F 3718 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2016

Fifth Semester

Branch : Mechanical Engineering / Automobile Engineering

THERMAL ENGINEERING—I (M, U)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Use of Mollier diagram and Steam tables are permitted.

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Calculate the enthalpy of 1 kg. of steam at a pr. of 8 bar and dryness fraction of 0.8.
2. Describe with a neat sketch, water level indicator for a boiler.
3. Discuss the effect of friction during the expansion of steam through a convergent-divergent nozzle when,
   (a) The steam at entry to nozzle is saturated.
   (b) The steam at entry is superheated.
4. What is critical pressure ratio of a nozzle ?
5. What are the essential components of a simple open cycle gas turbine plant.
6. Write a note on intercooling in gas turbine plants.
7. What is the function of a solar collector ? What are the different types ?
8. Write a short note on optical losses.
9. What are the functions of cooling pond and towers ?
10. Write a note on ash handling.

(10 × 4 = 40 marks)

Part B

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

11. Compare water tube boiler and fire tube boiler.

Or

12. Determine the quantity of heat required to produce 1 kg. of steam at a pressure of 6 bar at a temperature of 25 °C, under the following conditions :

    (a) When the steam is wet having a dryness fraction 0.9

    (b) When the steam is dry saturated

    (c) When it is superheated at a constant pressure at 250 °C assuming the mean specific heat of superheated steam to be 2.3 kJ/kg K.

13. Find the percentage increase in discharge from a convergent-divergent nozzle expanding steam from 8.75 bar dry to 2 bar, when (i) the expansion is taking place under thermal equilibrium ; (ii) the steam is in metastable state during part of its expansion.

Or

14. (a) Derive a relation for power produced by a reaction turbine.

    (b) Prove that Parson's reaction turbine is 50 % reaction turbine.

15. Describe the different types of combustion chambers in gas turbine plants.

Or

16. An axial flow compressor, with compression ratio as 4, draws air at 20°C and delivers it at 197°C. The mean blade speed and flow velocity are constant throughout the compressor. Assuming 50 % reaction blading and taking blade velocity as 180 m/s, find the flow velocity and the number of stages. Take work- factor = 0.82, $\alpha = 12°$, $\beta = 42°$ and $C_p = 1.005$ kJ/kg K.

17. Write a note on concentrating type solar collectors with suitable sketches.

Or

18. Write short note on :

    (a) Useful heat gained by fluid.

    (b) Solar water heating.

19. Describe with a neat sketch the layout and operation of a steam power plant.

Or

20. Write notes on :

    (i) Stockers.

    (ii) Draught.

    (iii) Precipitators.

(5 × 12 = 60 marks)

F 3612 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2016

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

AU 010 502 / ME 010 502 COMPUTER AIDED DESIGN AND MANUFACTURING (AU, ME)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. What do you understand by a design workstation ?
2. Differentiate between Incremental and Absolute systems.
3. Explain any three preparatory codes used in CNC systems.
4. Define CAPP.
5. What are stepper motors ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain the working of a CRT monitor.
7. What are the different types of control systems used in NC machines ?
8. Discuss the main aspects of word address format in NC.
9. Explain the concept of JIT used in manufacturing.
10. Explain with neat sketch the working of tactile sensors used in robotic grippers.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. Describe DDA line drawing algorithm with a suitable example.

Or

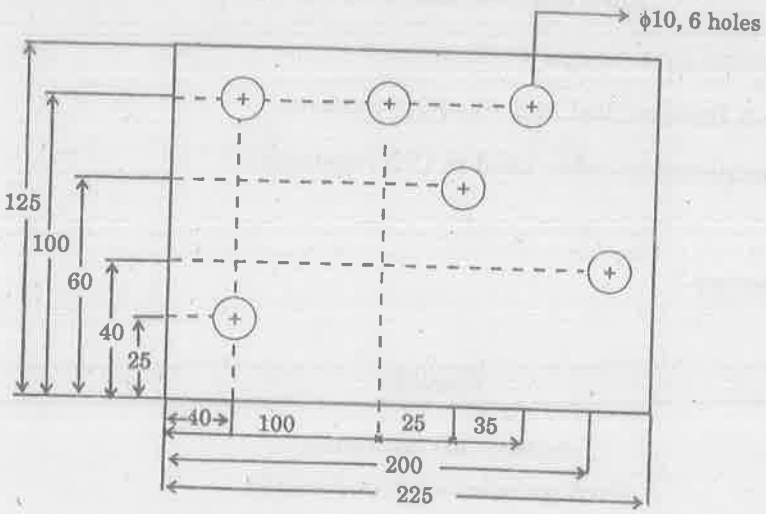
12. Describe all the 2D transformations operation used in CAD.

13. With neat sketches, explain the different feedback devices used in CNC.

Or

14. What are the components of PLC ? Explain the programming of a PLC using a ladder logic diagram for water level controller.

15. Write a part program to drill the holes in the part shown in figure. The part is 12 mm. thick. Cutting speed = 100 m/min. and feed is 0.06 mm/rev. Use the lower left corner of the part as the origin in the X-Y system. Write the part program in the word address format with TAB separation and variable word order. Use absolute positioning.



All dimensions in mm

Or

16. Write an APT part program to perform the drilling of 6 holes on a mild-steel plate. Use part geometry and machining data given in the above Question 15.

17. Define Group Technology. Discuss any one method of G.T. and apply it to a production system.

Or

18. Discuss a few applications of FMS in detail.

19. Explain the different sensors and actuators used in industrial robots.

Or

20. With neat sketch, explain the kinematics and dynamics of robotic system. What are the challenges involved in design of a SCARA robot ?

(5 × 12 = 60 marks)

F 3636 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2016

Fifth Semester

Branch : Automobile Engineering/Mechanical Engineering

AU 010 504/ME 010 504—KINEMATICS OF MACHINERY (AU, ME)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Explain Kutzbach criterion for a planar mechanism.
2. Explain Kennedy theorem for instantaneous centres.
3. Write a short note on precision points used for function generation.
4. List out classification of follower based on the path of motion.
5. Explain the term angle of obliquity.

(5 × 3 = 15 marks)

Part B

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

6. Briefly explain Whitworth quick return motion mechanism with neat sketch.
7. Explain graphical method to find out the velocity of slider in slider crank mechanism.
8. Explain the procedure for the graphical synthesis of four bar mechanism.
9. Draw the velocity, acceleration diagram when the followers moves with SHM.
10. What are the advantages of involute gears and cycloidal gear over one another ?

(5 × 5 = 25 marks)

Part C

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

11. (a) What are the inversions of a slider crank chains ? (6 marks)

(b) Briefly explain the coupler curves and coupler point in case of a four bar mechanism. (6 marks)

Or

Turn over

12. (a) Explain Davis steering gear mechanism with neat sketches. (8 marks)

(b) Write a short note on transmission angle. (4 marks)

13. Consider a four bar mechanism ABCD where the link AD is fixed. The length of links AB, BC & CD are 300 mm., 360 mm. and 360 mm. respectively. Angle DAB is (angle substended by input crank) 60°. The length of fixed link is 600 mm. If the input crank AB has angular velocity of 10 rad/sec. and angular acceleration of 30 rad/sec.^{2} both clockwise. Determine angular velocity and angular acceleration of output crank CD ?

Or

14. Illustrate the need of a Coriolis component of acceleration in a slider crank quick return mechanism. Also sketch the possible directions of Coriolis component of acceleration.

15. Briefly explain a method for the analytical synthesis of a four bar mechanism.

Or

16. Determine the proportions of a four bar mechanism by using three precision points to generate a function $y = x^{1.5}$ where x varies between 1 and 4. Assume $\theta_s = 30°$, $\phi_s = 90°$ and $\Delta\phi = 90°$. Take length of fixed link AD as 25 mm. Draw the four bar mechanism.

17. A cam drives a flat reciprocating follower in the following manner :

During first 120° rotation of cam, follower moves outward through a distance of 20 mm. with SHM. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inward with SHM. The follower dwells for next 90° of cam rotation minimum radius of cam is 25 mm. Draw the profile of the cam.

Or

18. (a) Write a short note on convex shaped cams with footed followers. (5 marks)

(b) Draw the velocity and acceleration diagram when the follower moves with uniform acceleration and retardation and derive an expression for maximum acceleration of the follower during return stroke. (7 marks)

19. A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm. are in mesh. The smaller gear rotates at 1000 r.p.m. Determine sliding velocities at engagement and at disengagement of pair of teeth and also find contact ratio.

Or

20. In an epicyclic gear train an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of gear A which is fixed. Determine the speed of gear B. If gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction. What wil be the speed of gear B ?

(5 × 12 = 60 marks)

F 3651 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2016

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)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Why four-stroke engines are more fuel efficient ?
2. Give the stoichiometric combustion equation for C_8H_{18}.
3. What are the effects of dissociation ?
4. Distinguish between ignition lag and ignition delay.
5. What is DPF ? How it is regenerated ?

(5 × 3 = 15 marks)

Part B

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

6. Explain the working of DTSi with a diagram.
7. Explain, how charge Stratification is obtained in a GDI system ?
8. Give the advantages of pressurized cooling system with an example.
9. What is the difference between pre-ignition and surface ignition ?
10. What is a Drive cycle ? Explain with an example.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. (a) Write a brief comparison of two-stroke engines and four-stroke engines.

    (b) Discuss the effect of ignition timing variation on combustion.

Or

12. (a) Explain, why a good SI engine fuel is a bad CI engine fuel ?

    (b) With a suitable sketch, explain the working of a stratified charge engine.

13. With suitable sketch, explain the following circuits in a Solex carburetor :

    (a) Idling. (b) Slow speed and part load.

    (c) Acceleration. (d) Cruising.

Or

14. Calculate the stoichiometric Air-Fuel ratio for the following fuels :

    (a) Ethanol. (b) Methanol.

    (c) LPG. (d) CNG.

15. Briefly discuss the working of an ORSAT apparatus with a suitable sketch.

Or

16. Explain the working of a VGT with a sectional diagram.

17. Describe the various stages of combustion in a CI engine with the help of Pθ diagram and a Heat release diagram.

Or

18. Explain the various factors (Like temperature, pressure, fuel composition) affecting the delay period in a CI engine.

19. What are the different sources of pollutants from an SI engine ? Discuss the working an SCR used in modern cars.

Or

20. What are the major reasons for excess soot from a CI engine ? Briefly explain the mechanism of soot formation in a Diesel engine.

(5 × 12 = 60 marks)

F 3664 (Pages : 3) **Reg. No**.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2016

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

ME 010 506/AU 010 506—THERMODYNAMICS (ME, AU)

(New Scheme—2010 Admission onwards)

(Regular/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. What is a Control Volume ?
2. Define Thermometric property. What is a fixed point ?
3. Draw a block diagram, showing the four energy interactions of a cyclic heat engine.
4. State the Maxwell equations.
5. What is dryness fraction ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain Quasi Static process with a plot.
7. Show that work is a path function and not a property.
8. Can you use the same plant as a heat pump in winter and as a refrigerator in summer ? Explain.
9. Derive the equation : $\left(\partial C_p / \partial p\right)_T = -T\left(\partial^2 V / \partial T^2\right)_p$.
10. What are saturation states ? Explain.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Write Down the van der Waal equation of state. How does it differ from ideal gas equation of state ? What is force of cohesion ? What is co-volume ?

(b) What is the concept of continuum ? How will you define density and pressure using this concept ?

Or

12. Calculate the volume of 2.5 kg moles of steam at 236.4 atm and 776.76 K with the help of compressibility factor versus reduced pressure graph. At this volume and given pressure, what would be the temperature be in K, if steam behaved like a van der Waal gas?

13. Water is being heated in a closed pan on top of a range while being stirred by a paddle wheel. During the process, 30 kJ of heat is transferred to the water, and 5 kJ of heat is lost to the surrounding air. The paddle-wheel work amounts to 500 N · m . Determine the final energy of the system if its initial energy is 10 kJ.

Or

14. The properties of a certain fluid are related as follows :

$$u = 196 + 0.718\,t$$
$$pv = 0.287\,(t + 273)$$

Where u is the specific internal energy (kJ/kg), t is in °C, p is pressure (kN/m^2), and v is the specific volume (m^3/kg). For this fluid, find C_v and C_p.

15. (a) An inventor claims to have developed an engine that takes in 105 MJ at a temperature of 400, rejects 42 MJ at a temperature of 200, and delivers 15 kWh of mechanical work. Would you advise investing money to put this engine in the market ?

(b) Using an engine of 30% thermal efficiency to drive a refrigerator having a COP of 5, what is the heat input into the engine for each MJ removed from the cold body by the refrigerator ?

Or

16. Discuss the various causes of irreversibility.

17. Derive general equations for Internal Energy and Enthalpy changes.

Or

18. Determine the enthalpy change and the entropy change of oxygen per unit mole as it undergoes a change of state from 220 K and 5 MPa to 300 K and 10 MPa :

(i) By assuming ideal-gas behaviour ; and

(ii) By accounting for the deviation from ideal-gas behaviour.

19. A rigid tank contains 2 kmol of N_2 and 6 kmol of CO_2 gases at 300 K and 15 MPa. Estimate the volume of the tank on the basis of :

(i) The ideal-gas equation of state ;

(ii) Kay's rule ;

(iii) Compressibility factors and Amagat's law ; and

(iv) Compressibility factors and Dalton's law.

Or

20. Saturated air leaving the cooling section of an air-conditioning system at 14°C at a rate of 50 m^3/min is mixed adiabatically with the outside air at 32°C and 60 percent relative humidity at a rate of 20 m^3/min. Assuming that the mixing process occurs at a pressure of 1 atm, determine the specific humidity, the relative humidity, the dry-bulb temperature, and the volume flow rate of the mixture.

(5 × 12 = 60 marks)