G 1359 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering (Elective I) [M]

WELDING TECHNOLOGY (Elective I) [M]

(Old scheme—Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Briefly explain the difference between Soldering and Brazing.
2. State the different types of solders.
3. Sketch an oxidizing flame and brief.
4. Explain rightward welding technique.
5. Briefly explain the welding positions.
6. Sketch submerged arc welding.
7. Brief Ultrasonic welding.
8. What are the applications of Electron beam welding.
9. What is HAZ ? Sketch HAZ.
10. Explain Magnetic particle testing.

(10 × 4 = 40 marks)

Part B

Each question carried 12 *marks.*

11. (a) (i) Explain aluminium soldering. (6 marks)

(ii) What are the advantages and limitations of brazing. (6 marks)

Or

(b) (i) Explain Forge welding. (6 marks)

(ii) Explain Flashbutt welding. (6 marks)

12. (a) (i) Explain the different types of flames with a neat sketch. (8 marks)

(ii) Explain the weldability of stainless steel. (4 marks)

Or

Turn over

(b) Explain Oxy-acetylene welding equipment with a sketch. (12 marks)

13. (a) (i) Explain heat distribution in an electric arc welding. (6 marks)

(ii) Explain MIG welding. (6 marks)

Or

(b) (i) Explain welding symbols with sketches. (6 marks)

(ii) Explain shielded metal arc welding with a neat sketch. (6 marks)

14. (a) Explain Electroslag welding with a neat sketch. (12 marks)

Or

(b) Explain Laser beam welding with a neat sketch. (12 marks)

15. (a) Explain welding residual stresses and ways to eliminate them. (12 marks)

Or

(b) (i) Explain the various types of destructive and Nondestructive tests. (6 marks)

(ii) Explain Ultrasonic and Dye-penetrant tests. . (6 marks)

[5 × 12 = 60 marks]

G 1070 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Automobile Engineering/Mechanical Engineering

AU 010 704 / ME 010 704—REFRIGERATION AND AIR CONDITIONING (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. Define Unit of refrigeration.
2. What is Cascading ?
3. Write a note on properties of refrigerant ?
4. What is a float valve ?
5. Define human comfort.

(5 × 3 = 15 marks)

Part B

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

6. Explain the working of a heat pump with a neat sketch.
7. Explain multistage vapour compression system.
8. Briefly explain thermoelectric refrigeration.
9. Explain semi-hermetic refrigeration compressor.
10. Write a note on Humidifiers.

(5 × 5 = 25 marks)

Part C

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

11. Explain Bell Coleman cycle with a neat sketch. (12 marks)

Or

Turn over

12. A Carnot refrigeration cycle absorbs heat at –12°C and rejects it at 40°C :

(a) Calculate the coefficient of performance of this refrigeration cycle.

(b) If the cycle is absorbing 15 kW at the –12°C temperature, how much power is required ?

(c) If a Carnot heat pump operates between the same temperatures as the above refrigeration cycle, what is the performance factor ?

(d) What is the rate of heat rejection at the 40°C temperature if the heat pump absorbs 15 kW at the –12°C temperature ?

(3 + 3 + 3 + 3 = 12 marks)

13. Explain a simple vapour compression system with a neat sketch. (12 marks)

Or

14. (a) Write short note on advanced vapour compression systems. (6 marks)

(b) What is a flash chamber ? What are its advantages ? (6 marks)

15. (a) Explain Cryogenic refrigeration. (6 marks)

(b) Write notes on Unit air conditioners and water coolers. (6 marks)

Or

16. (a) Write short note on ice plant. (6 marks)

(b) Write short note on cold storage. (6 marks)

17. (a) Explain the effect of inter-cooling in reciprocating compressors. (6 marks)

(b) Explain about open type refrigeration compressors. (6 marks)

Or

18. (a) Write short notes on thermostatic expansion valve. (6 marks)

(b) Write short note on reciprocating compressors. (6 marks)

19. (a) Write short notes on design of winter and summer air conditioning. (6 marks)

(b) Write short notes on design of air duct systems. (6 marks)

Or

20. Explain in detail centralised air-conditioning system. Write down the differences between unitary and central air conditioning systems.

(12 marks)

[5 × 12 = 60 marks]

G 1035 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Automobile Engineering

AU 010 701/ ME 010 701—DESIGN OF MACHINE ELEMENTS (AU, ME)

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Use of approved Design Data book is permitted.
Any missed data may suitably be assumed.
Answer **all** *questions.*
Each question carries 25 *marks.*

1. A SAE 1045 steel rod of σ_y = 309.9 M Pa with 80 mm diameter is subjected to a bending moment of 3 kN-m and torque T. Taking factor of safety as 2.5, find the maximum value of torque 'T' that can be safely carried by rod according to : (i) Maximum normal stress theory ; (ii) Maximum shear stress theory.

Or

2. A simply supported shaft carries a pulley at the center. The torque on pulley varies between 120 N-m and 200 N-m and the bending moment varies between 300 N-m and –150 N-m. The material of shaft has an ultimate stress of 600 MPa and yield stress of 450 MPa. Endurance stress may be taken as half the ultimate stress. The stress concentration factor for the shaft is 1.3 in bending and 1.2 in torsion. Take factor of safety as 1.8. The size and surface factors are 0.83 and 0.9 respectively.

3. Design a triple riveted zigzag lap joint to connect two plates each 12 mm thick. Draw a neat sketch of the joint.

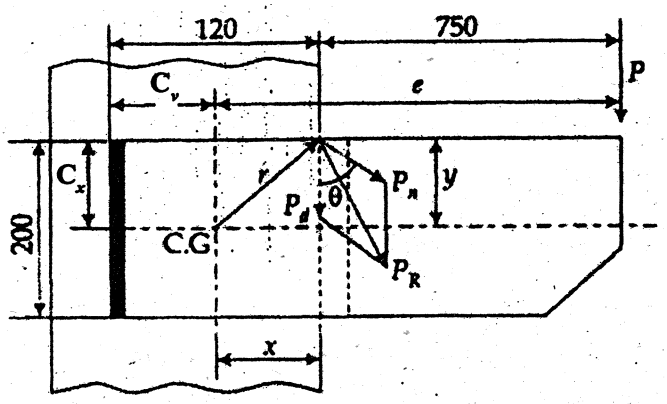
Or

4. A sluice gate weighing 500 kN is raised at a speed of 6 m/min by two screw rods with square threads 50 × 8 mm. The two screw rods are driven by bevel gears and motor.

   Determine : (i) torque required to raise the gate ; (ii) Speed of rotation of the screw rod assuming the threads are triple start ; (iii) maximum stresses induced in the screw ; (iv) efficiency of the screw ; (v) Length of nuts required to support to load taking the allowable bearing pressure as 12 MPa ; (vi) check for overhaul.

Turn over

5. Determine the load carrying capacity of a welded joint as shown in figure below. The size of weld is 10 mm and allowable shear stress in the weld is 66 MPa.



Or

6. Design a helical spring for a safety valve. The valve must blow off at a pressure of 1.2 MPa and should lift by 3 mm for 5 % increase in pressure. The valve diameter is 60 mm. The maximum allowable shear stress is 400 MN/m^2 and the modulus of rigidity is 82.7 GPa. Assume the spring index as 8.

7. A steel shaft 0.9 m long between bearings receives power of 18 kW at 900 r.p.m through a 20° involute gear of 2mm module and 100 teeth located at 250 mm to the left of the left bearing and is driven by a gear placed directly behind it. The power is transmitted by a 400 mm diameter pulley to another pulley placed behind and above it at an angle of 45° to horizontal. The pulley is located at a distance of 300 mm to the left of right bearing. The tension ratio is 2.7. Design a hollow shaft taking allowable shear stress as 72 MPa and diameter ratio as 2.0.

Or

8. Design a protected type flange coupling to transmit power between two shafts 40 mm and 50 mm. The allowable shear stress for shaft and bolts is 60 MPa. The allowable shear stress and bearing stress for key are 54 MPa and 120 MPa respectively. For CI flange, the allowable shear stress is 6 MPa.

(4 × 25 = 100 marks)

G 1329 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering

DYNAMICS OF MACHINERY (M)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Explain the need for balancing. Name the types of balancing machines.
2. Explain : (i) Hammer blow ; and (ii) Swaying couple as applied to balancing of locomotives.
3. Obtain an expression for the natural frequency of a simple pendulum neglecting the weight of the rod.
4. Derive the relationship between Logarithmic decrement and damping ratio.
5. State and prove Maxwell's reciprocal theorem.
6. If the force transmitted to the foundation of a machine operating at 480 r.p.m. is 10 % of the impressed force in the absence of a damper, determine the natural frequency of the machine.
7. Obtain an expression for the 'Torsionally equivalent Shaft' in a shaft with several steps.
8. Explain jump phenomenon in nonlinear vibrations.
9. Describe how sound pressure can be expressed in decibel (dB) ?
10. Explain Doppler effect as applied to acoustics.

(10 × 4 = 40 marks)

Part B

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

11. A rotating shaft carries four masses 1, 2, 3 and 4 which are radially attached to it. The mass centers are 30 mm, 38 mm, 40 mm. and 35 mm. respectively from the axis of rotation. The masses 1, 3 and 4 are 7.5, 5, and 4 kg. respectively. The axial distance between the planes 1 and 2 is 400 mm and between 2 and 3 is 500 mm. The masses 1 and 3 are at right angles to each other. Find for complete balance, (i) Angle between 1, 2 and 1, 4 ; (ii) Axial distance between 3 and 4 ; (iii) Magnitude of mass 2.

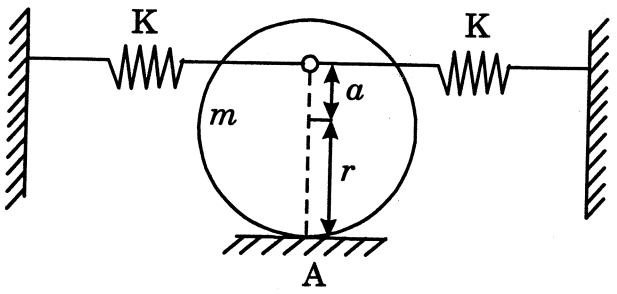
Or

Turn over

12. An engine has two cylinders in the form 'V'. The centre line of the cylinders being in one plane and inclined at 45° on either side of the vertical. The two connecting rods work on the same crank. The mass of the reciprocating parts per cylinder is 0.5 kg. Crank radius is 45 mm. Connecting rod is 167.5 mm. Show that if a suitable balancing mass is attached to the crank shaft, the primary forces can be reduced to zero.

    For this value of this balance mass, find the greatest out of balance secondary force actingon the engine in horizontal direction when the speed is 3000 r.p.m.

13. Determien the natural frequency of the system shown in Fig. using (i) Newtons method ; and (ii) Energy method :



Or

14. A mechanical vibrating system has mass of 10 kg. and stiffness of springs 5 N/mm along with a dashpot which exerts a force of 40 N when the mass has a velocity 1 m./sec. Determine ; (a) Critical damping coefficient ; (b) Damping factor ; (c) Frequency of damped vibrations (d) Logarithmic decrement ; and (e) Ratio of any two successive amplitudes.

15. Write a note on vibration isolation and transmissibility. Hence derive an expression for the transmissibility in terms of frequency ratio and damping factor. Also discuss the graph.

Or

16. A reciprocating machine of mass 75 Kg. is mounted on springs of stiffness 1176 KN/m. and a damper of damping factor 0.2. The slider of mass 2 Kg. within the machine has a reciprocating motion with a stroke of 0.08 m. The speed is 3000 r.p.m. Assuming the motion of the piston to be harmonic, determine ; (i) Amplitude of vibration of the machine ; (ii) Transmissibility ratio ; and (iii) Force transmitted to the foundation. Is vibration isolation achieved ? If so how ?

17. An engine drives a centrifugal pump through a 2 :1 speed reducer gear box. The mass moment of inertia of the engine flywheel and the pump impeller are 500 kg-m^2. and 60 kg-m^2. respectively. The length and diameter of the engine shaft are 250 mm. AND 50 mm. respectively. The length andD diameter of the pump impeller shaft are 150 mm. and 40 mm. respectively. The rigidity modulus of the shaft material is 80 Gpa. Determine the natural frequencies and location of node.

Or

18. An apparatus of mass m supported on springs of stiffness k is shipped in a container. In the process of unloading, the container is dropped from a height h to a hard floor. Find the response of the system.

19. How decibel is defined ? Using appropriate equations describe the following :

    (a) Sound power level.

    (b) Sound intensity level

    (c) Sound pressure level. Also specify the reference quantities and their values chosen to define the above scales.

Or

20. Give a brief account on the major industrial noise sources. Explain 'noise control at source'. List the methods and explain any one.

(5 × 12 = 60 marks)

G 1318 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering/Automobile Engineering

REFRIGERATION AND AIR CONDITIONING (MU)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Use of Reference and Accounts Tables and Charts and steam tables are permitted.

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Prove that $(COP)_{HP} = (COP)_R + 1$.
2. A refrigerator system operates on the reversed Carnot cycle. Higher temperature of the refrigerant is 35° C and the lower temperature is – 15° C. The capacity is to be 12 Tons. Neglect all losses. Determine : (i) COP and (ii) heat rejected per hour from the system.
3. Explain the effect of sub-cooling and superheating on COP of vapour compression refrigeration system.
4. Show the actual vapour compression refrigeration cycle on T-S and P-h chart.
5. Explain the working principle of Electrolux refrigeration system.
6. Distinguish between magnetic refrigeration and thermo electric refrigeration system.
7. Explain the working of thermostatic expansion valve.
8. Write a short note on vane type compressor.
9. Define : (a) DBT ; and (b) WBT.
10. Explain the principle of central air-conditioning system

(10 × 4 = 40 marks)

Turn over

Part B

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

11. An air refrigeration open system operating between 1 Mpa and 100 kpa is required to produce a cooling effect of 2000 kJ/min. Temperature of the air leaving the cold chamber is – 5° C and leaving the cooler is 30° C. Neglect losses and clearance in the compressor and expander. Determine :

    (a) Mass of air circulated per/min.

    (b) Compressor work, expansion work and cycle work.

    (c) COP and power required in kW.

(12 marks)

Or

12. An air refrigerator system operating on open cycle is required to produce 25 Ton of refrigeration with a cooler pressure of 12 bar and refrigerator pressure of 1 bar. The temperature of the air leaving the cooler is 25° C and the air leaving the room is 0° C. Assume the cycle with isentropic compression with $\square$ =1.41 and polytropic expansion with n = 1.35 and with no compression clearance. Determine (a) Mass of air circulated / min ; (b) Compressor and expander displacement required / min ; and (c) COP.

(12 marks)

13. A food storage locker requires a refrigeration system of 2400 kJ/min capacity at an evaporator temperature of 263 K and a condenser temperature of 303 K. The refrigerant used is Freon-12 and is sub cooled by 6°C before entering the expansion valve and vapour is superheated by 7°C before leaving the evaporator coil. The compression of refrigerant is reversible adiabatic. The compressor is two cylinder single acting with stroke equal to 1.25 times the bore and operates at 1000 r.p.m. Determine : (a) refrigeration effect / kg ; (b) Mass of refrigerant circulated / min ; (c) Theoretical piston displacement per /min ; and (d) Bore and stroke of the compressor.

(12 marks)

Or

14. A 10 Ton ammonia ice plant operates between an evaporator temperature of –15° C and condenser temperature of 35° C. The ammonia enters the compressor as dry and saturated vapour. Assuming isentropic compression determine : (a) Mass flow rate of ammonia ; (b) COP of the plant ; and (c) Tons of ice at –10° C produced from water at 25°C in a day.

(12 marks)

15. Explain with a neat sketch the working of steam jet refrigeration system. List the advantages over Electrolux system.

(4 + 6 + 2 marks)

Or

16. Differentiate between physical and thermo-chemical properties of refrigerant. Explain which properties are more important giving specific examples.

(6 + 6 marks)

17. (a) Compare the working of float valve with solenoid valve. (6 marks)

(b) Explain the working of screw Compressor. (6 marks)

Or

18. Explain the working of : (a) Dry expansion valve evaporator ; and (b) Natural convection evaporator.

(6 + 6 marks)

19. (a) Explain the working of winter air conditioning system. (6 marks)

(b) Explain any one method for duct design. (6 marks)

Or

20. A summer air conditioning system for hot and humid weather (DBT = 32° C and RH = 70 %) consists in passing the atmospheric air over a cooling coil where the air is cooled and dehumidified. The air leaving the cooling coil is saturated at the coil temperature. It is then sensibly heated to the required comfort condition of 24° C and 50 % RH by passing it over an electric heater and then delivered to the room. Sketch the flow diagram of the process undergone by the on a psychrometric chart and determine : (a) The temperature of the cooling coil ; (b) The amount of moisture removed per kg of dry air in the cooling coil ; (c) the heat removed per kg of dry air in the cooling coil ; and (d) the heat added per kg of dry air in heating coil

(5 × 12 = 60 marks)

G 1299 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering

GAS DYNAMICS AND JET PROPULSION (M)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Use of approved Gas tables and charts are permitted.

Part A

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

1. With usual notations and suitable supporting diagram, derive continuity equation for 1-D compressible steady flow conditions.
2. Draw the Mach cone and indicate various zones.
3. Differentiate between nozzle and diffuser.
4. Draw the variation of Mach number along the length of a convergent-divergent duct when it acts as a : (a) Nozzle ; (b) Diffuser.
5. Explain what is meant by stagnation properties of fluid and supersonic flow.
6. For constant area Fanno flow, how limiting length of pipe is determined ?
7. What is the effect of Mach number on compressibility ? Justify with equations.
8. Distinguish between nozzle and diffuser.
9. Compare the constructional features and operating performance of turboprop and turbojet engines.
10. With suitable supporting diagrams, explain the solid and liquid propellant system in rockets.

(10 × 4 = 40 marks)

Part B

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

11. (a) An aircraft flying at an altitude of 8 km where the ambient temperature is 250 K. Find the Mach number and classify as subsonic or supersonic when the speed of the aircraft is : (i) 30 m/s ; (ii) 300 m/s ; and (iii) 1000 m/s.

Turn over

(b) A test plane has attained a speed of M = 2.2 at an altitude of 16 km, where the temperature is approximately – 56°C. Assuming $\gamma = 1.4$ and R = 290 J/kg K. Determine the speed of airplane in m/s.

(8 + 4 = 12 marks)

Or

12. (a) Air flows through a duct. The pressure and temperature at station 1 are $p_1 = 0.7$ atmosphere and $T_1 = 30°C$, respectively. At a second station, the pressure is 0.5 atmospheres. Calculate the temperature and density at the second station. Assume the flow to be isentropic.

(b) Write short notes on effect of Mach number on compressibility.

(6 + 6 = 12 marks)

13. (a) Air approaches a symmetrical wedge ($\delta = 15°$) at a Mach number of 2.0. Determine for the strong waves : (a) wave angle ; (b) pressure ratio ; (c) density ratio ; (d) temperature ratio and (e) downstream Mach number.

Verify these values using Gas tables for normal shocks.

(b) Show graphically the variation of Mach number across a convergent-divergent nozzle.

(9 + 3 = 12 marks)

Or

14. (a) A De Laval nozzle has to be designed for an exit Mach number of 1.5 with an exit diameter of 200 mm. Find the required ratio of throat area to exit area. The reservoir conditions are given as $p_0 = 1$ atmg ; $T_0 = 20$ °C. Find also the maximum mass flow rate through the nozzle. What will be the exit pressure and temperature ?

(b) Explain for a convergent nozzle the variation of pressure and Mach number when the back pressure is gradually lowered from stagnation pressure.

(7 + 5 = 12 marks)

15. The state of a gas ($\gamma = 1.3$, R = 0.469 kJ/kg K) upstream of a normal shock wave is given by the following data : $M_x = 2.5$, $P_x = 2$ bar, $T_x = 275$ K. Calculate the Mach number, pressure, temperature, and velocity of the gas downstream of the shock ; check the calculated values with those given in the gas tables.

(12 marks)

Or

16. (a) Prove that in a Rayleigh line at maximum entropy point Mach number is unity.

(b) Air at pressure of 3.5×10^5 N/m^2 and a temperature of 300 K is to be transported at the rate of 0.090 kg/s over a distance of 600 m through a pipe, the final pressure is to be atleast 1.40×10^5 N/m^2. Assuming isothermal flow and $f = 0.004$, determine the minimum pipe diameter.

(5 + 7 = 12 marks)

17. (a) Nitrogen gas passes through a normal shock with upstream conditions of p_1 = 300 kPa, T_1 = 303 K and V_1= 923 m/s. Determine the velocity V_2, and pressure p_2, downstream of the shock. If the same deceleration from V_1 to V_2 takes isentropically what will be the resultant p_2?

(b) Define strength of a shock wave.

(8 + 4 = 12 marks)

Or

18. (a) Consider a pipe in which air at 300 K and 1.5 × 10^6 N/m^2 flows uniformly with a speed of 150 m/s. The end of the pipe is suddenly closed by a valve, and a shock wave is propagated back into the pipe. Compute the speed of the wave and the pressure and temperature of the air which has been brought to rest.

(b) Starting from energy equation derive Prandtl-Meyer function.

(7 + 5 = 12 marks)

19. Air enters a turbojet engine at 80 kPa, 240 K and an inlet velocity of 280 m/s. The pressure ratio across the compressor is 8. The turbine inlet temperature is 1200 K and the pressure at nozzle exit is 80 kPa. The work developed by the turbine equals the compressor work input. The diffuser, compressor, turbine and the nozzle processes are isentropic and there is no pressure drop for flow through the combustor. For operation at steady state, determine the velocity at the nozzle exit and the pressure at each principal state. Neglect kinetic energy at the exit of all components except the nozzle and neglect potential energy throughout.

(12 marks)

Or

20. (a) With T-S diagram explain, the working of turbo-jet system.

(b) Give the differences with merits and demerits of turbo-prop and turbo-jet engines.

(7 + 5 = 12 marks)

[5 × 12 = 60 marks]

G 1124 (Pages : 4) Reg.No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering

ME 010 706 L03—THEORY OF VIBRATION (Elective II) (ME)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Explain the importance of Vibration in engineering ?
2. Discuss briefly structural damping.
3. What is transmissibility ? Explain briefly.
4. Write a note on analysis of double pendulum.
5. Describe briefly longitudinal vibrations of bars.

(5 × 3 = 15 marks)

Part B

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

6. Define the following :—
   (i) SHM. (ii) Damping.
   (iii) Phase difference. (iv) Resonance.
   (v) Discrete Systems.
7. Discuss the uses of Critical Damping.
8. What is Vibration isolation ? Name few materials used for Vibration isolation.
9. Explain forced vibration of *two* degrees of freedom system.
10. Describe the transverse vibration of beams.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. Determine the natural frequency of spring mass system shown in Fig. 1 below :

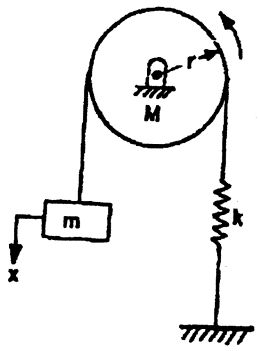


Fig. 1

Or

12. A homogenous solid cylinder of mass 'M' is linked by a spring of constant 'k' N/m and is resting on an inclined plane as shown in Fig. 2. If it rolls without slipping determine its natural frequency of oscillation θ.

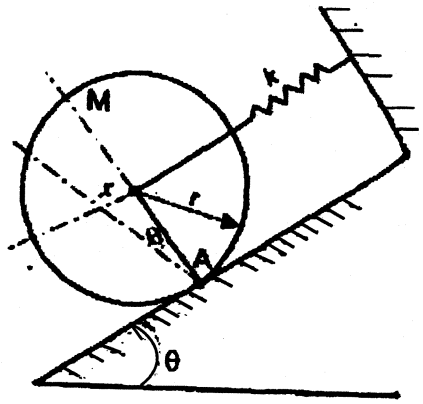


Fig. 2

13. A mass of 10 kg is kept on two slabs of isolators place one over the other. One of the isolators is of rubber having a stiffness of 3 kN/m and damping coefficient of 100 N-sec/m while the other isolator is of felt with stiffness of 12 kN/m and damping coefficient of 300 N-sec/m. If the System is set in motion in vertical directions, determine the damped and undamped natural frequencies of the system.

Or

14. Determine suitable expression for equation of motion of the damped vibratory system shown in Fig. 3 below. Find the critical damping coefficient when a = 0.10 m, b = 0.13 m, k = 4900 N/m and M = 1.5 kg.

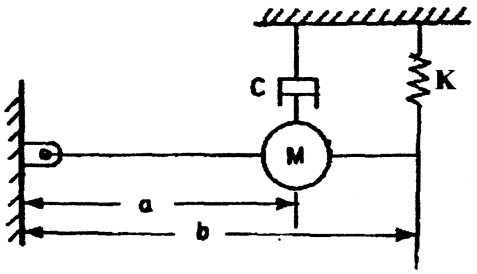


Fig. 3

15. A trailer has 1000 kg mass when fully loaded and 250 kg when empty. The stiffness of suspension is 350 kN/m. The damping factor is 0.5 when the trailer is fully loaded. The speed is 100 km/hr. The road varies sinusoidally with a wavelength of 0.5 m. Determine the amplitude ratio of the trailer when fully loaded and empty.

Or

16. A machine of mass 1000 kg is supported on springs which deflect 8mm under the static load. With negligible damping the machine vibrates with an amplitude of 5 mm when subjected to a vertical harmonic force at 80 % of the resonant frequency when a damper is fitted it is found that the resonant amplitude is 2 mm. Find (i) the amplitude of damping force ; (ii) damping coefficient.

17. In Fig. 4 shown below, find the natural frequency of car with the following conditions :—

(i) Total mass of the car – 300 kg.

(ii) Wheel base – 3.0 m.

(iii) C.G. – 1.5 m from front axle

(iv) Radius of Gyration – 1.0 m.

(v) Spring constants – 70×10^3 N/m for both front and rear springs.

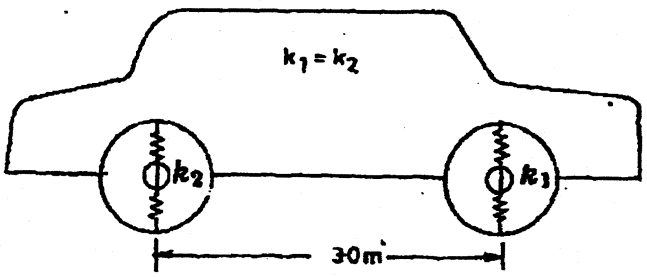


Fig. 4

Or

Turn over

18. Derive the equation of motion of the vibratory system shown in Fig. 5 below: Determine the natural frequencies for given data : (i) k_1 = 98000 N/m ; m_1 = 196 kg. ; (ii) k_2 = 19600 N/m ; m_2 = 49 kg.

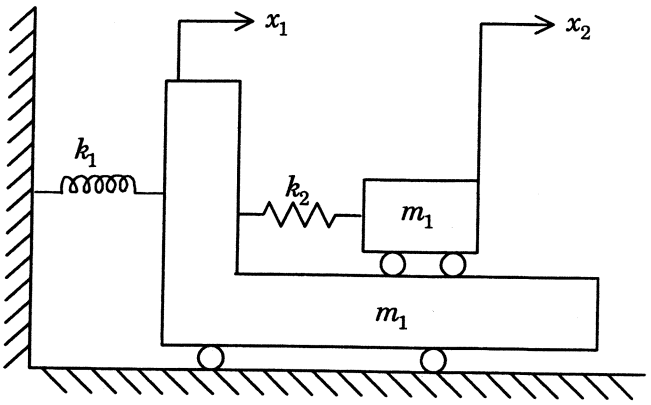


Fig. 5

19. With a neat sketch, explain the longitudinal Vibration of bars and hence derive the wave equation.

Or

20. A uniform string of length l and a large initial tension 'S', stretched between two supports, is displaced laterally through a distance 'a_o' at the center as shown in Fig. 6 below. It is released at t = 0 ; Find the equation of motion for the string :

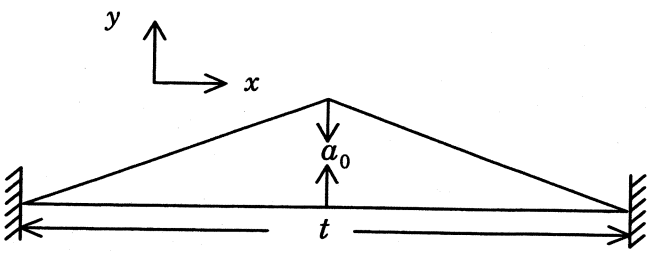


Fig. 6

(5 × 12 = 60 marks)

G 1065 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering

ME 010 703—GAS DYNAMICS AND JET PROPULSION (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. How will you classify the compressible flow based on Mach number range ?
2. Differentiate between Fanno and Rayleigh flow.
3. Deduce an expression for sonic velocity in terms of the properties of air.
4. Define thrust, power and propulsive efficiency of aircraft system.
5. With neat sketch explain the working of scramjet engine.

(5 × 3 = 15 marks)

Part B

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

6. With usual notations and suitable supporting diagram, derive continuity equation for 1-D compressible steady flow conditions.
7. Differentiate between nozzle and diffuser.
8. Explain what is meant by stagnation properties of fluid and supersonic flow.
9. What is the effect of Mach number on compressibility ? Justify with equations.
10. Compare the constructional features and operating performance of turboprop and turbojet engines.

(5 × 5 = 25 marks)

Part C

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

11. (a) During a flight, a fighter aircraft attains its cruise speed of 600 m/s at 10 km altitude after taking off at 150 m/s from sea level. Assuming the speed to have increased linearly with altitude during the climb, compute the variation in Mach number with altitude.

Turn over

(b) Deduce an expression for sonic velocity in terms of the properties of air.

(7 + 5 = 12 marks)

Or

12. (a) Air flows through a duct. The pressure and temperature at station 1 are p_1 = 0.7 atmosphere and T_1 = 30°C, respectively. At a second station, the pressure is 0.5 atmospheres. Calculate the temperature and density at the second station. Assume the flow to be isentropic.

(b) Write short notes on effect of Mach number on compressibility.

(6 + 6 = 12 marks)

13. (a) A gas (γ = 1.4, R = 0.287 kJ/kgK) at a Mach number of 1.8, p = 0.8 bar and T = 373 K passes through a normal shock. Determine its density after the shock. Compare this value in an isentropic compression through the same pressure ratio.

(b) Derive an expression for mass flow rate through varying cross sectional passage for isentropic flow in terms of pressure ratio.

(6 + 6 = 12 marks)

Or

14. (a) A De Laval nozzle has to be designed for an exit Mach number of 1.5 with an exit diameter of 200 mm. Find the required ratio of throat area to exit area. The reservoir conditions are given as p_0 = 1 atmg ; T_0 = 20 °C. Find also the maximum mass flow rate through the nozzle. What will be the exit pressure and temperature ?

(b) Explain for a convergent nozzle the variation of pressure and Mach number when the back pressure is gradually lowered from stagnation pressure.

(7 + 5 = 12 marks)

15. (a) A straight pipe of 0.05 m diameter is attached to a large air reservoir at pressure 13.8 × 10^5 N/m^2 and temperature 310 K. The exit of the pipe is open to atmosphere. Assuming adiabatic flow with an average friction coefficient of 0.005, calculate the pipe length necessary to obtain a mass flow rate of 2.25 kg/s.

(b) What are the effects of heat addition and removal from a gas during Rayleigh flow ?

(6 + 6 = 12 marks)

Or

16. (a) Prove that in a Rayleigh line at maximum entropy point Mach number is unity.

(b) Air at pressure of 3.5 × 10^5 N/m^2 and a temperature of 300K is to be transported at the rate of 0.090 kg/s over a distance of 600 m through a pipe. The final pressure is to be atleast 1.40 × 10^5 N/m^2. Assuming isothermal flow and f = 0.004, determine the minimum pipe diameter.

(5 + 7 = 12 marks)

17. (a) Prove that for a normal shock $\frac{Py}{Px} = \left(1 + KM_x^2\right)\left(1 + KM_y^2\right)$ where K is the ratio of specific heats for air.

(b) A normal shock moves in a constant area tube as shown in Fig (1). In region 1, V_1 = 100 m/s, T_1 = 30°C, and p_1 = 0.7 atm. The shock speed C_s with respect to a fixed coordinate system is 600m/s. Find the fluid properties in region 2.

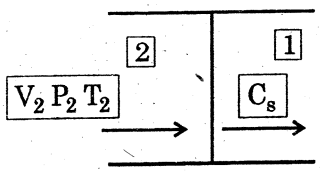


Fig (1)

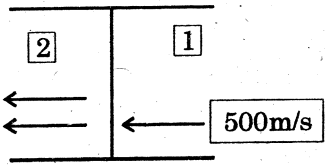


Fig (2)

(5 + 7 = 12 marks)

Or

18. (a) Consider a pipe in which air at 300 K and 1.5 × 10^6 N/m^2 flows uniformly with a speed of 150 m/s. The end of the pipe is suddenly closed by a valve, and a shock wave is propagated back into the pipe. Compute the speed of the wave and the pressure and temperature of the air which has been brought to rest.

(b) Starting from energy equation derive Prandtl-Meyer function.

(7 + 5 = 12 marks)

19. A turbojet engine flying at a speed of 990 km/hr consumes air at a rate of 55.5 kg/s Calculate :

(i) Exit velocity of jet when enthalpy change for the nozzle is 200 kJ/kg and velocity coefficient is 0.97.

(ii) Fuel flow rate in kg/s when air fuel ratio is 75 : 1.

(iii) Thrust-specific fuel consumption.

(iv) Thermal efficiency of the plant when combustion efficiency is 93% and calorific value of fuel is 45000 kJ/kg.

(v) Propulsive power.

(vi) Propulsive efficiency.

(vii) Overall efficiency.

(12 marks)

Or

20. (a) With T-S diagram explain, the working of turbo-jet system.

(b) Give the differences with merits and demerits of turbo-prop and turbo-jet engines.

(6 + 6 = 12 marks)

[5 × 12 = 60 marks]

G 1054 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Mechanical Engineering

ME 010 702—DYNAMICS OF MACHINES (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. State the conditions for dynamic balancing.
2. Discuss a method to find out the equivalent stiffness.
3. Define the terms coefficient of damping and critical damping coefficient.
4. Write a note on Laplace transformation.
5. Discuss tolerance levels of human ear in industrial context.

(5 × 3 = 15 marks)

Part B

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

6. Differentiate between Balancing of rotating masses and Reciprocating masses.
7. Find an expression for logarithmic decrement in terms of dampling factor.
8. Explain the working of Centrifugal pendulum damper with a neat sketch.
9. Write a note on hard spring and soft spring.
10. Discuss the key parameters of acoustic measurements. Discuss an acoustic impedance filter.

(5 × 5 = 25 marks)

Part C

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

11. Discuss in detail Dalby's method of balancing of several masses rotating in several planes.

(12 marks)

Or

Turn over

12. A disturbing mass of 600 kg is attached to a shaft. The shaft is rotating at a uniform velocity of ω rad/sec .The distance of centre of gravity of the disturbing mass from the axis of rotation is 270 mm. The disturbing mass is to be balanced by two masses in two different planes. The distances of the centre of gravity of the balancing masses from the axis of rotation is 450 mm each. The distances between the two planes of the balancing masses is 1.5 m and the distance between the plane of the disturbing mass and one of the planes of the balancing masses is 300 mm. Determine :

(i) the distance between plane of disturbing mass and the planes of the balancing masses. (6 marks)

(ii) the magnitude of balancing masses when :

(a) the planes of balancing masses are on the same side of the plane of disturbing mass.

(b) the planes of balancing masses are on either side of the plane of disturbing mass. (6 marks)

13. A coil of spring stiffness 4 N/mm supports vertically a mass of 20 Kg at the free end. The motion is resisted by the oil dashpot. It is found that the amplitude at the beginning of the fourth cycle is 0.8 times the amplitude of previous vibration. Determine the damping force per unit velocity. Also, find the ratio of frequency of damped and undamped vibrations. (12 marks)

Or

14. Explain Critically damped system and Underdamped system. (12 marks)

15. The moment of inertia of 3 rotors A, B and C are respectively 0.3, 0.6 and 0.8 kg-m^2 , the distance between A and B is 1.5 m and B and C is 1 m , the shaft is 70 mm in diameter and modulus of rigidity for the shaft material is $84*10^9$ N/m^2. Find :

(a) Frequencies of torsional vibrations. (4 marks)

(b) Position of nodes. (4 marks)

(c) Amplitude of vibrations. (4 marks)

Or

16. Derive expressions for dynamic behaviour of :

(i) distributed mass system ;

(ii) lumped mass system when the DOF of the system is more than two. (12 marks)

17. A Structure supporting rotating machinery vibrates excessively at an excitation frequency of 18 Hz. It is proposed to attach a vibration absorber tunes to this frequency. What should be absorber mass and stiffness so that the resulting 2 natural frequencies are at least 20% away from the excitation frequency ? The effective mass of the structure is 1 tonne and the natural frequency is 16Hz. (12 marks)

Or

18. Discuss the response of a transient vibration system, when the input signal is :

    (a) Step wave form ;

    (b) Impulsive. Derive the equations of motion.

(12 marks)

19. Discuss the methods, equipments and criteria for recording and reproduction of sound. Explain the entire process with a flow chart.

(12 marks)

Or

20. In the same area of a warehouse there are four large machines. M/C 1 produces a sound power of 1 W. M/Cs 2, 3 and 4 produce an acoustical power of 0.5, 0.75 and 1.25 W respectively. What is the total power level generated in the area by the four machines ?

(12 marks)

[5 × 12 = 60 marks]