H.T No: | | | | | | | | | | | **R18** **Course Code: A30331**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations May-2023

Course Name: DYNAMICS OF MACHINERY

(Mechanical Engineering)

Date: 09.05.2023 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. State the principle of Superposition. 2 M
2. Mention the application of gyroscopic principle. 2 M
3. When the equilibrium speed for all radii or rotation the balls within the working range of a governor is said to be isochronous? 2 M
4. In a reciprocating engine Mechanism, the crank and connecting rod of same length r meters are at right angles to each other at a given instant, when the crank makes an angle of 45^0 with IDC. If the crank rotates with a uniform velocity of ω rad/s, What will be the angular acceleration of the connecting rod? 2 M
5. Explain about Cone Clutch. 2 M
6. What is self locking and self energized brake? 2 M
7. The primary direct crank of a reciprocating engine is located at an angle θ clockwise, Where the secondary direct crank will be located at an angle? 2 M
8. Mention the conditions for dynamic balancing. 2 M
9. What do you mean by damping and damped vibration? 2 M
10. Mention the various analytical methods used for deriving the formula of natural frequency of a system. 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11.A). A four wheeled motor car of mass 2000kg has a wheel base 2.5m, track width 1.5m and the height of centre of gravity 500mm above the ground level and lies at 1 meter from the front axle .Each wheel has an effective diameter of 0.8m and a moment of inertia of 0.8 kg-m^2, the drive shaft, engine flywheel and transmission are rotating ar 4 times the speed of road wheel, in a clockwise direction when viewed from the front, and is equivalent to a mass of 75 kg having a radius of gyration of 100 mm. if the car is taking at right turn of 60m radius at 60 km/h, find the load of each wheel. 10M

OR

11. B). The crank and connecting rod of a vertical petrol engine, running at 1800 rpm are 60 mm and 270 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. During the expansion stroke when the crank has turned 20° from the top dead center, the gas pressure is 650 kN/m^2. Determine the,(i) Net force on the piston and net load on the gudgeon pin.(ii) Thrust on the cylinder walls. 10M

(P.T.O..)

12. A). The turning moment diagram for a multi-cylinder engine has been drawn to a scale of 1mm = 500 N-m torque and 1mm = 6° of crank displacement. The intercepted areas between output torque curve and men resistance line taken in order from one end, in sq.mm are -30, +410, -280, +320, -330, +250, -360, +280, -260 sq.mm, when the engine is running at 800 rpm. The engine has a stroke of 300mm and the fluctuation of speed is not to exceed ±2% of the mean speed. The material density may be assumed as 7200 kg/m³. The width of the rim is to be 5 times the thickness. Determine,(i) Diameter of the flywheel rim.(ii) Mass of the flywheel. 10M

OR

12. B). A spring loaded governor of the Hartnell type has arms of equal length. The masses rotate in a circle of 130 mm diameter when the sleeve is in the mid position and the ball arms are vertical. The equilibrium speed for this position is 450 r.p.m., neglecting friction. The maximum sleeve movement is to be 25mm and the maximum variation of speed taking in account the friction to be 5 per cent of the mid positon speed. The mass of the sleeve is 4 kg and the friction may be considered equivalent to 30N at the sleeve. The power of the governor must be sufficient to overcome the friction by one per cent change of speed either way at mid-position. Determine, neglecting obliquity effect of arms.(i) The value of each rotating mass.(ii) The spring stiffness in N/mm. 10M

13. A). Derive expression for frictional torque for single plate clutch considering uniform wear and uniform pressure condition. 10M

OR

13. B). A Simple band brake is applied to a drum of 560mm diameter, which rotates at 240 rpm. Angle of contact of band is 270°. One end of the band is fastened to a fixed pin and the other end of the brake lever 140 mm from the fixed pin. The brake lever is 800 mm long and is placed perpendicular to the diameter that bisects the angle of contact. The coefficient of friction is 0.3; determine the necessary pull at the end of the lever to stop the drum if 40 kW of power is being absorbed. Also find the width of the band if its thickness is 3 mm and the maximum tensile stress is limited to 40N/mm^2. 10M

14. A). Four masses A, B, C and D are completely balanced. Masses C and D makes angles 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 (i) Mass A and its angular position.(ii) Positions of planes A and D. 10M

OR

14. B). A two cylinder uncoupled locomotive with cranks at 90° has a crank radius of 320 mm. The distance between the centers of driving wheels is 1.4 m. The pitch of cylinders is 0.6 m. The diameter of treads of driving wheels is 1.8 m. The radius of centers of gravity of balance masses is 0.65 m. The pressure due to dead load on each wheel is 40 kN. The masses of reciprocating and rotating parts per cylinder are 330 kg and 300 kg respectively. The speed of the locomotive is 60 km/hr. Find, (i)The balancing mass in both magnitude and position required to be placed in the planes of driving wheels to balance whole of the revolving and two-third of the reciprocating masses. 10M

(P.T.O..)

15. A). An instrument vibrates with a frequency of 1 Hz when there is no damping. When the damping is provided, the frequency of damped vibration was observed to be 0.9Hz. Find (i) Damping factor (ii) Logarithmic decrement. 10M

OR

15. B). A shaft 1.5 m long is supported by two short bearings and carries two wheels each of 50 kg mass. One wheel is situated at the center of the shaft and other at a distance of 0.4 m from the center towards right. The shaft is hollow with external diameter 75 mm and inner diameter 37.5 mm. The density of the shaft material is 8000 kg/m^3. The young's modulus for the shaft material is 200 GN/m^2. Find (i) The frequency of free transverse vibration. (ii) Calculate the critical speed of the shaft. 10M

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H.T No: | | | | | | | | | | | **R18** **Course Code: A30332**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations May-2023

Course Name: MANUFACTURING TECHNOLOGY

(Mechanical Engineering)

Date: 11.05.2023 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. Describe the basic elements of machining. 2 M
2. Explain any two work holding devices used in Engine Lathe. 2 M
3. Distinguish between Drilling and Boring. 2 M
4. Write the principle parts of Drilling machine. 2 M
5. Explain the working principle of slotter. 2 M
6. Explain any two operations done on shaper machine. 2 M
7. Explain the principle of milling machine. 2 M
8. List the types of milling machines. 2 M
9. How do you specify the grinding wheel? 2 M
10. Explain about Honing operation. 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11.A). What is the working principle of lathe? Explain briefly the parts of a lathe. 10M

OR

11. B). Differentiate between Capstan and Turret Lathe. 10M

12. A). With the help of neat sketch, explain Radial Drilling Machine. Write any three operations performed on a drilling machine. 10M

OR

12. B). What is a jig-boring machine? Describe its construction and working in detail with a neat sketch. 10M

13. A). With the help of a line diagram explain the basic principle, construction details and working of shaper. 10M

OR

13. B). With the help of a line diagram explain the basic principle, construction details and working of slotter. 10M

14. A). Differentiate between up milling and down milling and explain their applications 10M

OR

14. B). With the help of a line diagram, explain the constructional features of a universal milling machine. 10M

(P.T.O..)

15. A). Explain the theory of grinding. What is the principle of metal removal? Discuss the elements of grinding. 10M

OR

15. B). Explain the differences between lapping and grinding. 10M

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H.T No: | | | | | | | | | | | **R18** **Course Code: A30334**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations May-2023

Course Name: THERMAL ENGINEERING

(Mechanical Engineering)

Date: 13.05.2023 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. How does regeneration improve Rankine cycle performance? 2 M
2. Why is there no chimney in the case of a locomotive boiler? 2 M
3. List the applications of steam nozzles. 2 M
4. What are the effects of air leakage in a steam condenser? 2 M
5. What is the effect of blade friction on turbine performance? 2 M
6. What is the difference between Impulse and Reaction turbine? 2 M
7. How can you improve thermal efficiency of gas turbine plant? 2 M
8. Compare Rankine cycle and Brayton cycle. 2 M
9. Classify various Jet propulsion engines. 2 M
10. Why liquid propellants are preferred in rocket propulsion? 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11.A). Determine the reheat pressure, total rate of heat input in the boiler, the thermal efficiency of the cycle if a steam power plant operates on an ideal reheat Rankine cycle between the pressure limits of 90 bar and 0.1 bar. The mass flow rate of steam through the cycle is 25 kg/s. Steam enters both stages of the turbine at 500° C. If the moisture content of the steam exiting the low pressure turbine should not to exceed 10%. 10M

OR

11. B). i) Differentiate a water tube boiler and fire tube boiler. 5M
ii) Explain the working of Bourdon pressure gauge with neat sketch. 5M

12. A). i) What is the significance of critical pressure ratio on discharge through the nozzle? 5M
ii) Derive an expression for condition of maximum discharge through nozzle. 5M

OR

12. B). i) Steam enters a condenser at 35° C. The barometer reading is 760 mm of mercury. If the vacuum of 690 mm is recorded, calculated the vacuum efficiency. 3M
ii) Explain the working of a surface condenser with neat sketch. 7M

(P.T.O..)

13. A). A single stage impulse turbine is supplied with steam at 4 bar and 160° C and it is exhausted at a condenser pressure of 0.15 bar at the rate of 60 kg/min. the steam expands in a nozzle with an efficiency of 90%. The blade speed is 250m/s and nozzle with are inclined 20° to the wheel. The blade angle at the exit of the moving blade is 30°. Neglecting fraction losses in the moving blade, determine: i) steam jet velocity ii) power developed iii) blade efficiency iv) stage efficiency. 10M

OR

13. B). At a stage in a reaction turbine, the mean blade ring diameter is 1m. The turbine runs at 3000 rpm. The blades are designed for a degree of reaction of 50% with exit angles of 30° and inlet angles of 50°. The turbine is supplied with a steam at 10000 kg/h and the stage efficiency is 85%. Determine: i) Power output of the stage, ii) specific enthalpy drop in kJ/kg, iii) percentage increase in relative velocity of steam over moving blades and iv) the specific steam consumption. 10M

14. A). Describe with a neat sketch the working of reheating gas turbine plant with P-V & T-S diagram and deduce an expression for its thermal efficiency. 10M

OR

14. B). Compare gas turbine plant with steam turbine plant. Write various applications of gas turbine plants. 10M

15. A). The diameter of the propeller of an aircraft is 2.5 m. It flies at a speed of 540 km/h at an elevation of 8000 m, where air density is 0.525 kg/m3. The flight to jet speed ratio is 0.75. Calculate i) the air flow rate through the propeller, ii) thrust produced, iii) specific thrust, iv) specific impulse and v) thrust power. 10M

OR

15. B). Explain the working of various types of propellant rockets and compare with its advantages. 10M

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H.T No: | | | | | | | | | | | R18 | Course Code: A30335

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations May-2023

Course Name: MACHINE DESIGN

(Mechanical Engineering)

Date: 16.05.2023 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. What are preferred numbers? What is their significance in design? 2 M
2. Write Soderberg's equation and state its application to different type of loadings. 2 M
3. What is caulking? What is its objective? 2 M
4. What are the advantages of welded joints compared with riveted joints? 2 M
5. What are the advantages of hollow shaft over solid shaft? 2 M
6. What is clamp coupling? Give its applications. 2 M
7. What are journal bearings? Give a classification of these bearings. 2 M
8. How do you express the life of a bearing? What is an average or median life? 2 M
9. What are the applications of spring? 2 M
10. What is the minimum number of teeth on spur gear? Why? 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11.A). The principal stresses induced at a point in a machine component made of steel 50C4 (S_{yt} = 460 N/mm^2) are as follows: 10M

σ_1 = 200N/mm^2 σ_2 = 150 N/mm^2 σ_3 = 0

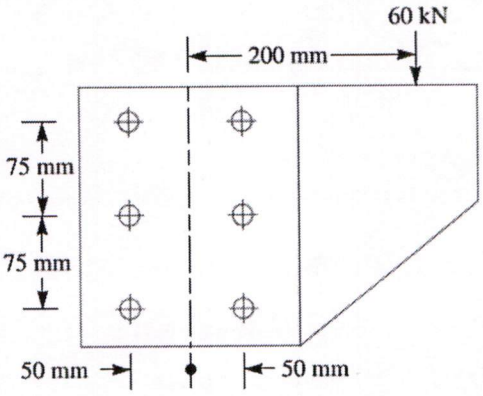
Calculate the factor of safety by (i) Maximum Shear Stress Theory, and (ii) Distortion Energy Theory.

OR

11. B). A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4 P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9. 10M

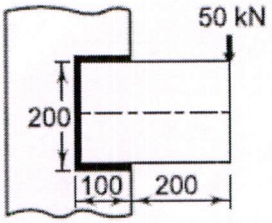
(P.T.O..)

12. A). A bracket is riveted to a column by 6 rivets of equal size as shown in Fig. It carries a load of 60 kN at a distance of 200 mm from the centre of the column. If the maximum shear stress in the rivet is limited to 150 MPa, determine the diameter of the rivet. 10M



OR

12. B). A welded connection of steel plates is shown in Fig. It is subjected to an eccentric force of 50 kN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 N/mm^2. 10M



13. A). A propeller shaft is required to transmit 50 kW power at 600 rpm. It is a hollow shaft, having an inside diameter 0.8 times of the outside diameter. It is made of steel (Syt = 380 N/mm^2) and the factor of safety is 4. Calculate the inside and outside diameters of the shaft. Assume (Ssy = 0.5Syt). 10M

OR

13. B). Design a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa. 10M

14. A). A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm^2. The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. Find: 1. The amount of artificial cooling required, 2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of the oil as 1850 J / kg / °C. 10M

(P.T.O..)

OR

14. B). A rolling contact bearing is subjected to the following work cycle : 10M
(i) Radial load of 6000 N at 150 r.p.m. for 25% of the time;
(ii) Radial load of 7500 N at 600 r.p.m. for 20% of the time; and
(iii) Radial load of 2000 N at 300 r.p.m. for 55% of the time.
The inner ring rotates and loads are steady. Select a bearing for an expected average life of 2500 hours.

15. A). A railway wagon moving at a velocity of 1.5 m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of the wagon is 1500 kg. The springs are compressed by 150 mm in bringing the wagon to rest. The spring index can be taken as 6. The springs are made of oil-hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm^2 and modulus of rigidity of 81 370 N/mm^2. The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) Solid length; (vi) free length; (vii) pitch of the coil; 10M

OR

15. B). In a pair of spur gears, the number of teeth on the pinion and the gear are 20 and 100 respectively. The module is 6 mm. Calculate (i) the centre distance; (ii) the pitch circle diameters of the pinion and the gear; (iii) addendum and dedendum; (iv) tooth thickness and bottom clearance; and (v) the gear ratio. 10M

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H.T No: | | | | | | | | | | | **R18** **Course Code: A30351**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations May-2023

Course Name: NON DESTRUCTIVE TESTING METHODS

(Mechanical Engineering)

Date: 18.05.2023 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. What are the objectives of Non-Destructive Testing? 2 M
2. What is Visual Inspection? 2 M
3. What types of defects can be detected in a liquid penetrate test? 2 M
4. Why should the material be demagnetized after it is subjected to NDT? 2 M
5. State the basic principle involved in Thermography testing. 2 M
6. List the types of probe used in eddy current inspection. 2 M
7. List the different modes of ultrasonic waves. 2 M
8. What is the basic principle of acoustic emission test? 2 M
9. What is meant by Film density? 2 M
10. What is Thomson scattering? 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11.A). Explain the testing methods for the detection of material characterization. 10M

OR

11. B). Compare NDT versus Mechanical testing methods. 10M

12. A). Explain the principle and process in detecting flaws in materials using liquid penetrant method with help of neat sketch. 10M

OR

12. B). Explain various methods of magnetization and demagnetization commonly practiced in Non destructive testing procedure. 10M

13. A). Explain with neat sketch about the principle of thermography test and write its advantages. 10M

OR

13. B). Classify the eddy current probes on the basis of following:
i) Mode of application, ii) Mode of operation. 10M

14. A). Explain different transducers in ultrasonic testing with neat sketch. 10M

OR

14. B). Explain about time flight diffraction (TOFD) Technique principle and steps involved in TOFD and its advantages. 10M

(P.T.O..)

15. A). With the help of a neat sketch explain about Ultrasonic Testing. What are the Variables that Affect Ultrasonic Test? 10M

OR

15. B). Discuss the following: 10M
i) Computed radiography, ii) Computed tomography.

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H.T No: | | | | | | | | | | | **R18** **Course Code: A30371**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations May-2023

Course Name: REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Date: 18.05.2023 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. Classify different methods of refrigeration. 2 M
2. What is meant by relative COP? 2 M
3. List the major components of vapour compression refrigeration system. 2 M
4. Sketch the T-S diagram of a simple air-cooling system. 2 M
5. What are the examples of azeotropes? 2 M
6. List the desirable properties of refrigerants. 2 M
7. Tell the role of the generator in a vapour absorption refrigeration system. 2 M
8. List out the demerits of steam jet refrigeration system. 2 M
9. Define dew point temperature. 2 M
10. List out the factors affecting human comfort. 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11.A). Illustrate the working of a simple air cycle cooling system used for aircrafts. 10M

OR

11. B). An air refrigerator works between pressure limits of 1 bar and 4 bar. The temperature of the air entering the compressor is 15^{O}C and entering the expansion cylinder is 30^{O}C. The expansion follows the law $pv^{1.35}$ = constant. The compression follows the law $pv^{1.35}$ = constant. Calculate (i) COP of the refrigerating cycle, (ii) If the mass flow rate of air is 25kg/min, the refrigeration capacity of the system. 10M

12. A). A vapour compression refrigerator uses methyl chloride and operates between temperature limits of -10^{O}C and 45^{O}C. At entry to the compressor, the refrigerant is dry saturated and after compression it requires a temperature of 60^{O}C. The relevant properties of methyl chloride are as follows: 10M

Saturation Temperature ^{O}C	Enthalpy in kJ/kg		Entropy in kJ/kg K	
	Liquid	Vapour	Liquid	Vapour
-10	45.4	460.7	0.183	1.637
45	133.0	483.6	0.485	1.587

Determine the following:

(i) Sketch the cycle in a T-S and p-h diagram,

(ii) Find the COP of the refrigerator.

(P.T.O..)

OR

12. B). Explain the effect of subcooling of condensate with the help of T-S and p-h diagrams in vapour compression system. 10M

13. A). Compare air-cooled and water-cooled condenser with examples. 10M

OR

13. B). Elaborate the working of flooded evaporator with its sketch and also list its application. 10M

14. A). Elaborate about the working principle and operation of thermoelectric refrigerator. 10M

OR

14. B). Illustrate about vapour absorption refrigeration system using three fluids. 10M

15. A). With the help of psychrometric chart, explain the following processes: 10M

(i) Sensible heating and sensible cooling process,

(ii) Heating and dehumidification process.

OR

15. B). The following data relates to the office air conditioning plant having maximum seating capacity of 25 occupants: 10M

Outside design conditions = 34^{O}C DBT, 28^{O}C WBT

Inside design conditions = 24^{O}C DBT, 50% RH

Solar heat gain = 3120 W

Latent heat gain per occupant = 105 W

Sensible heat gain per occupant = 90 W

Lightening load = 2300 W

Sensible heat load from other sources = 11630 W

Infiltration load = 14 m^3/min

Assume 40% fresh air and 60 % of recirculated air passing through the evaporator coil and the by-pass factor of 0.15, find the dew point temperature of the coil and capacity of the pant.

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