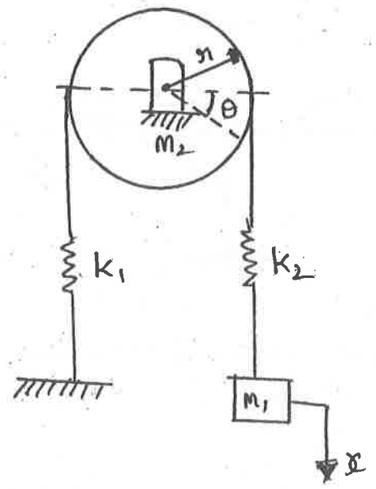
17. Find the natural frequencies of the system shown in figure. Assume that there is no slip between the cord and cylinder.

Given : $K_1 = 40$ N/m, $K_2 = 60$ N/m

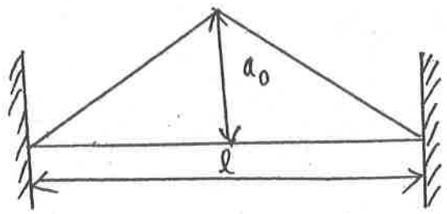
$m_1 = 2$kg, $m_2 = 10$ kg



Or

18. Explain the principle of dynamic vibration absorber. Derive the necessary equations.

19. A uniform string of length l and a large initial tension s, stretched between two supports, is displaced laterally through a distance a_0 at the centre as shown in figure, and is released at $t = 0$. Find the equation of motion for the string.



Or

20. Derive the differential equation for transverse vibration of beams. Also find the solution.

(5 × 12 = 60 marks)

F 6863 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Seventh Semester

Branch : Mechanical Engineering

ME 010 706 L03—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. A harmonic motion is given by $x(t) = 10 \sin(30t - \pi/3)$ mm where t is in seconds and phase angle in radians. Find : (i) Frequency and the period of motion, (ii) The maximum displacement, Velocity and acceleration.
2. What is the significance of critical damping ? Give some practical applications.
3. Define dry friction damping factor and structural damping factor.
4. What do you mean by dynamic coupling ?
5. How does a continuous system differ from a discrete system in the nature of its equation of motion ?

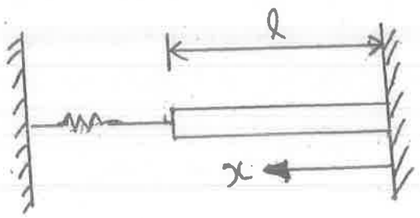
(5 × 3 = 15 marks)

Part B

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

6. Discuss about the energy method for deriving the equation of motion for vibratory system.
7. Derive the expression for amplitude decay in Coulomb damping.
8. Discuss the working of vibrometer.
9. Discuss the working of centrifugal pendulum absorber.

10. A bar of length l fixed at one end and connected at the other end by a spring of stiffness k as shown in figure. Derive suitable expression of motion for longitudinal vibrations.

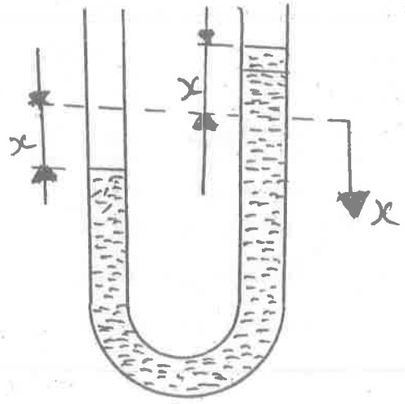


(5 × 5 = 25 marks)

Part C

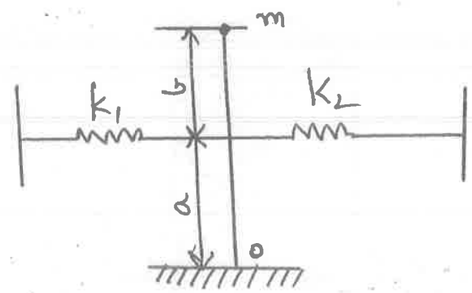
Answer **all** *questions.*
Each full question carries 12 *marks.*

11. A simple U tube manometer filled with liquid is shown in figure. Calculate the frequency of resulting motion if the minimum length of manometer tube is 0.15 m.



Or

12. Find the natural frequency of vibration of the system for small amplitudes. If K_1, K_2, a and b are fixed, determine the value of b for which the system will not vibrate. Find maximum acceleration of the mass.



13. What do you mean by viscous damping and specific damping capacity ? Derive the expression for energy dissipated in viscous damping.

Or

14. A gun barrel of mass 600 kg, has a recoil spring of stiffness 294000 N/m. If the barrel recoils 1.3 m on firing, determine (a) The initial recoil velocity of the barrel ; (b) The critical damping coefficient of the dashpot which is engaged at the end of the recoil stroke ; (c) The time required for the barrel to return to a position 5 cm from the initial position.

15. Write the equation of motion for a spring mass system undergoing forced vibration with viscous damping. Derive the complete solution for the equation and also analyse the total response of the system using displacement time plot.

Or

16. A vehicle of mass 490 kg and total spring constant of its suspension system is 60×10^3 N/m. The profile of the road may be approximated to a line curve of amplitude 4.0 cm and wavelength of 4.0 metres. Determine

    (a) The critical speed of the vehicle.

    (b) The amplitude of the steady state motion of mass when the vehicle is driven at 57 km/hr and the damping factor is 0.5.

F 6798 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Seventh Semester

Branch : Mechanical Engineering/Automobile Engineering

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

(New Scheme—2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Usage of Refrigeration Data book is allowed.
Psychrometric chart is permitted.
Assume missing data with proper justification.

Part A

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

1. What are the advantages of air refrigeration system ?
2. What are the effects of super heating and subcooling of refrigerants in evaporator and condensor respectively ?
3. What are the absorbent and refrigerant in electrolux refrigeration system ?
4. What the effects of intercooling in multistage compression ?
5. Explain various air distribution system in airconditioning systems.

(5 × 3 = 15 marks)

Part B

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

6. A refrigerator works between 30°C and – 5°C. Calculate the Carnot efficiency of refrigerator.
7. Explain the advantages of using flash intercooler in multistage refrigeration system.
8. Explain the working of unitary airconditioning system.
9. Explain the working of flooded evaporators with neat sketch.
10. Sketch and explain all psychometric process in a psychometric chart.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. A reversal cycle has refrigerating COP of 4. Determine (a) the ratio T_1/T_2 ; (b) if the work done on the cycle is 10 kW. Determine maximum refrigeration effect in tonnes of refrigeration ; (c) if the cycle is used as heat pump determine COP and heat delivered.

Or

12. In a Bell Coleman cycle, air taken from cold room at 268 K and compress from 760 mm of Hg to 5.5 bar. The index of compression and expansion as 1.25. The compressed air is cooled to 300 K. The ambient temperature is 23°C. Calculate (a) COP ; (b) mass of air flow for production of 1500 kg of ice per day at 0°C from water at 23°C ; capacity of plant in tonnes of refrigeration. Take h_{fg} as 335 kJ/K.

13. For an R12 refrigerator evaporator temperature – 30°C, condensor pressure 2.75 bar, Refrigerant entering the condensor is at 3°C super heat, refrigerant leaving condensor is at 13°C. Determine COP.

Or

14. A R12 refrigerator three evaporators of capacity 10 tonnes at 10°C, 20 tonnes at 0°C and 30 tonnes at – 5°C, with individual expansion valves and individual compressors and one condensor at 40°C. Exit of all evaporators are dry saturated, 1 sentropic compression in each compressor, determine (a) RE in evaporator ; (b) m of each evaporator ; (c) power required ; (d) heat rejected ; (e) COP.

15. Explain the working of steam jet refrigeration system with neat sketch.

Or

16. Explain the working of thermoelectric refrigeration system. What are the materials used in thermoelectric refrigeration system.

17. Classify different types of condensors used in refrigeration system, brief each condensor.

Or

18. Explain the working of Automatic expansion value with neat sketch. What are the disadvantages of Automatic expansion valves.

19. Moist air at Dry Bulb temperature 23°C wet bulb temperature 17°C, Atmospheric pressure 710 mm of Hg, calculate, relative humidity, absolute humidity sp. volume and enthalpy of moist air. Also calculate Dew point temperature of air.

Or

20. For designing air-conditioning system :

Outdoor condition	=	32°C DBT and 65% RH.
Inlet condition	=	25°C DBT and 60% RH.
Free air	=	250 m^3/min.
Coil ADP	=	13°C.
First process	:	Cooling and dehumidification.
Second process	:	Heating.

Calculate (a) capacity of cooling coil and BPF ; (b) Heating capacity of coil and surface temperature if the BPF of heating coil is 0.3 ; (c) mass of water removed per hour.

(5 × 12 = 60 marks)

F 6791 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Seventh Semester

Branch : Mechanical Engineering/Automobile Engineering

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

(New Scheme—2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Use of Gas tables are permitted.

Part A

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

1. Define Mach number. What is its significance ?
2. What do you mean by choking in isentropic flow ?
3. What is Rayleigh flow ? Give some applications.
4. What do you mean by strong shocks ?
5. List the types of gas turbine engines.

(5 × 3 = 15 marks)

Part B

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

6. Explain the classification of flow based on Mach number.
7. Derive for an isentropic flow :

$$\frac{T^*}{T} = \frac{2}{r+1} + \frac{r-1}{r+1} M^2.$$

8. Show that in a Fanno flow the velocity is sonic at maximum entropy point.
9. Explain why shock is impossible in a subsonic flow.
10. Briefly explain the construction and working of ramjet engine.

(5 × 5 = 25 marks)

Turn over

Part C

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

11. Show that for a sonic flow of air, the variation of pressure coefficient between compressible and incompressible flow is 27.5%.

Or

12. A supersonic aircraft is flying horizontally at an altitude of 3 km with a constant flight speed of 2000 km/hr. The aircraft passes directly over a ground observation post. Find the time taken to hear the sound waves from the aircraft at the observation post after it has passed directly over it. Assume average temperature of air below 3 km altitude is 27°C.

13. Explain the behaviour of compressible flow through a convergent-divergent nozzle.

Or

14. A conical diffuser has an intake area of 0.11 m^2 and an exit area of 0.44 m^2. Air enters the with a static pressure of 0.18 MPa, static temperature of 37°C, and velocity of 267 m/s. Calculate :

    (i) The mass flow rate of air through the diffuser.

    (ii) The Mach number, static temperature, and static pressure of air leaving the diffuser, and

    (iii) The net thrust acting upon the diffuser. Assume that its outer surfaces are wetted by atmospheric pressure at 0.1 MPa.

15. Air at inlet to an insulated constant area duct of diameter 160 mm has a Mach number of 0.36. The mean friction factor of the duct for flow conditions is 0.0025. What length of the pipe would give a 10% loss in stagnation pressure ? What is the Mach number at the corresponding exit section ? What is the percentage loss in stagnation pressure, if the flow exceeds to sonic conditions ?

Or

16. Air enters a constant area duct at 200 m/s and has the static conditions of 300 K and 100 KPa. If 50 kJ/kg heat is rejected along the duct, find the exit Mach number and stagnation temperature change.

17. The following data refers to a supersonic wind tunnel :

    Nozzle throat area = 200 cm^2

    Test section cross-section = 337.5 cm^2

    Working fluid : air (γ = 1.4, C_p = 0.287 kJ/kgK)

    Determine the test section Mach number and the diffuser throat area if a normal shock is located in the test section.

Or

18. Starting from the energy equation for flow through a normal shock, derive :

    $M_x^* \cdot M_y^* = 1$.

19. A rocket flies at 10,080 km/hr with an effective exhaust jet velocity of 1400 m/s and propellant flow rate of 5 kg/s. If the heat of reaction of the propellant is 6500 kJ/kg of propellant mixture, determine :

    (i) Propulsion efficiency and propulsion power.

    (ii) Engine output and thermal efficiency, and

    (iii) Overall efficiency.

Or

20. Explain with a neat sketch the working of a turbo-pump feed system used in a liquid propellant rocket.

(5 × 12 = 60 marks)

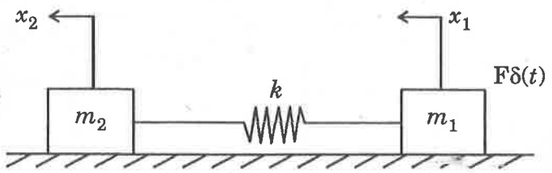
17. The following data relate to a shaft held in long bearings :

Length of shaft	=	1.5 m
Diameter of shaft	=	20 m
Mass of rotor at midpoint	=	20 kg
Eccentricity of centre of mass of rotor from centre of rotor	=	0.5 mm
Modulus of elasticity of shaft material	=	200 GN/m^2
Permissible stress in shaft material	=	70×10^6 N/m^2

Determine the critical speed of the shaft and range of speed over which it is unsafe to run the shaft. Assume the shaft to be massless.

Or

18. A spring mass system consisting of two masses and a coupling spring as shown in figure. If the system is initially at rest on a frictionless horizontal surface and $F(\delta(t))$ is the applied impact on mass m_1, find the motions of the masses :



19. Explain :
    (a) Air columns.
    (b) Dopple effect and its applications.
    (c) Acoustic impedance filters.

Or

20. Explain "Noise control" and its importance.

(5 × 12 = 60 marks)

F 6777 **(Pages : 4)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

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. Differentiate static balancing and dynamic balancing.
2. What do you understand by vibration ?
3. Define 'Free Vibration'.
4. What do you understand by critical speed of a shaft ?
5. Explain how sound propagates.

(5 × 3 = 15 marks)

Part B

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

6. The following data relates to a single - cylinder reciprocating engine :

Mass of reciprocating parts	=	40 kg
Mass of revolving parts	=	30 kg at crank radius
speed	=	200 r.p.m.
stroke	=	400 mm

If 60% of the reciprocating parts and all the revolving parts are to be balanced, determine the

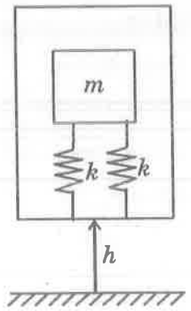
(a) Balance mass required at a radius of 320 mm.

(b) Unbalanced force when crank has turned 45° from top dead centre.

7. Derive an expression for find out natural frequency of a system by Rayleigh method.

8. Explain stodola method for the calculation of natural frequency of a system.

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



10. Explain different strategies adopted by industries for noise control.

(5 × 5 = 25 marks)

Part C

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

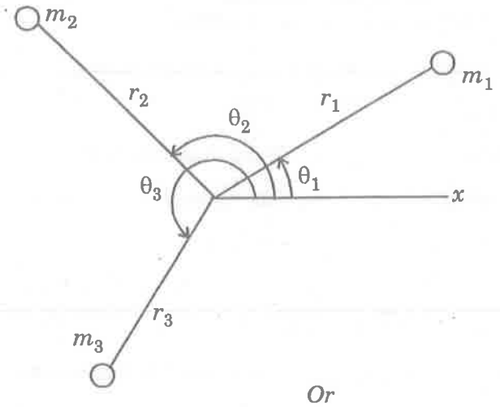
11. The rotor shown in Fig. has the following properties :

$m_1 = 5kg$ $r_1 = 30mm$ $\theta_1 = 35^o$

$m_2 = 6kg$ $r_2 = 20mm$ $\theta_2 = 125^o$

$m_3 = 3kg$ $r_3 = 25mm$ $\theta_3 = 280^o$

Find the amount of countermass of a radial distance of 40 mm for the static balance :



Or

12. The connecting rod of a three-cylinder air compressor are coupled to a single crank and the axis are at 120° to one another. Each connecting rod is 180 mm long and the stroke is 120 mm. The reciprocating parts have a mass of 1.8 kg per cylinder. Find the magnitude of the primary and secondary forces. When the engine runs at 1200 r.p.m.

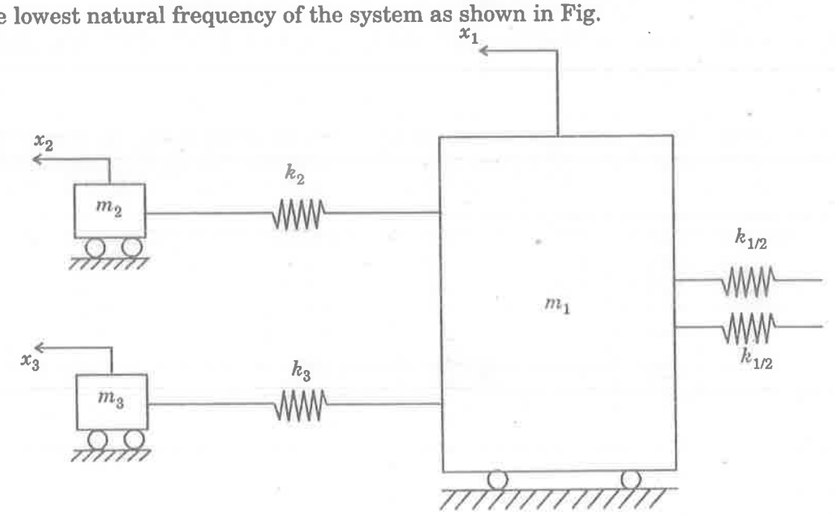
13. In a single degree damped vibrating system, the suspended mass of 4 kg makes 24 oscillations in 20 seconds. The amplitude decreases to 0.3 of the initial value after 4 oscillations. Find the stiffness of the spring, the logarithmic decrement, the damping factor and damping coefficient.

Or

14. A machine part having a mass of 2.5 kg. vibrates in a viscous medium. A harmonic exciting force 40 N acts on the parts and causes a resonant amplitude of 14 mm with a period of 0.22 second. Find the damping coefficient.

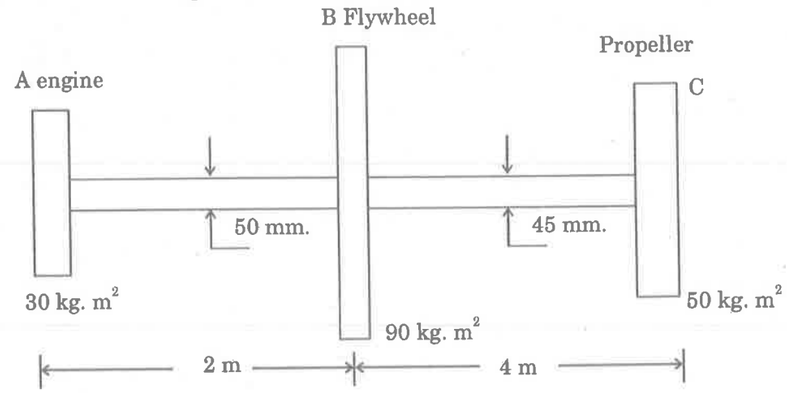
If the frequency of the exciting force is changed to 4 Hz, determine the increase in the removal of the damper.

15. Find the lowest natural frequency of the system as shown in Fig.



Or

16.A torsional system is shown in Fig. Find the frequencies of torsional vibrations and positions of the nodes. Also find the amplitude of vibrations $G = 84 \times 10^9$ N/m^2.



F 6754 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2017

Seventh Semester

Branch : Mechanical Engineering/Automobile Engineering

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

(New Scheme—2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Missing data if any may be suitably assumed.
Use of approved design data hand book is permitted.

Answer **all** *questions.*
Each full question carries 25 *marks.*

Module 1

1. (a) Explain 'hole basis system' and 'shaft basis system'. Which one is preferred and why ? (10 marks)

(b) Calculate the tolerance, fundamental deviations and limits of size for hole and shaft in the following cases of fits :

(i) 25 H 8/d 9. (ii) 60 H 7/m 6. (15 marks)

Or

2. A cylindrical shaft made of carbon steel C-40 is subjected to static load consisting of bending moment 30 kN-m and a torsional moment 50 kN-m. Determine the diameter of the shaft according to :

(i) Maximum principal stress theory.

(ii) Maximum shear stress theory.

(iii) Maximum principal strain theory.

(iv) Maximum strain energy thoery and

(v) Maximum distortion energy theory.

Take factor of safety as 2, and Poisson's ratio as 0.25.

Module 2

3. A steam boiler is to be designed for a working pressure of 2.5 N/mm^2, with inside diameter 1500 mm. Give the design calculations for the longitudinal and circumferential joints for the following working stresses for the steel plates and rivets :

In tension = 90 MPa, In shear = 75 MPa, In crushing = 150 MPa.

Draw the joints to a suitable scale.

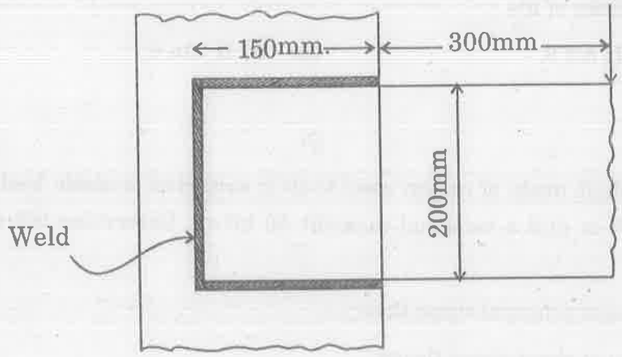
Or

4. A vertical square threads screw of a 70 mm mean diameter and 10 mm pitch supports a vertical load of 50 kN. It passes through the boss of a spur gear wheel of 70 teeth which acts as a nut. In order to raise the load, the spur gear wheel is turned by means of a pinion having 20 teeth. The mechanical efficiency of pinion and gear wheel drive is 90%. The axial thrust on the screw is taken up by a collar bearing having a mean radius of 100 mm. The coefficient of friction for screw and nut is 0.15 and that of collar bearing is 0.12. Find (a) Torque to be applied to the pinion shaft ; (b) Maximum principal and shear stresses in the screw ; and (c) Height of nut, if the bearing pressure is limited to 12 N/mm^2.

Module 3

5. (a) What are the assumptions made in the design of weld joint ? (5 marks)

(b) A bracket as shown in figure carries a load of 30 kN. Calculate the size of the weld, if the allowable shear stress is not to exceed 80 MPa :



(20 marks)

Or

6. It is desirable to design a valve spring of IC engine for the following details :

Spring load when the valve is closed = 80 N

Spring load when the valve is open = 100 N

Space constraints for the fitment of springs are

– Inside guide bush diameter = 24 mm

– Outside recess diameter = 36 mm

Valve lift = 5 mm

Spring steel has the following properties :

– Maximum permissible shear stress = 350 MPa,

– Modulus of rigidity.

Design and give a sketch of the spring, when additional 15 per cent of the working deflection is used to avoid complete closing of coils.

Module 4

7. Three pulleys A, B and C are mounted on a shaft and are at a distances of 1200 mm, 2100 mm and 2700 mm respectively from the left hand bearing. The bearings are 3600 mm apart. Pulley A is 50 cm, B is 75 cm and C is 37.5 cm in diameter. A power unit supplies 20 hp to A and machinery takes 12 hp from B and 8 hp from C. A horizontal drive is arranged to A, while the drive from B has to be vertically downward. The drive from C is taken off at 45° to drive A and in a downward direction. The speed of the shaft is 200 r.p.m. and the allowable shear stress in the shaft is 320 kg/cm^2. Coefficient of friction between belt and pulley is 0.30. Obtain the shaft diameter.

Or

8. (a) How are the keys classified ? Draw neat sketches of different types of keys and state their applications.

(10 marks)

(b) Design and make a neat sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The materials for the shafts and key is plain carbon steel and for the muff is cast iron.

(15 marks)

[4 × 25 = 100 marks]