F 7072 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

ME 010 506 / AU 010 506 —THERMODYNAMICS [ME, AU]

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Use of Steam tables and Psychometric chart are permitted.

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Distinguish between macroscopic and microscopic analysis of thermodynamics.
2. What do you mean by thermometer and thermometric property ? Give examples.
3. What are the causes of entropy ?
4. Define Gibbs and Helmholtz functions.
5. Define Partial pressure and partial volume. (5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Explain the concept of continuum.
7. Prove that energy is a property of the system.
8. Derive the relation between coefficient of performance of a heat pump and refrigerator which are operating between same temperature source and sink.
9. Derive the equation :

$$\left(\frac{\partial c_p}{\partial p}\right)_T = -T\left(\frac{\partial^2 v}{\partial T^2}\right)_P.$$

10. What is Möllier diagram ? Why do isobars on Möllier diagram diverge from one another ? (5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. What do you mean by law of corresponding states ? Derive an expression for the law of corresponding states.

Or

12. (a) One kg. of CO_2 has a volume of 1 m^3 at 100° C. Compute the pressure by :

(i) Van der Waals' equation.

(ii) Ideal gas equation.

Take van der Waal's constants – $a = 3.647$ bar $\left(\frac{m^3}{kmol}\right)^2$ and $b = 0.0428$ m^3/Kmol for CO_2.

(6 marks)

(b) A certain gas has $C_p = 0.913$ kJ/kgK and $q = 0.653$ kJ/kgK. Find the Molecular weight and characteristic gas constant.

(6 marks)

13. (a) Derive Steady Flow Energy Equation for a single stream of fluid entering and leaving the control volume.

(9 marks)

(b) Using steady flow energy equation, prove that throttling is an isenthalpic process. (3 marks)

Or

14. (a) Write short notes on Joule-Thomson expansion. (6 marks)

(b) Prove that Joule-Kelvin coefficient for an ideal gas is zero. (6 marks)

15. One kg. of ice at – 5° C is exposed to the atmosphere which is at 20° C. The ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe. What is the minimum amount of work necessary to convert the water back into ice at – 5° C ?

Take C_p of ice as 2.093 kJ/kgK and the latent heat of fusion of ice as 333.3 kJ/kg.

Or

16. Air expands in a turbine adiabatically from 500 kPa, 400 K and 150 m/s to 100 kPa, 300 K and 70 m/s. The environment is at 100 kPa, 290 K. Calculate per kg. of air :

(i) The maximum work output.

(ii) The actual work output, and

(iii) The irreversibility.

17. (a) Draw and explain the phase equilibrium diagram for water on P–T and T–S co-ordinates. (9 marks)

(b) Why does the fusion line for water have negative slope on P–T diagram ? (3 marks)

Or

18. 0.5 kg. of Helium and 0.5 kg. of Nitrogen are mixed at 20°C and at a total pressure of 100 kPa. Find :

(i) The volume of the mixture.

(ii) The partial volumes of the components.

(iii) The partial pressures of the components.

(iv) The mole fraction of the components.

(v) The specific heats of the mixture, and

(vi) The gas constant of the mixture.

19. (a) Derive the Clausius-Clapeyron equation. (6 marks)

(b) The vapour pressure, in mm of mercury of solid ammonia is given by :

$$\ln P = 23.03 - \frac{3754}{T}$$

and that of liquid ammonia by :

$$\ln P = 19.49 - \frac{3063}{T}$$

(i) What is the triple point temperature and pressure ?

(ii) What are the latent heats of sublimation and vaporization.

(iii) What is the latent heat of fusion at the triple point.

(6 marks)

Or

20. Using the Tds relations :

(i) Prove that $C_p > C_v$.

(ii) For an ideal gas, $C_p - C_v = R$.

[5 × 12 = 60 marks]

F 7059 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

ME 010 505/AU 010 505—I.C. ENGINES AND COMBUSTION (ME, AU)

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is the difference between Air-standard Cycle and Fuel-air Cycle analysis ?
2. Define Flash Point and Fire Point.
3. What do you mean by Supercharging ?
4. What is meant by Abnormal Combustion ?
5. Define Brake Mean Effective Pressure.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each full question carries 5 *marks.*

6. Explain with the help of a neat diagram the working of a Battery Ignition System ?
7. What are the functions of Nozzle in a Fuel Injector ?
8. Compare the Air Cooling and Water Cooling Systems.
9. What are the factors affecting the Delay Period ?
10. What is EGR ? How it reduces the NO*x* Emmission ?

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Explain how SI and CI Engine Fuels are rated.

(b) Explain the scope of using Alcohols as Alternate Fuels for IC Engines.

Or

12. What do you understand by Charge Stratification ? Explain the various methods of Charge Stratification.

13. With the help of a neat sketch explain the working of Solex Carburetor.

Or

14. Explain in detail about the classification of Fuel Injection Systems.

15. The products of Combustion of an unknown Hydrocarbon CxHy have the following composition as measured by an Orsat apparatus :

CO_2 – 8%, CO – 0.9%, O_2 – 8.8%, and N_2 – 82.3%.

Determine :

(i) The Composition of the Fuel.

(ii) The Air-fuel ratio, and

(iii) The Percentage Excess Air used.

Or

16. (a) How do the Specific Heat vary with Temperature ? What is the Physical explanation for this variation ?

(6 marks)

(b) Write short notes on Evaporative Cooling System.

(6 marks)

17. (a) Explain the Phenomenon of knock in S.I. Engines.

(6 marks)

(b) Discuss the effect of Engine variables on knock.

(6 marks)

18. Write short notes on : *Or*

(i) Ignition delay.

(ii) Squish, Tumble and Swirl Motions.

19. A full-kload test on a Two-stroke Engine yielded the following results :

Speed	–	440 r.p.m.
Brake Load	–	50 kg
IMEP	–	3 bar
Fuel Consumption	–	5.4 kg/hr
Rise in Jacket Water Temperature	–	36°C.
Jacket Water flow	–	440 kg/hr.
Air-fuel ratio by Mass	–	30.
Temperature of Exhaust Gas	–	350°C.
Temperature of Test Room	–	17°C.
Barometric Pressure	–	76 cm of Hg.
Cylinder Diameter	–	22 cm.
Stroke	–	25 cm.
Broke Diameter	–	1.2 m.
Calorific value of Fuel	–	43 MJ/kg.
Proportion of Hydrogen by Mass in Fuel	–	15%.
Mean Specific heat of dry Exhaust Gases	–	1KJ/kgK.
Specific heat of dry steam	–	2KJ/kgK.

Assume Enthalpy of Superheated Steam to be 3180 KJ/kg. Determine :

(i) The indicated Thermal efficiency.

(ii) Specific Fuel consumption in g/kWh.

(iii) Volumetric efficiency based on atmospheric conditions.

Draw up a heat balance for the test on the percentage basis indicating the content of each item in the balance.

Or

20. Explain in detail about the various Engine Exhaust Emissions.

(5 × 12 = 60 marks)

F 7044 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Automobile Engineering/Mechanical Engineering

AU 010 504 / ME 010 504 —KINEMATICS OF MACHINERY [AU, ME]

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Explain Grubblers criterion for plane mechanisms.
2. Write a short note on Coriolis component of acceleration.
3. Write a short note on structural error.
4. List the classification of follower based on the surface in contact.
5. Explain the term contact ratio for a pair of teeth.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Briefly explain the procedure to determine the angular velocity of output link in a four bar mechanism using method of instantaneous centre.
7. Write a short note on pantograph.
8. Explain the procedure for graphical synthesis of a Slider Crank mechanism.
9. Draw the velocity and acceleration diagram when the follower moves with uniform acceleration and retardation.
10. Derive an expression for the velocity ratio of a reverted gear train.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) What are the inversions of a four bar chains ? (8 marks)

(b) Write a short note on mechanical advantage of a four bar mechanism. (4 marks)

Or

12. (a) Write a short note on Ackerman stearing mechanism with neat sketches. (7 marks)

(b) Write a short note on Universal Hooke's Joint. (5 marks)

13. The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from inner dead centre position. Determine velocity of piston and angular velocity of connecting rod.

Or

14. Explain the graphical method of determining the angular velocity and angular acceleration of output crank of a four bar mechanism using velocity and acceleration polygons. Illustrate with an input crank rotating at 500 r.p.m. in the clockwise direction. Consider one link is fixed (AD) = 150 mm. ∠BAD = 60°, AB = 40 mm, BC = 150 mm, CD = 80 mm.

15. Briefly explain a method for the analytical synthesis of a slider crank mechanism.

Or

16. Design a four bar mechanism to cordinate the input and output angles as follows "Input angle = 15°, 30° and 45° output angles = 30°, 40°, 55°. Draw the four bar mechanism.

17. A cam is to give the following motion to a knife edge follower :

60° of cam rotation : outstroke.

30° of cam rotation : Dwell.

60° of cam rotation : Return stroke.

210° of cam rotation : Dwell for remaining follower stroke is 40 mm. Minimum radius of cam 50 mm. follower has uniform velocity during outstroke and return stroke. Draw the profile of the cam when the axis of the follower is offset by 20 mm from the axis of cam shaft.

Or

18. (a) Draw the displacement velocity and acceleration diagram when the follower moves with a cycloidal motion. (8 marks)

(b) Write a short note on polynomial Cams. (4 marks)

19. (a) What are the standard proportions of a 14½° complete or full depth involute system ? (4 marks)

(b) The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20°. Involute profile and the module is 6 mm. If the arc of contact is 1.75 times circular pitch find the addendum. (8 marks)

Or

20. (a) Discuss the working of a Epicyclic gear train. (4 marks)

(b) With neat sketch, briefly explain the working of differentiate gear of an automobile. (8 marks)

[5 × 12 = 60 marks]

F 7038 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Production Engineering/Mechanical Engineering

ME 010 503/PE 010 503—ADVANCED MECHANICS OF MATERIALS (ME, PE)

(Old Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What do you mean by principal stresses and principal planes ?
2. Define plane stress.
3. Define shear centre.
4. What is complementary energy ?
5. What is meant by membrane analogy ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Discuss about the generalised Hooke's law.
7. Write down compatibility equations in terms of Airy's stress function.
8. Locate the shear centre for an unequal I section.
9. Explain the virtual work principle.
10. Explain the warping of non-circular shaft.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. At a point p_1 the rectangular stress components are :

$\sigma_x = 1,\ \sigma_y = -2, \sigma_z = 4, \tau_{xy} = 2, \tau_{yz} = -3$ and $\tau_{xz} = 1$, all units in kPa. Find the principal stresses and their directions. Also check for the invariance.

Or

12. If the displacement field is given by :

$u_x = kxy, u_y = kxy, u_z = 2k\,(x + y)\,z,$

where 'k' is a constant.

(a) Write down the strain matrix.

(b) What is the strain in the direction $n_x = n_y = n_z = 1/\sqrt{3}$?

13. Analyse the bending of a cantilever beam under an end load using polynomial method.

Or

14. Derive the equilibrium equations for plane stress state.

15. Determine the stress components is polar co-ordinates for the stress function $\phi = \frac{P}{\pi} r\theta \cos\theta$.

Or

16. A steel turbine rotor of 750 mm. outer diameter, 150 mm. inner diameter and 50 mm thickness, has 100 blades 150 mm. long, each weighing 4N. It is shrink fitted on a rigid shaft. Calculate the initial shrinkage allowance on the inner diameter of the rotor so that it just loosens on the shaft at 3000 r.p.m. The density of shaft rotor is 7500 kg/m^3. Take modulus of elasticity and Poisson's ratio as 200 GPa and 0.3 respectively.

17. A load of 6 tonne is gradually applied to the centre of a rolled steel beam of uniform section, simply supported at its ends. The span is 3 m. and the moment of inertia is 1509 cm^4. and modulus of elasticity may be taken as 200 GPa. Find the amount of strain energy stored in the beam and the central deflection.

Or

18. A simply supported beam carries a concentrated load 'p' at its centre and a uniformly distributed load of 'w'/m on the whole span. Using Castigliano's second theorem, find the deflection at the centre of the beam. Take the span as 'L' and stiffness as 'EI'.

19. Using two dimensional Laplace equations solve for the torsional equations for an elliptical bar.

Or

20. Show by membrane analogy that a multiply connected section under torsion is much stronger and stiffer compared to a singly connected section of same cross-sectional area.

(5 × 12 = 60 marks)

F 7020 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Fifth Semester

Branch : Automobile Engineering / Mechanical Engineering

AU 010 502/ME 010 502—COMPUTER AIDED DESIGN AND MANUFACTURING
[AU, ME]

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Enumerate the benefits of using CAD.
2. Compare the 2D and 3D wireframe modeling.
3. Explain any *three* miscellaneous codes used in CNC system.
4. What is Group Technology ?
5. Differentiate between Hydraulic and Pneumatic Systems.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Explain the elements of interactive graphics.
7. Differentiate between open loop system and closed loop system with suitable example.
8. Write short note on APT language.
9. Explain the different components of FMS.
10. What are the challenges in application of a robot for welding ?

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Describe the Bresenham's Circle algorithm with a suitable example.

Or

Turn over

12. The vertices of a triangle are situated at points (15, 30), (25, 35) and (15, 45). Find the co-ordinates of the vertices if the triangle is first rotated 100° counter clockwise direction about the origin and then scaled to twice it's size ?

13. Discuss in detail how the usage of computer technology influence the conventional Engineering Design Process.

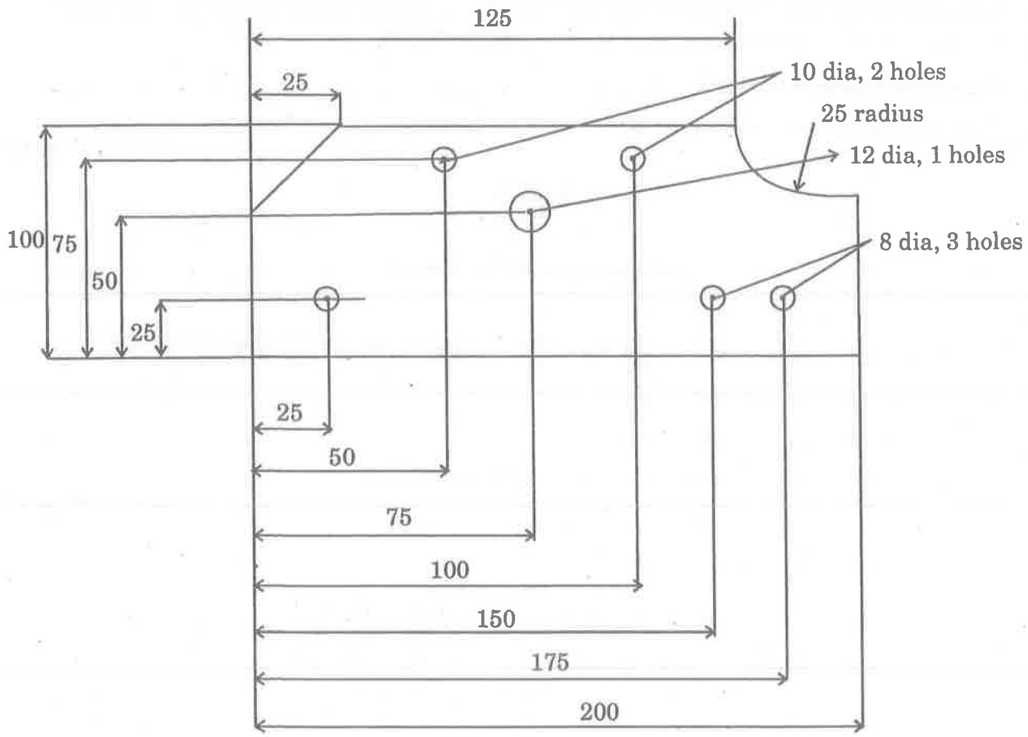
Or

14. Explain the following logic functions using ladder logic diagrams and truth tables :

    (a) OR. (b) AND.

    (c) XOR.

15. The part in figure is to be drilled on a turret drill press. The part is 15 mm. thick. There are three drill size to be used 8 mm., 12 mm. and 10 mm. These drills are to be specified in the part program by tool turret position TO1, TO2 and TO3. All tooling is High-speed steel. Cutting speed is 75 m./min and feed is 0.08 mm./rev. Use the lower left corner of the part as the origin in the XY axes system. Write the part program in the word address format with TAB separation and Variable work order. Use absolute positioning.



All Dimensions in mm.

Or

16. Write an APT part program to perform the machining of a mildsteel plate. Use part geometry and machining data given in the above question (15).

17. What are the steps involved in CAPP ? Explain the different types of CAPP systems.

Or

18. Explain OPITZ and MICLASS Coding System ?

19. Discuss the basic configurations of Industrial robots.

Or

20. Explain the robotic control, drives and actuators of a robotic system applied in manufacturing industry.

(5 × 12 = 60 marks)