



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations December-2024

Course Name: Dynamics of Machinery

(Mechanical Engineering)

Date: 16.12.2024 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. What are the forces acting on the slider crank mechanism due to gas Pressure acting on the piston? 2 M
2. What is the effect of gyroscopic couple on rolling of ship? Why? 2 M
3. Distinguish between crank effort and piston effort 2 M
4. Can a porter governor be isochronous. Justify? 2 M
5. What are functions of Clutches? 2 M
6. Define dynamometer. 2 M
7. Whether your watch needles are properly balanced or not. Justify? 2 M
8. Classify the locomotive based on arrangement of cylinders. 2 M
9. What is meant by whirling speed? 2 M
10. Why the natural frequency plays a vital role in analysis of vibration? 2 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). A turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 rpm, clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship, (i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/hr.(ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees. 10M

OR

11. B). In a vertical double – acting steam engine, the connecting rod is 4.5 times the crank. The weight of the reciprocating parts is 120 kg and the stroke of the piston is 440 mm. The engine runs at 250 rpm. If the net load on the piston due to steam pressure is 25 kW when the crank has turned through an angle of 120° from the top dead center. Determine the,(i) Thrust in the connecting rod and pressure on slide bars.(ii) Tangential force on the crank pin and thrust on the bearings. 10M
12. A). A Hartnell governor having a central sleeve spring and two right angled bell crank levers moves between 290r.p.m and 310 r.p.m for a sleeve lift of 15mm. the sleeve arms and the balls arms are 80 mm and 120mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine the loads on the spring at the lowest and highest equilibrium speed and stiffness of the spring. 10M

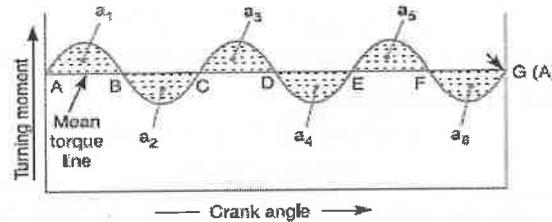
OR

12. B). i) A horizontal cross compound steam engine develops 300 kW at 90 rpm. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within $\pm 0.5\%$ of mean speed, find the mass of the flywheel required, if the radius of gyration is 2m. 5M

(P.T.O..)

ii) From the following figure, consider a_1, a_2, a_3, a_4, a_5 and a_6 are the energy of the moving parts of the engine, What is the energy level at A, B, C, D, E, F and G which are intersection of resulting torque with mean torque line.

5M



13. A). A conical pivot supports the load of 20KN. The intensity of pressure is 0.5MN/m^2 . Find diameter of bearing surface and cone angle, if the face width is 0.75 times the diameter. If the shaft runs at 120 rpm and Coefficient of Friction is 0.06. Find power lost in friction. 10M

OR

13. B). A band and block brake having 12 blocks, each of which subtends angle of 16° at center is applied to a rotating drum of diameter 600 mm. The blocks are 75 mm thick. The drum and flywheel mounted on same shaft have mass of 1800 kg and combined radius of gyration is 600 mm. The two ends of band are attached to pins on opposite sides of the brake fulcrum at distance of 40 mm and 150 mm from fulcrum. If the force of 250 N is applied at the distance of 900mm from fulcrum. Find a) Max braking torque. b) Angular retardation of drum. c) Time taken by system to be stationary from rated speed of 300 rpm. Take COF as 0.3. 10M

14. A). A shaft is supported between bearings, 2 m apart extended 0.5 m beyond bearing at each end. The shaft carries three pulleys, one at each end and one at the middle of length. The masses of end pulleys are 50 kg and 25 kg and their center of gravity are 20 mm and 16.5 mm respectively from the shaft axis. The center pulley has mass of 60 kg and its center of gravity is 20 mm from the shaft axis. If the pulleys are arranged so as to give the static balance, determine: (i) The relative angular positions of the pulleys.(ii) The dynamic forces produced on the bearings when the shaft rotates at 300 rpm. 10M

OR

14. B). Two locomotives are built with similar sets of reciprocating parts. One is an inside cylinder engine with two cylinders with center lines at 0.6m apart. The other is an outside cylinder with center lines at 1.98m apart. The distance between the driving wheel centers is 1.5m in both the cases. The inside cylinder locomotive runs at 0.8times the speed of the outside cylinder locomotive and the hammer blow of the inside cylinder locomotive is 1.2 times the hammer blow of the outside cylinder locomotive. If the diameter of the driving wheel of the outside locomotive is 1.98m, calculate the diameter of the driving wheel of the inside cylinder locomotive. Also Compare the variation in the swaying couples of the two engines, Assume that same fraction of the reciprocating masses are balanced in both the cases. 10M

15. A). Using the concepts of equilibrium method, deduce the expression for natural frequency of free longitudinal vibration. 10M

OR

15. B). A steel shaft 1.5 m long is 95 mm in diameter of the first 0.6 m of its length, 60 mm in diameter for the next 0.5 m of the length and 50 mm in diameter for the remaining 0.4 m of its length. The shaft carries two flywheels at the ends, the first having a mass of 900 kg and 0.85 m radius of gyration located at the 95 mm diameter end and the second having a mass of 700 kg and 0.55 m radius of gyration located at the other end. Determine the location of the node and the natural frequency of free torsional vibration of the system. The modulus of rigidity of the shaft material may be taken as 80GN/m^2 . 10M

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R18

Course Code: A30332



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations December-2024

Course Name: **Manufacturing Technology**
(Mechanical Engineering)

Date: 18.12.2024 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. Mention the basic principle of lathe working. 2 M
2. Mention the significance of tool layout. 2 M
3. Mention the basic principle of drilling machine working. 2 M
4. Mention the tool holding devices in radial drilling machine. 2 M
5. Mention the classification of planning machine 2 M
6. Mention the classification of slotting machine 2 M
7. Differentiate between turning and milling processes. 2 M
8. Mention the application of milling machined surfaces. 2 M
9. Differentiate between honing and broaching processes. 2 M
10. Differentiate between lapping and honing processes. 2 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Sketch & explain the lathe attachments. 10M
- OR**
11. B). Explain the features of capstan & turret lathe. 10M
12. A). Mention the basic principle of lathe working. 10M
- OR**
12. B). Sketch and explain deep drilling machine. 10M
13. A). Explain the working principles & operation of planning machine. 10M
- OR**
13. B). Explain the working principles & operation of slotting machine 10M
14. A). Discuss briefly geometry of milling cutter. 10M
- OR**
14. B). Explain the working principle of universal milling machine. 10M
15. A). Explain special types of grinding machine. 10M
- OR**
15. B). Sketch & explain cylindrical grinding machine. 10M

H.T No:

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R18

Course Code: A30334

**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations December-2024

Course Name: **Thermal Engineering**

(Mechanical Engineering)

Date: 20.12.2024 AN

Time: 3 hours

Max.Marks:70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. State the advantages of regenerative cycle over simple Rankine cycle. 2 M
2. Enumerate the various accessories normally used in steam generating plant. 2 M
3. Define the term nozzle. Explain various types of nozzles. 2 M
4. What are effects of super saturated flow? 2 M
5. Distinguish between impulse and reaction turbine. 2 M
6. Why are steam turbines compounded? 2 M
7. Write the merits and demerits of gas turbine plant over internal combustion engine. 2 M
8. What are the different methods used to improve efficiency of a gas turbine plant? 2 M
9. Why is thrust augmentation necessary? What are the methods for thrust augmentation in a turbo jet engine? 2 M
10. Define the following terms as applied to rocket propulsion: thrust, propulsive efficiency. 2 M

PART-B

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

- 11.A). In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Determine: 10M
- (i) The pump work
 - (ii) The turbine work
 - (iii) The Rankine efficiency
 - (iv) The condenser heat flow.

Assume flow rate of 9.5 kg/s.

OR

11. B). Derive an expression for draught produced in terms of height chimney, ambient and flue gas temperatures. State clearly the assumptions made. 10M
12. A). Dry saturated steam at a pressure of 10 bar is discharged through a nozzle at a back pressure of 1 bar. Determine the throat and exit diameters for a mass flow rate of 1 kg/s and nozzle efficiency of 90%. 10M

OR

12. B). Explain the working of an evaporative condenser with a neat diagram. 10M
13. A). i) Make a comparison between the impulse and reaction type steam turbine. 5M
ii) Define the term "degree of reaction" as applied to a steam turbine. Show that for Parson's reaction turbine the degree of reaction is 50%. 5M

(P.T.O)

OR

13. B). A 50% reaction turbine (with symmetrical velocity triangles) running at 400 rev/min has the exit angle of the blades as 20° and the velocity of steam relative to the blades is 1.35 times the mean blades speed. The steam mass flow rate is 8.25 kg/s and at a particular stage the specific volume is $1.382 \text{ m}^3/\text{kg}$. For this stage, make calculations for
- a) A suitable blade height if the rotor mean diameter is 10 times blade height.
 - b) The diagram work.
- 10M

14. A). Explain the working of reheat gas turbine plant with the help of a T-s diagram. 10M

OR

14. B). In gas turbine plant operating on Joule cycle, air is compressed from 1 bar and 15°C through a pressure ratio of 6. It is then heated to 72°C in the combustion chamber and expanded back to a pressure of 1 bar. Calculate network done, cycle efficiency and work ratio. Assume isentropic efficiencies of turbine and compressor are 90% and 85% respectively. 10M

15. A). A turbojet engine air craft flies with a velocity of 260 m/s at an altitude where the air is at 35kPa and -40° . The compressor has a pressure ratio of 10 and the temperature of the gases at the turbine is 1095°C . The air enters the compressor at a rate of 8.5 kg/sec. determine (a) temperature and the pressure of the gases at the turbine exit (b) velocity of gases at the nozzle exit and (c) propulsive efficiency of the cycle. 10M

OR

15. B). What is propellant? How are propellant classified? What are desirable properties of a liquid propellant for a rocket engine? 10M



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations December-2024

Course Name: Machine Design

(Mechanical Engineering)

Date: 23.12.2024 AN

Time: 3 hours

Max.Marks:70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

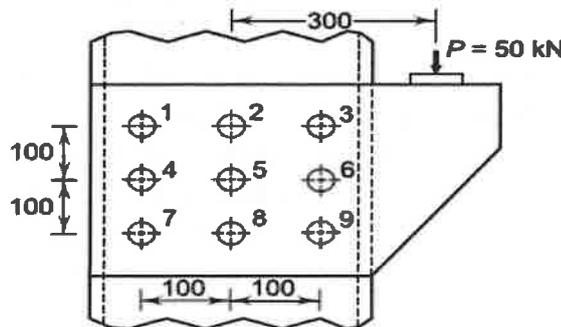
Each question carries TWO marks. 10x2=20M

1. Write the relations used for maximum stress when a machine member is subjected to tensile or compressive stresses along with shearing stresses. 2 M
2. Write a note on the influence of various factors of the endurance limit of a ductile material. 2 M
3. What is Fullering? What is its objective? 2 M
4. What is bolt of uniform strength? 2 M
5. Define equivalent torsional moment and equivalent bending moment. State when these two terms are used in the design of shafts. 2 M
6. What is Muff coupling? Give its applications? 2 M
7. Write short note on the lubricants used in sliding contact bearings. 2 M
8. What are rolling contact bearings? Discuss their advantages over sliding contact bearings? 2 M
9. Distinguish between closely coiled and open coil helical springs. 2 M
10. Why is the pinion weaker than the gear made of same material? 2 M

PART-B

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

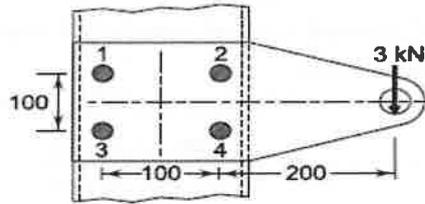
- 11.A). Write general considerations involved in machine design. 10M
- OR**
11. B). A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 KN and a maximum value of 50 KN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by: ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. 10M
 12. A). A bracket is attached to a steel channel by means of nine identical rivets as shown in Fig. Determine the diameter of rivets, if the permissible shear stress is 60 N/mm² 10M



(P.T.O..)

OR

12. B). A steel plate subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts is shown in Fig. The bolts are made of plain carbon steel 45C8 ($S_{yt} = 380 \text{ N/mm}^2$) and the factor of safety is 2. Determine the diameter of the shank. 10M



13. A). Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the center of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 rpm. The angle of the lap of the belt is 180° and the coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factor for bending and twisting are 1.5 and 2.0 respectively. The allowable she stress in the shaft may be taken as 35 MPa. 10M

OR

13. B). Design a muff coupling which is used to connect two steel shafts transmitting 25 kW power at 360 rpm. If the permissible shear stress is 40 MPa., allowable Tensile stress of bolts is 70 MPa. The number of bolts is 6. The coefficient of friction between muff and shaft is 0.3. 10M

14. A). The following data is given for a full hydrodynamic bearing: 10M
Radial load = 25 kN, Journal Speed = 900 rpm, class of fit = H7e7
Unit Bearing Pressure = 2.5 MPa(l/d) ratio = 1,
Viscosity of Lubricant = 20 CP,
Calculate (i) dimensions of the bearing, (ii) Minimum film thickness, and (iii) Requirement of oil flow.

OR

14. B). Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day. Assume uniform and steady load. 10M

15. A). A helical compression spring is required to deflect through 25 mm approximately when the external force acting on it varies from 500 to 1000 N. The spring index is 8. The spring has square and ground ends. There should be a gap of 2 mm between adjacent coils when the spring is subjected to the maximum force of 1000 N. The spring is made of cold-drawn steel wire with ultimate tensile strength of 1000 N/mm^2 and permissible shear stress in the spring wire should be 50% of the ultimate tensile strength ($G = 81370 \text{ N/mm}^2$). Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) free length. 10M

OR

15. B). It is required to design a pair of spur gears with 20° full-depth involute teeth consisting of a 20-teeth pinion meshing with a 50 teeth gear. 10M
The pinion shaft is connected to a 22.5 kW, 1450 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe410 ($S_{ut} = 410 \text{ N/mm}^2$), while the gear is made of grey cast iron FG 200 ($S_{ut} = 200 \text{ N/mm}^2$). The factor of safety is 1.5. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load.

H.T No:

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R18

Course Code: A30371



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations December-2024

Course Name: Refrigeration & Air Conditioning
(Mechanical Engineering)

Date: 26.12.2024 AN

Time: 3 hours

Max.Marks: 70

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries TWO marks.

10x2=20M

1. Give the unit of refrigeration and its SI Equivalent. 2 M
2. What is COP? Give its relation. 2 M
3. List the essential components of the vapour compression refrigeration plant. 2 M
4. Draw the T-s diagram of the vapour-compression refrigeration cycle with saturated vapour after compressor. 2 M
5. List any four advantages of vapour compression refrigeration cycle. 2 M
6. List any four desirable properties of refrigerants. 2 M
7. What are the three temperature levels in vapour absorption refrigeration system? 2 M
8. Enlist the Basic Components of Steam Jet Refrigeration System. 2 M
9. List the Psychometric properties of consideration in an Ideal Air Conditioning System. 2 M
10. Enlist the requirements of an Ideal Air Conditioner System. 2 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Enumerate the different types of mechanical refrigeration systems. Provide an overview of mechanical refrigeration and its role in modern cooling systems. 10M

OR

11. B). Explore real-world applications of air refrigeration systems. Identify and discuss common issues and problems encountered. 10M

12. A). A vapour compression refrigerator uses methyl chloride (R-40) and operates between temperature limits of -10°C and 45°C. At entry to the compressor, the refrigerant is dry saturated and after compression it acquires a temperature of 60°C. Find the C.O.P. of the refrigerator. The relevant properties of methyl chloride are as follows. 10M

Saturation Temp T_{sat} (°C)	Enthalpy in kJ/kg		Entropy in kJ/kgK	
	Vapour	Liquid	Vapour	Liquid
-10	460.7	45.4	0.183	1.637
45	483.6	133.0	0.485	1.587

OR

12. B). Explain how the vapor compression refrigeration cycle is represented on a T-S (Temperature-Entropy) chart. Discuss the representation of the cycle on a P-H (Pressure-Enthalpy) chart. 10M

(P.T.O.)

13. A). Name and describe common refrigerants used in refrigeration applications. Enlist their properties. 10M

OR

13. B). What are the advantages, limitations and applications of vapour refrigeration systems. 10M

14. A). Explain the working of NH_3 – Water and Li-Br system with suitable sketches. 10M

OR

14. B). Explain the principle, applications and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube with suitable sketches. 10M

15. A). Explain the need for ventilation and Explicate the Load concepts of RSHF, ASHF, ESHF and ADP. 10M

OR

15. B). Explain the concepts of cooling, heating, humidification and dehumidification, with suitable sketches. 10M
