F 3318 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Automobile Engineering/Mechanical Engineering

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

(New Scheme—2010 Admission onwards—Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

1. What are the different factors affecting design process ? Explain with the help of an example.

Or

2. Explain in detail any *three* theories of failure.

3. Determine the efficiency of a single riveted lap joint having a rivet diameter of 29 mm., pitch 80 mm. and a plate thickness of 12.5 mm.

Or

4. Determine the safe useful load for a M 36 × 4C bolt, 110 mm. long, made of mild steel, for three conditions :

   (a) Static load.

   (b) Sudden change of load from zero to maximum.

   (c) Impact action resulting from a variable load when the nut is unscrewed 1/16th turn.

5. Determine the maximum torsional moment that a 55 mm. dia solid steel shaft welded to a flat plate can sustain when the leg of the fillet weld is 12.5 mm. The allowable shear stress in the weld material under static conditions is not to exceed 75.0 N/mm^2.

Or

6. A truck weighing 20 kN and moving at 25 km/hr. has to be brought to rest by a buffer. Find how many springs each of 15 coils will be required to store the energy of motor during the compression of 150 mm. The available size of the wire is 20 mm. The mean radius for the coils is 100 mm.

7. A machinery shaft supplied a bearings 2.4 m. apart is to transmit 187.5 kW at 200 r.p.m. It is subjected to a bending load of 5000 N located at a distance of 0.66 m from one bearing. Safe stress in shear is 42 MPa and in bending 84 MPa. Determine

   (a) The shaft dia for steady loading.

   (b) The shaft dia if the transverse load is steady and the torsional load is suddenly applied.

Or

8. Design a rigid sleeve coupling to connect two shafts transmitting 18.75 kW at 1000 r.p.m. The allowable shear stress in the material of the shaft is 55 N/mm^2. The material of the key and the shaft is same and the coupling is required to transmit 20 % over load. The material of the sleeve is cast iron, the allowable shear stress for which is 16 N/mm^2. Make a neat sketch of the designed sleeving coupling showing the side view and sectional elevation.

(4 × 25 = 100 marks)

F 3348 ME (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

ME 010 703—GAS DYNAMICS AND JET PROPULSION (ME)

(New Scheme—2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Explain Mach cone and Mach angle.
2. Give assumptions regarding Fanno Flow. What is Fanno line ?
3. How is turbo fan engine different from turboprop engine ?
4. What is an isentropic flow ? Give its assumptions.
5. Write down the properties of flow across a normal shock.

(5 × 3 = 15 marks)

Part B

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

6. What is the effect of Mach number on compressibility ?
7. With neat sketch explain the working of a pulse jet engine. Write down its advantages and disadvantages.
8. Derive $\frac{A}{A^*} = \frac{1}{M}\left(\frac{2}{r+1} + \frac{r-1}{r+1} M^2\right)^{\frac{r+1}{2(r-1)}}$ for one dimensional isentropic flow.
9. Starting from the Energy equation for flow through a normal shock obtain the relation $M_x^* \, M_y^* = 1$.
10. Derive the unsteady flow continuity equation for a control volume :

$$\int_{CV} \frac{\partial \rho}{\partial t} dv = \int_{in} \rho c_n \, dA - \int_{out} \rho c_n \, dA$$

hence show that for one dimensional steady flow ρAC = const.

(5 × 5 = 25 marks)

Turn over

F 3363 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Automobile Engineering/Mechanical Engineering

AU 010 705/ME 010 705—INDUSTRIAL ENGINEERING (AU, ME)

(New Scheme—2010 Admission onwards—Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Define Total Productivity.
2. What are the types of layout ?
3. What is Public Buying ?
4. What is a SIMO chart ?
5. Differentiate between Sampling inspection and 100 % inspection.

(5 × 3 = 15 marks)

Part B

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

6. What are the objectives of Value Engineering ?
7. Discuss the advantages of Group Technology Layout.
8. Distinguish between P and Q system of inventory.
9. Define "Therblig" write the names of different therbligs.
10. Discuss the benefits of bench marking.

(5 × 5 = 25 marks)

Part C

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

11. Discuss briefly the functions of Industrial Engineering and the role it can play in raising industrial productivity.

Or

12. "Value Engineering in a powerful cost reduction tool." Justify.

Turn over

13. Discuss the role of material handling system in improving the productivity of a company.

Or

14. Write short note on JIT and cellular manufacturing system.

15. List and explain the criteria and steps of vendor evaluation.

Or

16. Derive the EOQ formula for the purchase model without shortage.

17. What is "Method Study" ? What are its objectives ? How will you determine the areas that require method study application in an industry ?

Or

18. Explain various Job Evaluation technique. How Job Evaluation used in preparing wage structure ?

19. Define TQM. Enlist the priority areas along with essential steps of implementing TQM in an organization.

Or

20. What is ISO ? **Explain how** to implement ISO system.

(5 × 12 = 60 marks)

F 3466 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

MACHINE DESIGN AND DRAWING – I (M)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Answer any **four** *questions by selecting* **two** *from Part A and* **two** *from Part B.*

Missing data, if any may be assumed suitably.

Each question carries 25 *marks.*

Part A

1. Explain the following theories of failure :
   (a) Maximum principal stress theory.
   (b) Maximum shear stress theory.
   (c) Maximum strain theory.
   (d) Shear – Energy theory.
   (e) Maximum strain energy theory.
2. Design a knuckle joint for a tie rod of circular section to sustain a maximum pull of 60 kN, The ultimate strength of the material against tearing is 420 MPa. The ultimate compressive and shear strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety as 6. Also draw the designed sketch.
3. A cast iron protective type flange coupling is used to connect two shafts of 80 mm diameter. The shaft runs at 250 r.p.m. and transmits a torque of 4300 N mts. The permissible shear stress for shaft and bolts material is 50 MPa and permissible shear stress for flange is 8 MPa. Design the bolts, hub and flange for the coupling.
4. Design a double rivetted butt joint with two cover plates of equal width for the longitudinal seam of a boiler shell of 1 meter diameter subjected to a steam pressure of 2 MPa. The rivet pitch is to be same in all rows and zig-zag invetting is to be used. The allowable stresses in tension, shear and crushing are 124 MPa, 93 MPa and 180 MPa respectively. Assume that the rivets in double shear are 1.875 times stronger than in single shear.

(2 × 25 = 50 marks)

Turn over

Part B

5. A section of steel shaft of 2 meters long supported between bearings running at 1000 r.p.m. carries a 20° involute spur gear of pitch diameter 200 mm at its midpoint. The gear delivers 20 KW power to its mating gear located directly above the shaft. If the shaft material selected has an allowable shear stress of 40 MPa, determine the size of the shaft. Assume loads are steady.

6. A steel pipe of 100 mm interval diameter and 400 mm long is welded to the vertical plate by an all round fillet weld. The thickness of the pipe is 10 mm. Determine the size of the weld, if it is to have the same strength as that of the pipe. Also determine the load that can be supported at the end of the pipe, if the maximum permissible stress is 100 MPa.

7. Design a closed-coil helical spring for a boiler safety valve which is required to blow off steam at the pressure of 1.5 N/mm^2. The diameter of the valve is 50 mm. The initial compression of the spring is 40 mm and lift is limited to 20 mm.

8. Design a flywheel for a single cylinder four-stroke vertical cylinder diesel engine developing 4 kW at 1500 r.p.m. Assume co-efficient of speed fluctuation, $\varsigma = 0.01$.

(2 × 25 = 50 marks)

F 3404 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

ME 010 706 L 03—THEORY OF VIBRATION (Elective II) (ME)

(New Scheme—2010 admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Give a mathematical representation of beat phenomenon.
2. List the applications of dry friction damping.
3. Discuss the logic behind the introduction of "equivalent viscous damping".
4. Enumerate the effects of degree of freedom on modal analysis.
5. Clearly differentiate between the dynamic behaviour of a continuous system and discrete system.

(5 × 3 = 15 marks)

Part B

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

6. Discuss the characteristics of simple harmonic motion.
7. With neat sketches, explain the application of dampers in automobile engineering.
8. From fundamentals, derive an expression for energy dissipated during damping.
9. Explain the challenges in combining the effects of angular and linear modes.
10. Discuss how stresses are induced in shafts during torsional vibrations.

(5 × 5 = 25 marks)

Part C

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

11. Derive the differential equation representing free vibrations with viscous damping. How will you obtain solution for the differential equation ?

(12 marks)

Or

Turn over

12. With a suitable example derive the expressions for the following cases :

    (i) Displacement of the given mass from mean position in "over damping" condition. (4 marks)

    (ii) Displacement in "under damping" condition. (4 marks)

    (iii) Displacement for critical damping. (4 marks)

13. Derive expressions for (i) Amplitude reduction factor and (ii) Logarithmic decrement from fundamentals. Discuss the behaviour of a vibration system, with a change in logarithmic decrement. (12 marks)

Or

14. Show that for finding the natural frequency of a spring-mass system, the mass of the spring can be taken into account by adding one-third of its mass to the main mass. (12 marks)

15. Derive an expression for whirling speed of shafts. Why is this speed significant ? (12 marks)

Or

16. Distinguish between forced vibration and free vibration. Derive the equation of motion and solution of equation for forced vibrations due to excitation of the support. (12 marks)

17. Discuss the concept of vibration absorbers. What do you mean by vibration isolation ? Explain vibration isolation analytically and graphically. (12 marks)

Or

18. Considering a three DOF system, explain the method of obtaining :

    (i) Influence coefficients, and

    (ii) Natural frequencies.

    Based on the above considerations, draw all the mode shapes for this system. (6 + 6 = 12 marks)

19. Derive the equations of motion for the longitudinal vibration of a rod. Write all the assumptions. Determine the national frequencies and find out a solution for the problem. (12 marks)

Or

20. Analytically determine the behaviour of a system of vibration of a stretched string. Derive an expression for displacements. Give any three practical applications. (12 marks)

[5 × 12 = 60 marks]

F 3405 (Pages : 2) Reg. No.....

Name.....

ME

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

ME 010 706 L04 – SALES AND MARKETING MANAGEMENT (Elective II) [ME]

(New Scheme – 2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Write four P's of marketing.
2. Brief strategic business unit.
3. What is meant by product life-cycle ?
4. Brief " Buying center concept".
5. What are the goals in sales management?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain Delphi method.
7. Explain strategic business unit.
8. Explain product development idea generation.
9. Explain Buyer behaviour model.
10. Brief the theories of basic selling styles.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Explain Time Series Analysis.

Or

12. Differentiate marketing and selling.

Turn over

13. What is SWOT analysis? Explain.

Or

14. Explain marketing decision support systems.

15. Explain the four distinct steps in product life-cycle.

Or

16. "Ball pens are to be developed by a company". Explain the steps in research development and testing.

17. What are the cultural, social and personal factors that affect buying.

Or

18. What are the factors influence buyer behaviour? Explain.

19. Explain the term :

    (a) In company *vs*. External training.

    (b) Individual *vs*. Group training.

Or

20. Explain the main tasks involved in sales management.

(5 × 12 = 60 marks)

F 3424 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

GAS DYNAMICS AND JET PROPULSION (M)

(Old Scheme—Prior to 2010 admissions)

[Supplementary/Mercy Chance]

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. Give the characteristic equation for a gas.
2. Explain Mach cone and Mach angle.
3. Define the terms : nozzle efficiency and nozzle discharge coefficient.
4. Distinguish between under-expanded and over-expanded nozzle.
5. Derive an equation describing Rayleigh line.
6. Discuss Prandtl's velocity relationship.
7. Discuss the effect of friction on flow parameters in Fanno flow.
8. Explain how flow velocity is determined in supersonic flow.
9. Explain what is meant by thrust Augmentation. What is its effect ?
10. Define thrust power ; propulsive power and propulsive efficiency.

(10 × 4 = 40 marks)

Part B

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

11. Derive the continuity equation in integral form for a control volume.

Or

Turn over

12. An aircraft flies at 800 km/hr at an attitude of 10,000 m (T = 223.15 K, P = 0.2646 bar). The air is reversibly compressed in an inlet diffuser. If the Mach number at the exit of the diffuser is 0.36, determine :

    (i) Entry Mach number.

    (ii) Velocity, pressure and temperature of air at the diffuser exit.

13. Discuss the operation of a converging-diverging nozzle under vary back pressure.

Or

14. Air is discharged from a reservoir at P_0 = 6.91 bar and T_0 = 325°C through a nozzle to an exit pressure of 0.98 bar. If the flow rate is 3600 kg/hr, determine for isentropic flow, throat at area, pressure, velocity, exit area and maximum velocity.

15. Show that the upper and lower branches of a Fanno line represents the subsonic and supersonic flow. Also show that the maximum entropy condition is sonic.

Or

16. The pressure, temperature and Mach number at the entry of a flow passage are 2.45 bar, 26.6°C and 1.4 respectively. If the exit Mach number is 2.5, determine for adiabatic flow of a perfect gas (r = 1.4), stagnation temperature, temperature and velocity of gas at exit, and the flow rate per square meter of the inlet cross-section.

17. Derive the following relation for flow through a normal shock :

$$P_y / P_x = \frac{2r}{r+1} \mu x^2 - \frac{r-1}{r+1}.$$

Discuss the impossibility of a shock wave in subsonic flow.

Or

18. An aircraft flies at a Mach number of 1.2 at an attitude of 16,000 m (P = 103 M bar, T = 216.65 K). The compression in its engine is partly achieved by a normal shock wave standing at the entry of its diffuser. Determine immediately down stream of the shock :

    (i) Mach number. (ii) Temperature of the air.

    (iii) Pressure of the air. (iv) Stagnation pressure loss across the shock.

19. With the help of neat sketches explain the working of Ramjet engine. Discuss its merits and demerits.

Or

20. Explain about turbo pump feed system for liquid propellant with neat sketch.

(5 × 12 = 60 marks)

F 3484 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

WELDING TECHNOLOGY (Elective I) [M]

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Differentiate brazing and soldering.
2. Explain Forge welding.
3. List and brief different types of flames.
4. Briefly explain welding of stainless steel.
5. How electrodes are classified ?
6. What is meant by reverse polarity ?
7. PAW. Brief.
8. What are the application of special welding process ?
9. List the common defects in welding.
10. Brief HAZ.

(10 × 4 = 40 marks)

Part B

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

11. What are the advantages and limitations of welding ? Explain. (12 marks)

Or

12. (a) Sketch and explain seam welding. (6 marks)
    (b) Sketch and explain flash butt welding. (6 marks)
13. Explain the preparation of acetylene gas and storing. (12 marks)

Or

Turn over

14. (a) Explain the applications of oxy-acetylene welding. (6 marks)

    (b) Discuss the safety rules in welding. (6 marks)

15. (a) Explain with neat sketch "SMAW". (8 marks)

    (b) What is meant by flux ? (4 marks)

Or

16. Write a note on electric arc welding power source, advantage, limitations. (12 marks)

17. (a) Sketch and explain ultrasonic welding. (6 marks)

    (b) Briefly explain cold welding process. (6 marks)

Or

18. With a neat sketch explain Electro slag welding process. (12 marks)

19. What is residual stress in welding and explain the relieving and its control. (12 marks)

Or

20. Write a note on need of inspection of welded joints with suitable example. (12 marks)

[5 × 12 = 60 marks]

19. Give an account about the industrial noise sources. Explain how noise control at source is categorized.

Or

20. How decibel scale is defined with the help of suitable equations explain : (a) sound intensity level ; and (b) Sound Power Level.

Specify the reference quantities to define the above scales.

(5 × 12 = 60 marks)

F 3454 **(Pages : 4)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

DYNAMICS OF MACHINERY (M)

[Old Scheme—Prior to 2010 Admissions]

(Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Explain the conditions of static and dynamic balancing.
2. Explain the effects of Partial balancing in locomotives.
3. Derive the expression for natural frequency using Rayleigh's method.
4. Explain the characteristics of an under damped system with a neat sketch.
5. Determine the influence Coefficients of the system shown in fig. 1.

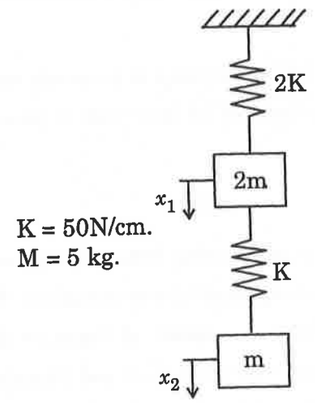


Fig. 1

6. Explain mode shape of a system with 3 rotor system.

7. Describe the behaviour of a light shaft with a disk subjected to resonance.
8. Explain the non-linear characteristics of a soft and hard spring.
9. Describe how sound pressure can be expressed in dB.
10. Obtain the relationship between the sound intensity and the distance from the point source.

(10 × 4 = 40 marks)

Part B

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

11. A shaft supported in bearings that are 1.6 m. apart projects 400 mm. beyond bearings at each end. It carries three pulleys one at each end and are at the centre of its length. The masses of the end pulleys and 40 kg. and 22 kg. and their centres of mass are at 12 mm. and 18 mm. respectively from the shaft axis. The mass of the centre pulley is 38 kg. and its centre is 15 mm. from shaft axis. The system is statically balanced. Determine (a) the relative angular positions of the pulleys ; (b) dynamic forces developed on the bearings when the shaft rotates at 210 r.p.m.

Or

12. A single cylinder reciprocating engine has a reciprocating mass of 60 kg. The crank rotates at 60 r.p.m. and the stroke is 320 mm. The mass of the revolving parts at 160 mm. radius is 40 kg. If $\frac{2}{3}^{rd}$ of the reciprocating parts and whole of the revolving parts are to be balanced, determine the (a) Balance mass required at a radius of 350 mm. ; (b) Unbalanced force when the crank has turned 50° from TDC.

13. A machine part having a mass of 2.5 kg. vibrates in a viscous medium. A force of 30 N acts on the part and causes a resultant amplitude of 14 mm. with a period of 0.22 sec. Find the damping coefficients.

Or

14. A body having a mass of 15 kg. is suspended from a spring which deflects 12 mm. under the weight of the mass. Determine the frequency of free vibrations. What is the viscous damping force needed to make the motion aperiodic at a speed of 1 mm. /s. If when damped to this extent, a disturbing force having a maximum value of 100 N and vibrating at 6 Hz is made to act or the body, determine the amplitude of the ultimate motion.

15. A torsional system has an inertia of 1.5 kg-m^2. and a torsional stiffness of 4.36×10^3 N-m./radian It is acted upon by a torsional excitation of 54 rad/sec. Determine the parameter of the absorber to be fixed to the main system if it is desired to keep the natural frequency at least 20 % away from the impressed frequency.

Or

16. A reciprocating engine has a mass of 40 kg. and runs at a constant speed of 3000 r.p.m. After it was installed it vibrated with a large amplitude at operating speed. What dynamic absorber should be coupled to the system if the nearest resonant frequency of the combined system has to be at least 25 % away from the operating speed.

17. A spring mass system shown in fig. 2 is initially relaxed and a step-function excitation is applied to the mass. Find the response of the system.

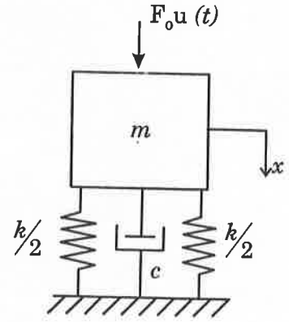


Fig. 2.

Or

18. A rotor has a mass of 9.5 kg. and is mounted midway on a 24 mm. dia. horizontal shaft supported at the ends by bearings. The bearings are 1.2 m. apart. Speed of shaft is 2000 r.p.m. If the centre of mass of the rotor is 0.12 mm. away from the axis of rotation ; find the amplitude of the steady state vibration and the dynamic force transmitted to the bearing. Take $\in$ = 200 GPa.

F 3353 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Automobile Engineering/Mechanical Engineering

AU 010 704/ME 010 704—REFRIGERATION AND AIR-CONDITIONING (AU, ME)

(New Scheme—2010 Admission onwards—Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

Use of RAC Data Book, Psychrometric charts and Steam tables are permitted.

Part A

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

1. Represent COP of a Carnot refrigerator in terms of compression ratio and ratio of specific heats.
2. Discuss the desirable characteristics of a fluid to be used as a refrigerant.
3. Discuss the effect of subcooling on COP.
4. Explain the terms :
   (a) Thermodynamic wet bulb temperature.
   (b) Dew point temperature.
   (c) Absolute humidity.
5. How capillary tube works in a refrigeration system ?

(5 × 3 = 15 marks)

Part B

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

6. Write the working of a steam jet refrigeration system with a neat diagram.
7. With the help of a neat diagram, discuss the working of Bell-Coleman refrigerator.
8. Discuss the effect of wet, dry and superheated compression on COP of a vapour compression refrigeration system. Draw the p-h diagram for the process.
9. Discuss briefly about any two expansion devices used in refrigeration systems.
10. Describe thermal analysis of human body.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. A reversed Carnot cycle working as a heat pump is delivering 40,000 kJ/min to heat conditioned space and maintaining it at 25° C. when the outside atmospheric air is 15° C. Find :

    (a) Heat pumped into the conditioned space from atmospheric air. (4 marks)

    (b) Power required to operate the cycle. (3 marks)

    (c) If the same conditioned space is heated by electric coils determine the consumption of electricity. (3 marks)

    (d) COP. (2 marks)

Or

12. In a Bell-Coleman refrigeration plant, the air is drawn from the cold chamber at 1 bar and 10° C. and compressed to 5 bar. The same is cooled to 25° C. in the cooler before expanding in expansion cylinder to cold chamber pressure of 1bar :

    (a) Determine the theoretical COP of the plant and the theoretical net refrigeration effect/kg. of air. The compression and expansion is assumed to be isentropic. (6 marks)

    (b) If the compression and expansion laws followed are $PV^{1.35} = C$ and $PV^{1.3} = C$ respectively, how will the result be modified. (6 marks)

13. A two stage refrigeration system with flash intercooling works between a condenser temperature of 40° C. and an evaporator temperature of – 15° C. Obtain COP and capacity of the system if the mass flow rate through the evaporator is 0.2 kg/s. The intermediate pressure is 4.2 bar. Compare the COP and capacity with a corresponding single stage system operating between the above temperature limits R-12 is used as the refrigerant.

Or

14. A R-12 refrigerating machine operates at – 10° C. evaporator and 35° C. condenser temperature. Assume simple saturated cycle. Determine the volume of suction vapour and power consumption per ton of refrigeration and COP of the cycle.

15. Explain the working of LiBr-H_2O absorption refrigeration system with the help of a neat diagram.

Or

16. Explain :

    (i) Magnetic refrigeration. (6 marks)

    (ii) Thermoelectric refrigeration. (6 marks)

17. With the help of a neat diagram, explain the working of thermostatic expansion values.

Or

18. How condensers are classified ? Explain each of them with the help of diagrams.

19. (a) Define (a) relative humidity ; (b) WBT. (4 marks)

    (b) Moist air exists at 24° C. DBT and 18° C. WBT find other properties of air at 101.325 kPa by psychrometric chart. Also find the properties by using equations/tables for a pressure of 80 kPa. (8 marks)

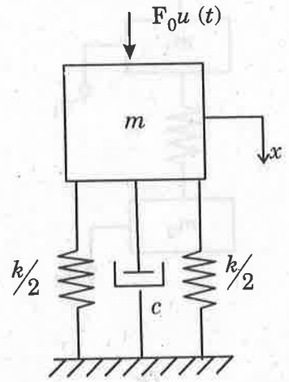
Or

20. (a) Air at 25° C., 70 % humidity and 1 bar is compressed to 2 bar and cooled back to 25° C. find water condensation per kg. of air.

    (b) Air at 1 bar, 25° C., 50 % RH is to be heated to 50° C. as it flows through an air heater. Sketch the process on the psychrometric chart labelling initial and final points. How much heat is transferred in the process if the flow rate of air is 2.5 kg./s.

[5 × 12 = 60 marks]

8. A spring mass system shown in figure is initially relaxed and a step function excitation is applied to the mass. Find the response of the system.



(12 marks)

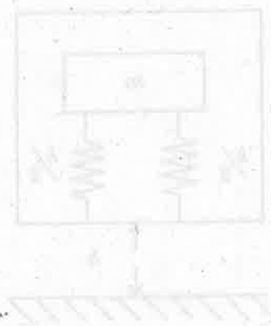
9. With a neat sketch explain the working of a sound level meter. (12 marks)

Or

10. In a warehouse there are 4 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 fan M/Cs.

(12 marks)

[5 × 12 = 60 marks]



F 3337 (Pages : 4) **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

ME 010 702—DYNAMICS OF MACHINES (ME)

(New Scheme—2010 admission onwards)

[Regular / Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Explain Hammer blow and swaying couple.
2. What are the different types of vibrations ? Explain.
3. Write down the differential equation of motion for a two degree of vibrating system.
4. Explain shock spectrum.
5. Define acoustic impedance.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

1. Derive the expression for variation of tractive effort.
2. Explain the behaviour of a system subjected to under, over and critically damped conditions.
3. Explain the function of a vibration absorber.
4. Derive the expression for critical speed of a shaft.
5. Briefly explain the process of recording and reproduction of sound.

(5 × 5 = 25 marks)

Part C

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

1. For Masses A, B, C and D are completely balanced. Masses C and D makes angle of 90° and 210° respectively with B in the same sense. The planes containing B and C are 300 mm apart. Masses A, B, C, and D can be assumed to be concentrated at radii of 360, 480, 240 and 300 mm respectively. The masses B, C and D are 15 kg, 25 kg and 20 kg respectively. Determine (a) mass A and its angular position (b) positions of planes A and D.

(12 marks)

Or

2. A single cylinder reciprocating engine has a reciprocating mass of 60 kg. The crank rotates at 60 r.p.m. and the stroke is 320 mm. The mass of the revolving parts at 160 mm radius is 40 kg. If two-thirds of the reciprocating part and whole of the revolving parts are to be balanced, determine the (a) balance mass required at a radius of 350 mm ; (b) unbalanced force when the crank has turned 50° from TDC.

(12 marks)

3. A vibrating system consists of a mass of 50 kg, a spring with a stiffness of 30 kN/m and a damper. The damping provided is only 20% of the critical value. Determine (a) damping factor ; (b) critical damping coefficient ; (c) natural frequency of damped vibrations ; (d) logarithmic document.

(12 marks)

Or

4. A machine part having a mass of 2.5 kg vibrates in a viscous medium. A harmonic exciting force of 30 N acts on the part and causes a resonant amplitude of 14 mm with a period of 0.22 second. Find the damping coefficient.

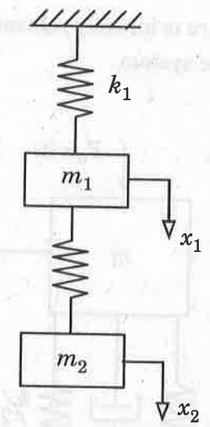
(12 marks)

5. A two DOF is shown in figure. Determine :

   (a) The two natural frequencies of vibrations.

   (b) Ratio of amplitudes of motion of m_1 and m_2 for the two modes of vibration.

   (c) Mode shapes.



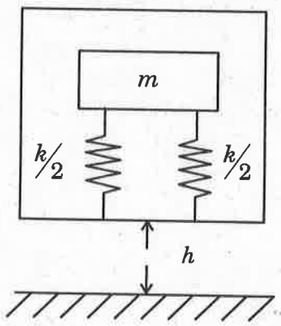
(12 marks)

Or

6. A 1.2 m log shaft has a dia of 45 mm for half the length and 60 mm for the remaining length. One end of the sahft is fixed and the other carries a rotor of 200 kg mass with a radius of gyration of 45 mm. Find the frequency of the torsional vibration neglecting the inertia of the shaft. Take G = 84 GN/m^2.

(12 marks)

7. An apparatus of mass 'm' is shipped in a container as shown in figure. In the process of unloading, the container is dropped from a height 'h' to a hard floor. Find the response of the system.



(12 marks)

Or

F 3348 ME

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

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

ME 010 703—GAS DYNAMICS AND JET PROPULSION (ME)

(New Scheme—2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Explain Mach cone and Mach angle.
2. Give assumptions regarding Fanno Flow. What is Fanno line ?
3. How is turbo fan engine different from turboprop engine ?
4. What is an isentropic flow ? Give its assumptions.
5. Write down the properties of flow across a normal shock.

(5 × 3 = 15 marks)

Part B

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

6. What is the effect of Mach number on compressibility ?
7. With neat sketch explain the working of a pulse jet engine. Write down its advantages and disadvantages.
8. Derive $\frac{A}{A^*} = \frac{1}{M}\left(\frac{2}{r+1} + \frac{r-1}{r+1} M^2\right)^{\frac{r+1}{2(r-1)}}$ for one dimensional isentropic flow.
9. Starting from the Energy equation for flow through a normal shock obtain the relation $M_x^* \, M_y^* = 1$.
10. Derive the unsteady flow continuity equation for a control volume :

    $$\int_{CV} \frac{\partial \rho}{\partial t} \, dv = \int_{in} \rho c n \, dA - \int_{out} \rho c n \, dA$$

    hence show that for one dimensional steady flow $\rho AC = \text{const.}$

(5 × 5 = 25 marks)

Turn over

Part C

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

11. Starting from continuity and momentum equation derive the equation for velocity of sound in a perfect gas, in terms of characteristic gas constant and static temperature.

Or

12. (a) What is velocity temperature ? Determine the velocity of air corresponding to a velocity temperature of 1°C.

(5 marks)

(b) Determine the Mach number of an aircraft at which the velocity temperature of air at the entry of the engine equals the static temperature.

(7 marks)

13. Air is discharged from a reservoir at $P_0 = 6.91$ and $t_o = 325°C$, through a nozzle to an exit pressure of 0.98 bar. If the flow rate is 3000 kg/hr determine the isentropic flow

(a) Throat area and velocity.

(b) Exit area and Mach number.

Or

14. Describe the behaviour of flow in a convergent-divergent nozzle when it is operated at :

(i) design pressure ratio ;

(ii) pressure ratio higher than design value ;

(iii) pressure ratio lesser than design value.

15. A gas at a pressure of 0.7 bar and 280 K enters a combustion chamber at a velocity of 55 m/s. The heat supplied in the combustion chamber is 1500 kJ/kg. Determine the Mach number, pressure, temperature of the gas at the exit. (Take $\gamma = 1.4$, $C_p = 1.005$ kJ/kg K for gas).

Or

16. (a) What is the value of Mach number of air at the maximum enthalpy point in Rayleigh heating process ? Depict static and stagnation values of pressure and temperature at this point and the sonic point on Rayleigh line.

(b) If the conditions at sonic point are $p^* = 1$ bar $T^* = 500$ K. Calculate pressure, temperature and velocity at maximum enthalpy point. What is the change of entropy between these points ?

17. The ratio of exit to entry area in a sub-sonic diffuser is 4.0. The Mach number of a jet of air approaching the diffuser at $p_0 = 1$ bar. T = 300 K is 2.2. There is a standing normal shock wave just outside the diffuser entry. Determine ; (a) Mach number ; (b) temperature and (c) pressure at the exit of the diffuser.

What is the stagnation pressure loss between the initial and final states of flow ?

Or

18. (a) Derive the equation for temperature ratio across a normal shock.

(b) A gas ($r = 1.4$, R = 0.287 kJ/kg K) at a Mach number of 2, $p = 0.9$ bar and T = 373 K passers through a normal shock. Determine its density after the shock.

19. (a) What are the main components of a gas turbine engine used for turbo jet aircrafts ? Show the various processes occurring in the engine on a T-S diagram.

(b) Describe the working of a scram jet engine. What is its advantages over the ramjet ?

Or

20. An aircraft flies at 960 km/hr are of its turbo jet engine takes in 40 kg/s of air and expands the gases to the ambient pressure. The air fuel ratio is 50 and the LCV of the fuel is 43 MJ/kg. For maximum thrust power determine :

(a) jet velocity ;

(b) specific thrust ; and

(c) propulsive, thermal and overall efficiencies.

[5 × 12 = 60 marks]