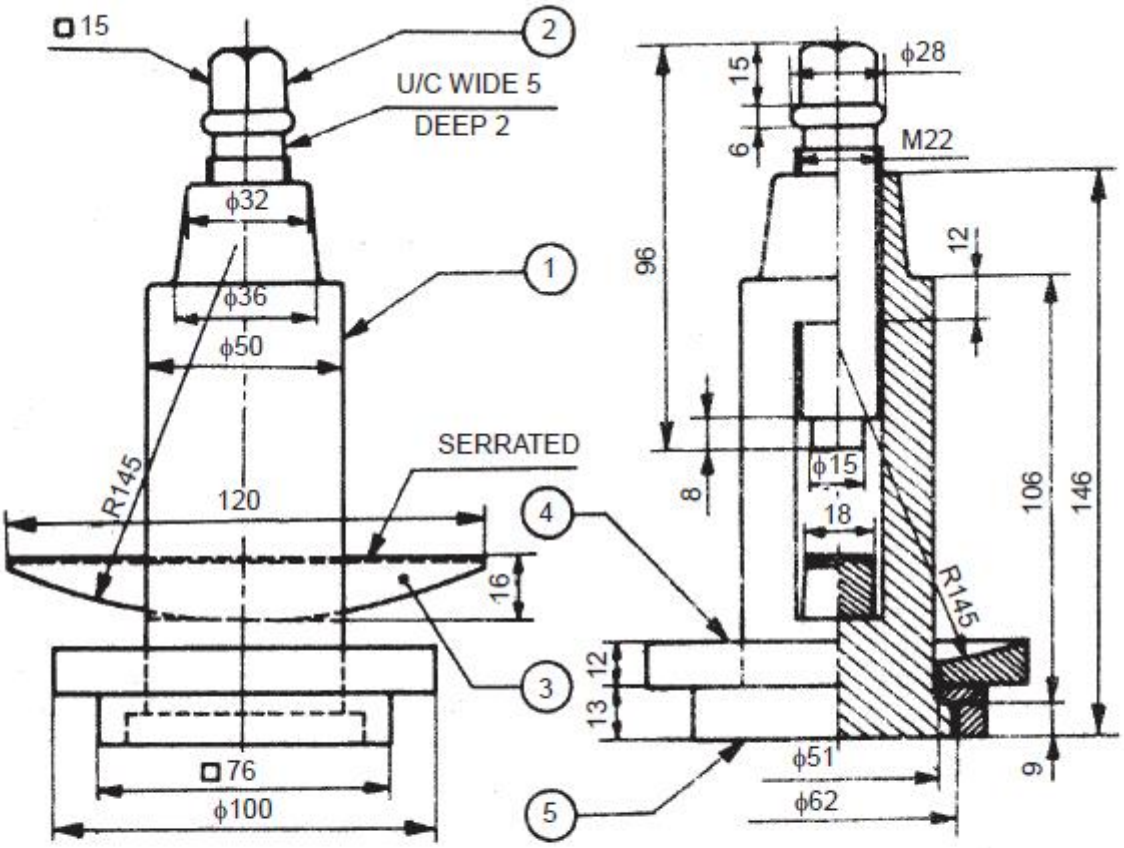


Parts list

Part No.	Name	Matl.	Qty.
1	Body	CS	1
2	Cock	GM	1
3	Gland	CS	1

OR

7. Prepare the part drawings of the tool post



Parts list

Part No.	Name	Matl.	Qty.
1	Body	MS	1
2	Clamp screw	MCS	1
3	Wedge	CI	1
4	Ring	MS	1
5	Square block	MS	1

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Hall Ticket Number :										

Code: 5G534

R-15

II B.Tech. I Semester Supplementary Examinations May 2018

Manufacturing Technology

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Discuss various types of patterns in detail with examples. 7M
   b) What are various moulding materials and their properties? Explain. 7M

OR

2. a) What are the design considerations adopted in 'casting'? Explain. 7M
   b) What are the 'casting defects'? Explain the reasons for such defects and suggest suitable remedies. 7M

UNIT–II

3. a) Briefly describe the 'shield metal arc welding process'? Give its advantages and limitations over 'gas welding'. 7M
   b) Give the advantages and limitations of 'TIG welding' over 'MIG welding'. 7M

OR

4. a) Explain types of 'welding joints' with sketches. Also give various welding positions. 7M
   b) Explain with the help of a neat sketch the process of 'Resistance welding'. 7M

UNIT–III

5. a) Define and explain the terms (**i**) cold working and (**ii**) hot working. Discuss the effects of 'cold working' and 'hot working' on the properties of materials. Explain their advantages and disadvantages. 7M
   b) Classify 'rolling mills'. Explain the factors effecting roll pressure. 7M

OR

6. a) Explain the process of 'blanking' and 'piercing' operations with the help of neat sketches. 7M
   b) Briefly explain 'Embossing process'. Give its advantages and applications. 7M

UNIT–IV

7. a) Discuss the effect of tool material and temperature on 'extrusion process'. 7M
   b) Discuss in detail about 'hot extrusion' and 'cold extrusion' processes. 7M

OR

8. a) Explain different 'forging methods'. 7M
   b) Classify 'forging defects' and give the necessary remedies. 7M

UNIT–V

9. a) Explain in brief as how 'plastic materials' are used for engineering applications. 7M
   b) Describe the process of 'Blow moulding' with a neat sketch. 7M

OR

10. a) List out some important properties of 'plastic materials'. 7M
    b) Explain the process of 'Extrusion moulding' with a neat sketch. 7M

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Hall Ticket Number :										

R-15

Code: 5G531

II B.Tech. I Semester Supplementary Examinations May 2018

Mechanics of Solids

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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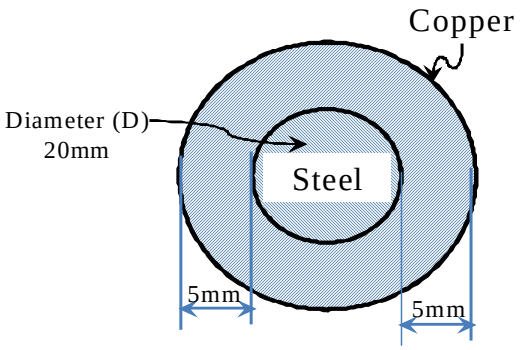
UNIT–I

1. a) Explain stress strain diagram for mild steel specimen for tensile test in detail. 7M

   b) A bar of 25 mm diameter is tightly fitted into a tube. Find the stresses in the bar and changes in its volume due to compressive force of 60 KN in the bar if the tube restrains 50 percent of expansion in diameter. Take length of the bar=400 mm, $E=2\times10^5$ N/mm^2 and $\mu=0.3$ 7M

OR

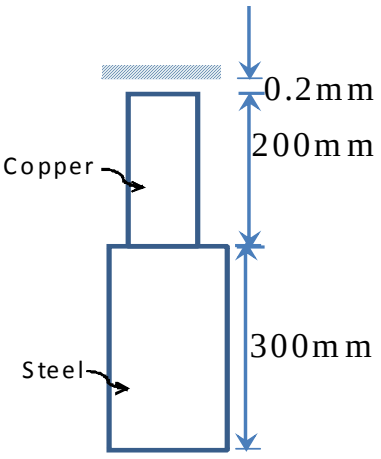
2. a) A compound bar consists of a circular rod of steel with diameter 20 mm rigidly fitted into a copper tube of internal diameter 20 mm and thickness 5 mm as shown in the figure. If the bar is subjected to a load of 100 KN, find the stresses developed in the two materials.



7M

   b) The composite bar shown in figure is 0.2 mm short of the distance between the rigid supports at room temperature. What is the maximum temperature rise which will not produce stresses in the bar? Find the stresses induced when the temperature rise is 40^{o}C.Given

   $A_s:A_c=4:3$, $\alpha_s=12\times10^{-6}/^0C$, $\alpha_c=17.5\times10^{-6}/^0C$, $E_s=2\times10^5 N/mm^2$, $E_c=1.2\times10^5 N/mm^2$

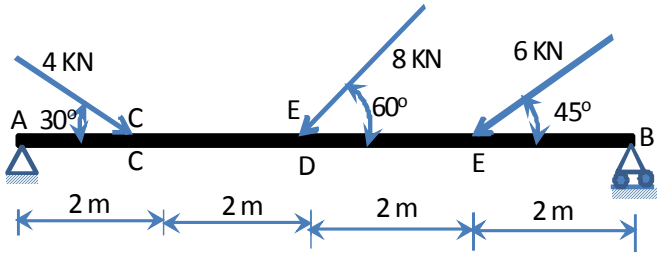


7M

UNIT–I

3. a) Draw S.F. and B.M. diagrams for a simple supported beam carrying a uniformly distributed load of w per unit length over the entire span. Also calculate the maximum B.M. 7M

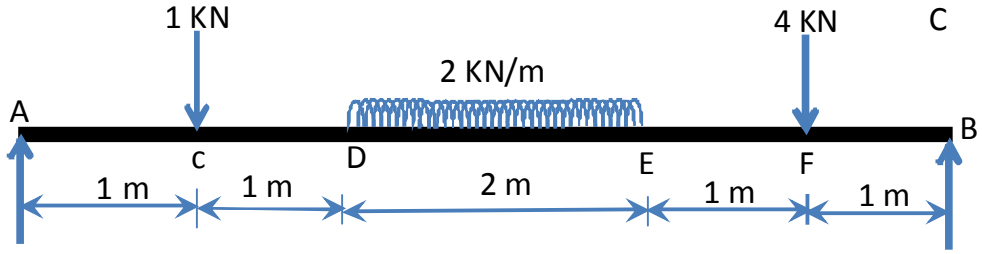
b) A horizontal beam AB of length 8 m is hinged at A and placed on the rollers at B. The beam carries three inclined point loads as shown in the figure. Draw the S.F.,B.M, and axial force diagrams of the beam.



7M

OR

4. Draw the shear force and bending diagrams for the beam shown loaded in fig. Clearly mark the position of the maximum bending moment and determine its value.

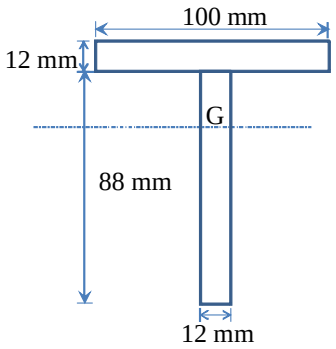


14M

UNIT–III

5. a) State the assumptions made in the theory of simple bending and derive the bending equation? 7M

b) Figure shows the cross section of a beam which is subjected to a shear force of 20 KN. Draw shear stress distribution across the depth marking values at salient points.



7M

OR

6. A cast iron beam has an I-section with top flange 80 mm ×40 mm, web 120 mm ×20 mm and bottom flange 160 mm × 40 mm. If the tensile stress is not to exceed 30 N/mm^2 and compressive stress 90 N/mm^2, what is the maximum uniformly distributed load the beam can carry over a simply supported span of 6 m if the larger flange is in tension? 14M

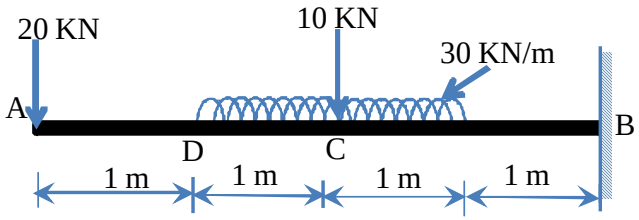
UNIT–IV

7. a) Write assumptions made in torsional equation. Derive the relation for a circular shaft when subjected to torsion as given below.

$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$

Where T=torque transmitted
J=polar moment of inertia
τ= Maximum shear stress
R= radius of shaft
C= modulus of rigidity
Θ= Angle of twist
L=length of shaft 7M

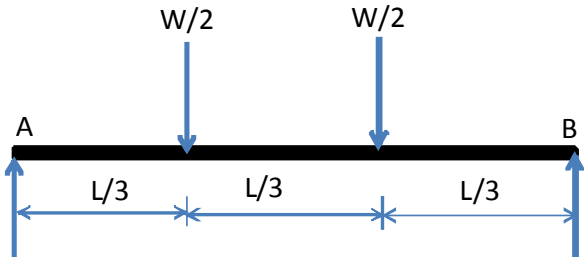
b) Plot the elastic curve and find the maximum deflection and maximum slope for the cantilever beam loaded as shown in the figure.



7M

OR

8. a) A simple supported beam of span L is subjected to equal loads W/2 at each of 1/3rd span points. Find the expression for deflection under the load and at mid-span.



7M

b) A composite shaft has an aluminum tube of external diameter 60 mm and internal diameter 40 mm closely fitted to a steel rod of 40 mm. If the permissible stress is 60 N/mm ^{2}in aluminum and 100 N/mm^2 in steel, find the maximum torque the composite section can take. Given G_a=27 KN/mm^2 and G_s=80 KN/mm^2 7M

UNIT–V

9. a) Show that in thin cylinder shells subjected to internal fluid pressure, the circumferential stress is twice the longitudinal stress. 7M

b) Find the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 8 N/mm^2. The maximum hoop stress in the section is not to exceed 35 N/mm^2. 7M

OR

10. a) Explain the assumptions made in Euler's column theory. How far the assumptions valid in practice? 7M

b) A boiler shell is to be made of 15 mm thick plate having a limiting tensile stress of 12 N/mm^2. If the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively, Determine:

(i) The maximum permissible diameter of the shell for an internal pressure of 2 N/mm^2 and
(ii) Permissible intensity of internal pressure when the shell diameter s 1.5 m. 7M

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