Hall Ticket Number :										

R-11 / R-13

Code: 1G533

II B.Tech. I Semester Supplementary Examinations May 2018

Thermodynamics

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks** each)

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1. a) Differentiate reversible process and irreversible process? 4M

   b) A gas of mass 1.5 kg undergoes a quasi-static expansion, which follows a relationship P=a+bV, where 'a' and 'b' are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.2 m^3 and 1.2 m^3. The specific internal energy of the gas is given by the relation U = (1.5PV – 85) kJ/kg, where P is in kPa and V is in m^3. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion. 10M

2. a) Define first law of thermodynamics. 4M

   b) A reciprocating air compressor takes in 2m^3/min. at 0.11 MPa, 20^{0}C which it delivers at 1.5 MPa, 111^{0}C to an after cooler where the air is cooled at constant pressure to 25^{0}C. The power absorbed by the compressor is 4.15 kW. Determine the heat transfer in the compressor and the cooler. 10M

3. A heat pump working on the Carnot cycle takes in heat from a reservoir at 5°C and delivers heat to a reservoir at 60°C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840°C and rejects heat to a reservoir at 60°C. The reversible heat engine also drives a machine that absorbs 30 kW. If the heat pump extracts 17 kJ/s from the 5°C reservoir, determine

   (i) The rate of heat supply from the 840°C source

   (ii) The rate of heat rejection to the 60°C sink. 14M

4. a) Bring out the concept of entropy and importance of T-s diagram. 4M

   b) Ten grams of water at 20°C is converted into ice at –10°C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2 J/gK and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0°C to be 335 J/g, calculate the total entropy change of the system. 10M

5. a) What is the quality of steam? 4M

   b) A sample of steam from a boiler drum at 3 MPa is put through a throttling calorimeter in which the pressure and temperature are found to be 0.1 MPa, 120°C. Find the quality of the sample taken from the boiler. 10M

6. A certain gas has C_p =1.968 and C_v = 1.507 kJ/kg K. Find its gas constant and molecular weight. A constant volume chamber of 0.3 m^3 capacity contains 2 kg of this gas at 5^0C. Heat is transferred to the gas until the temperature is 100^0C. Find the work done, the heat transferred and the changes in internal energy, enthalpy and entropy. 14M

7. Consider a gas mixture of molecular weight 33, initially at 3 bar, 300K and occupying a volume of 0.1 m^3. The gas undergoes an expansion to 0.2 m^3 during which the pressure-volume relation is $PV^{1.3}$ = constant. Assuming C_v=0.6+2.5 X 10^{-4} T. where T is in K and C_v is in kJ/kg K, and neglecting K. E. and P. E. effects, determine (i) the mass of gas (ii) the final pressure (iii) the final temperature (iv) the work and (v) the heat transfer. 14M

8. a) Compare with the help of P-V and T-S diagram air standard Otto, Diesel and Dual cycles with respect to i) same compression ratio and same heat input ii)same maximum pressure and same heat input. 6M

   b) An engine working on Otto cycle is supplied with air at 0.1 MPa, 35^0C. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure, temperature of the cycle, the cycle efficiency and the mean effective pressure. (For air, C_p = 1.005, C_v = 0.718,and R = 0.287 kJ/kg K). 8M

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Hall Ticket Number :										

R-11 / R-13

Code: 1GC31

II B.Tech. I Semester Supplementary Examinations May 2018

Mathematics -II

(Common to CE & ME)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks** each)

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1. a) Prove that the Eigen values of a triangular matrix are the diagonal elements of the matrix. 4M

   b) Verify Cayley-Hamilton theorem for the matrix

   $$A=\begin{bmatrix} 3 & 4 & 1 \\ 2 & 1 & 6 \\ -1 & 4 & 7 \end{bmatrix} \text{ and hence find } A^{-1}.$$ 10M

2. a) Write the Fourier representation of the periodic function $f(x)=x$ in $(-\pi\ \pi)$. 7M

   b) Find the half range cosine series for the function $f(x)=(x-1)^2$ in the interval (0 1) and hence show that $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+------=\frac{\pi^2}{6}$. 7M

3. a) Form a partial differential equation by eliminating the arbitrary constants a, b, c from the equation $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$. 7M

   b) A tightly stretched string with fixed end points $x=0$ and $x=l$ is initially in a position given by $y(x,0)=y_0\sin^3(\frac{\pi x}{l})$. If it is released from rest from this position. Find the displacement 'y' at any time 't' and at a distance 'x' from one end. 7M

4. a) Find the roots of the equation $x^3-x-4=0$ using *False position method* 7M

   b) Using Newton-Raphson method, find a positive root of the equation $x^4-x-9=0$ and correct to three decimal points. 7M

5. a) Find the value of y at x=0.1 by Picard's method, given that $\frac{dy}{dx}=\frac{y-x}{y+x},\ y(0)=1$ 7M

   b) Use Milne's Predictor corrector method to find y(0.3) from $y'=x^2+y^2,\ y(0)=1.$ 7M

6. a) *Evaluate* $\int_0^{\pi} t \sin t \, dt$ using *the Trapezoidal rule.* 4M

   b) *Evaluate* $\int_0^6 \frac{1}{1+x} \, dx$ using *Simpson's* $1/3$ *rule and Simpson's* $3/8$ *rule.* 10M

7. a) *Prove that* $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |\text{Re}\, al \; f(z)|^2 = 2|f'(z)|^2$, *where* $w = f(z)$ *is analytic.* 7M

   b) Show that for $f(z) = \frac{2xy(x+iy)}{x^2+y^2}$, *if* $z \neq 0$

   $= 0$, *if* $z = 0$,

   The C-R equations are satisfied at the origin but the derivative of $f(z)$ at origin does not exists. 7M

8. a) *Evaluate* $\int_c \frac{z^2 - z - 1}{z(z-i)} \, dz$, *where* $c : \left|z - \frac{1}{2}\right| = 1$, using *Cauchy's* integral *formula*. 4M

   b) *Find the Taylor's series* expansion *of* $f(z) = \frac{2z^3+1}{z^2+1}$ *about the* point

   i) $z = i$ *ii)* $z = 1$ 10M

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Hall Ticket Number :										

R-11 / R-13

Code: 1G531

II B.Tech. I Semester Supplementary Examinations May 2018

Mechanics of Solids

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer any **five** questions

All Questions carry equal marks (**14 Marks** each)

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1. a) Define the term 'composite bar'. How will you find the stresses and load carried by each member of a composite bar? 4M

   b) A steel rod 20mm in diameter passes centrally through a steel tube of 25mm internal diameter and 30mm external diameter. The tube is 800m long and is closed by rigid members of negligible thickness which are fastened by nut threaded on the rod. The nuts are tightened until the compressive load on the tube is 20KN. Calculate the stresses in the tube and the rod. 10M

2. a) What are the different types of beams? Differentiate between a cantilever and simply supported beam. 4M

   b) A beam ABCD is 24 m long and is simply supported at B and D, 18 m apart. A concentrated load of 20 KN at A and a total distributed load of 120KN which varies linearly from p KN/m at the center C to q KN/m at D, is spread from C to D. Find the values of p and q for the reaction at B and D to the equal. Find also the point of contra-flexure and the position and magnitude of the maximum bending moment. 10M

3. a) Explain the terms: (i) Bending stress in a beam (ii) Neutral axis and (iii) Section modulus. 4M

   b) A timber beam of rectangular section of length 8m is simply supported. The beam carries a U.D.L. of 12kN/m run over the entire length and a point load of 10kN at 3m from the left support. If the depth is two times the width and the stress in the timber is not to exceed 8N/mm^2, find the suitable dimensions of the section. 10M

4. a) Explain how shear stress develops in beams. Write an expression for maximum shear stress developed in beams of triangular section. 4M

   b) Derive an expression for shear stress distribution across a rectangular section 10M

5. a) Define the term 'polar modulus'. Write expressions for polar modulus of a solid shaft and a hollow shaft. 4M

   b) Find the power that can be safely transmitted by a solid steel shaft 100mm diameter running at 250 rpm without exceeding a shearing stress of 60 N/mm^2. If this shaft is to be replaced by a hollow shaft of the same external diameter but with a permissible shearing stress of 72 N/mm^2, determine the internal diameter to transmit the same power at the same speed as the solid shaft 10M

6. a) Write expressions for slope and deflection of a cantilever beam carrying U.D.L. along its entire length. 4M

   b) A beam of length 10m is simply supported at the ends. It carries a uniformly distributed load of 10kN/m over a length of 6m from the right support. Determine the deflection of the beam at its mid-point and also the position of maximum deflection. 10M

7. a) What is meant by 'crippling load'? Explain. 4M

   b) A hollow cast-iron column whose outside diameter is 260 mm and has a thickness of 20 mm is 5.2 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 2.8. Find the ratio of Euler's to Rankine's loads. Take young's modulus as 106 GPa and Rankine's constant as 1/1670 for both ends pinned and the crushing strength of the material as 575 MPa. 10M

8. a) State the important assumptions made in the analysis of 'thick cylinders'. 4M

   b) A steel tube of 200 mm external diameter is to be shrunk on to another steel tube of 60 mm inner diameter. After shrinking, the diameter at the junction is 120 mm. Before shrinking on the difference of diameter at the junction is 0.08 mm. Find the hoop stresses developed in the two tubes after shrinking on, and the radial pressure at the junction. Take E=200 GPa**.** 10M

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