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

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations June/July-2025

Course Name: Dynamics of Machinery

(Mechanical Engineering)

Date: 30.06.2025 FN **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 is gyroscopic effect during pitching of ship?	2 M
2.	What is dynamic force analysis?	2 M
3.	List few machines in which flywheel are used.	2 M
4.	What is the difference between the Porter and Proell governors?	2 M
5.	Write down the applications of clutches.	2 M
6.	Discuss the various types of the brakes.	2 M
7.	What are primary and secondary forces in the reciprocating engine?	2 M
8.	What is reciprocating balancing?	2 M
9.	How torsional vibrations are produced?	2 M
10.	Explain the term 'Whirling speed'.	2 M

PART-B

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

11.A). A four-wheeled trolley car of mass 2500 kg runs on rails, which are 1.5 m apart and travels around a curve of 30 m radius at 24 km / hr. The rails are at the same level. Each wheel of the trolley is 0.75 m in diameter and each of the two axles is driven by a motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of the wheels. The moment of inertia of each axle with gear and wheels is 18 kg-m^2. Each motor with shaft and gear pinion has a moment of inertia of 12 kg-m^2. The centre of gravity of the car is 0.9 m above the rail level. Determine the vertical force exerted by each wheel on the rails taking into consideration the centrifugal and gyroscopic effects. State the centrifugal and gyroscopic effects on the trolley. 10M

OR

11. B). Explain the procedure for performing static force analysis of a four-bar linkage mechanism. Illustrate with a neat diagram. 10M

12. A). The turning moment diagram for a multi cylinder engine has been drawn to a scale 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows : 10M

+ 52, – 124, + 92, – 140, + 85, – 72 and + 107 mm^2, when the engine is running at a speed of 600 r.p.m. If the total fluctuation of speed is not to exceed ± 1.5% of the mean, find the necessary mass of the flywheel of radius 0.5 m.

OR

12. B). Briefly explain the working principle of Porter governors with neat sketch. 10M

(P.T.O..)

13. A). With a neat sketch, explain the working of Multi-Plate Clutch. 10M

OR

13. B). A band and block brake, having 14 blocks each of which subtends an angle of 15° at the centre, is applied to a drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. The two ends of the band are attached to pins on opposite sides of the brake lever at distances of 30 mm and 120 mm from the fulcrum. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, find: 10M

i). maximum braking torque, ii). angular retardation of the drum, and iii). time taken by the system to come to rest from the rated speed of 360 r.p.m.

The coefficient of friction between blocks and drum may be taken as 0.25.

14. A). Four masses A, B, C and D revolves at equal radii and are equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angles of 90° and 240° respectively with the radius of B. Find the magnitude of masses A, C and D and angular position of A so that the system may be completely balanced. 10M

OR

14. B). Explain the method of balancing of different masses revolving in the same plane. 10M

15. A). Derive an equation of motion and natural frequency of vibration of spring mass system in vertical position by Newtons method. 10M

OR

15. B). A steel shaft 25 mm diameter, 1.5 m long carries a disc of mass 5 kg at its center and 2 kg at 0.5 m from one support. Determine the whirling speed if $E = 2 \times 105$ MN/m^2. 10M

*****

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

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations June/July-2025

Course Name: Thermal Engineering

(Mechanical Engineering)

Date: 04.07.2025 FN **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 the simple Rankine cycle.	2 M
2.	What are the major differences between boiler mountings and accessories?	2 M
3.	What do you understand by the term "Critical Pressure" as applied to steam nozzles?	2 M
4.	Define the term "vacuum efficiency" as applied to a condenser.	2 M
5.	Classify different steam turbines.	2 M
6.	State the operational principle of impulse turbine.	2 M
7.	What are the basic requirements of a combustion chamber used in Gas Turbine Plant?	2 M
8.	Draw the T-S diagram of actual gas turbine plant indicating its processes.	2 M
9.	What do you understand by Thrust Augmentation?	2 M
10.	List out the desirable properties required for liquid propellant rockets.	2 M

PART-B

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

11.A).	Describe the different processes of Rankine cycle. Derive the expression for its efficiency and show them on P-v and T-s diagrams.	10M
	OR	
11. B).	In a chimney draught, the draught produced is 19 mm of water when the gas temperature is 290°C and ambient temperature is 20°C. Find out the mass of flue gases passing through the chimney when the air supplied is 22 kg per kg of fuel. Neglect the losses and take diameter of the chimney = 1.8 m.	10M
12. A).	A surface condenser is designed to handle 10000 kg of steam per hour. The steam enters at 0.08 bar abs. and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow per hour, If the cooling water temperature rise is limited to 10^0C.	10M
	OR	
12. B).	Dry saturated steam at 10bar is expanded in a nozzle to 0.4 bar. The throat area is 7cm and the inlet velocity is negligible. Estimate the mass flow and the exit area. Assume isentropic flow and take the index n=1.135 for dry saturated steam.	10M
13. A).	Derive an expression for optimum stage efficiency of a reaction turbine.	10M
	OR	
13. B).	The following data related to a stage of reaction turbine: mean rotor diameter 1.5m, speed ratio 0.72, blade outlet angle 20^0 and rotor speed 3000rpm. Determine (i) the diagram efficiency (ii) the percentage increase in diagram efficiency and rotor speed if the rotor is designed to run at best theoretical speed, the exit angle being 20^0.	10M

(P.T.O..)

14. A). What are the effects of the following factors on the specific output and thermal efficiency of the open cycle gas turbine at different pressure ratios? **(i)** Compressor inlet temperature, **(ii)** Isentropic efficiency of the compressor, **(iii)** Turbine inlet temperature, and **(iv)** Turbine isentropic efficiency. 10M

OR

14. B). In an air standard regenerative gas turbine cycle the pressure ratio is 5. Air enters the compressor at 1 bar, 300 K and leaves at 490 K. The maximum temperature in the cycle is 1000 K. Calculate the cycle efficiency, given that the efficiency of regenerator and the adiabatic efficiency of the turbine are each 80%. Assume for air, the ratio of specific heats is 1.4. Also show the cycle on T-S diagram. 10M

15. A). Explain the working of liquid propellent rocket engine with neat sketch and mention its applications. 10M

OR

15. B). The effective jet exit velocity of a rocket is 3500 m/s, the forward flight velocity is 1250 m/s and the propellent consumption is 75 kg/s. Calculate (i) Thrust (ii) Thrust Power and (iii) Propulsive efficiency. 10M

*****

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

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations June/July-2025

Course Name: Machine Design

(Mechanical Engineering)

Date: 07.07.2025 FN **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. Enumerate the most commonly used engineering materials 2 M
2. What are the general considerations that are taken into account while designing a machine element. 2 M
3. What is an economical joint and where does it finds applications? 2 M
4. List advantages of bolted joints over welded joints 2 M
5. What types of stresses are induced in shafts? 2 M
6. What are the differences between Rigid couplings and Flexible couplings 2 M
7. Enumerate any two advantages and disadvantages of rolling contact bearings to sliding contact bearings 2 M
8. Why are ball and roller bearings called anti friction bearings? 2 M
9. Compare the beam strength of spur and helical gears 2 M
10. Differentiate between helical and leaf springs 2 M

PART-B

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

11.A). A shaft is designed based on maximum distortion energy theory with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of310MPa. It is subjected to an axial load of 40kN. Determine the maximum torque capacity. Diameter of the shaft is 20 mm. 10M

OR

11. B). Determine the diameter of the circular rod made of ductile material with a fatigue strength (complete stress reversal), σ_e=265 MPa and tensile yield strength of 350MPa. The member is subjected to a varying axial load from Wmin= -300x10^3N to Wmax=700x10^3N and has a stress concentration factor=1.8. Use factor of safety as 2.0 10M

12. A). A circular steel bar 50 mm diameter and 200 mm long is welded perpendicularly to steel plate to form a cantilever to be loaded with 5 KN at the free end. Determine the size of the weld, assuming the allowable stress in the weld as100 MPa 10M

OR

12. B). A welded connection of steel plates, as shown in Fig.1, is subjected to an eccentric force of 10 kN. Determine the throat dimension of the welds, if the permissible shear stress is limited to 95 N/mm^2. Assume static conditions. 10M

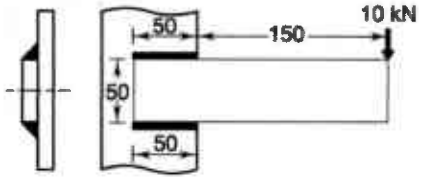

Fig:1

(P.T.O..)

13. A). Design a cast iron protective type flange coupling to connect two shafts in order to transmit 7.5kW at 720rpm. The following permissible stresses may be used: Permissible shear stress for shaft, bolt and key material = 33MPa Permissible crushing stress for shaft, bolt and key material =60MPa Permissible shear stress for the cast iron = 15MPa. 10M

OR

13. B). 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

14. A). Design a suitable journal bearing for a centrifugal pump from the following available data: Load on the bearing = 13.5 kN; Diameter of the journal = 80 mm; Speed = 1440 r.p.m.; Bearing characteristic number at the working temperature (75°C) = 30; Permissible bearing pressure intensity = 0.7 N/mm^2 to 1.4 N/mm^2; Average atmospheric temperature = 30°C. Calculate the cooling requirements, if any. 10M

OR

14. B). A 100 mm long and 60 mm diameter journal bearing supports a load of 2500 N at 600 r.p.m. If the room temperature is 20°C, what should be the viscosity of oil to limit the bearing surface temperature to 60°C? The diametral clearance is 0.06 mm and the energy dissipation coefficient based on projected area of bearing is 210 $W/m^2/°C$. 10M

15. A). A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast-iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. 10M

OR

15. B). Design a compression helical spring to carry a load of 500 N with a deflection of 25 mm. The spring index may be taken as 8. Assume the following values of the spring material: Permissible shear stress=350 Mpa Modulus of rigidity =84 KN/mm^2 Wahl's factor =(4C-1)/(4C-4) +0.615/C, where C is spring index. 10M

*****

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

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations June/July-2025

Course Name: Refrigeration & Air Conditioning

(Mechanical Engineering)

Date: 09.07.2025 FN **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. List the main components of a refrigeration process. 2 M
2. Draw the T-S diagram for Bell-Coleman Cycle. 2 M
3. Draw the p-h diagram of a simple vapour compression refrigeration system. 2 M
4. Calculate the Coefficient of Performance (C.O.P.) for the Carnot refrigeration system. 2 M
   Given data:
   Evaporator temperature (Te) = -10°C
   Condenser temperature (Tc) = 40°C
5. List the desirable properties of refrigerants in a vapor compression system. 2 M
6. Name and briefly describe common refrigerants used in refrigeration applications. 2 M
7. Draw the sketch of lithium-bromide absorption refrigeration system. 2 M
8. List the salient features that distinguish a three-fluid system from conventional two-fluid absorption systems. 2 M
9. List the psychometric properties in the context of air conditioning. 2 M
10. Write any two differences between sensible and latent heat loads. 2 M

PART-B

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

11.A). i. Discuss the significance of Coefficient of Performance (C.O.P.) in assessing the efficiency of refrigeration systems. 5M

ii. Evaluate the advantages and limitations of each ideal cycle and their practical applications. 5M

OR

11. B). Discuss the key features and applications of the Bell-Coleman cycle in air refrigeration systems with suitable diagrams. 10M

12. A). Explain the representation of the vapor compression refrigeration cycle on Temperature-Entropy (T-S) and Pressure-Enthalpy (P-H) charts. 10M

OR

12. B). The temperature limits of an ammonia refrigerating system are 25° C and -10° C. If the gas is dry at the end of compression, calculate the C.O.P. of the cycle assuming no undercooling of the liquid ammonia. Use the following table for properties of ammonia: 10M

Temperature (°C)	Liquid Heat (kJ/kg)	Latent Heat (kJ/kg)	Liquid Entropy (kJ/kgK)
25	298.9	1166.94	1.1242
-10	135.37	1297.68	0.5443

(P.T.O..)

13. A). Compare and contrast different types of compressors used in vapor compression refrigeration systems. List the advantages and disadvantages. 10M

OR

13. B). Differentiate between azeotropes and zeotropes in refrigeration. Discuss the advantages and challenges associated with the use of azeotropic and zeotropic refrigerant blends. 10M

14. A). Explain the significance of calculating the maximum C.O.P. Discuss the factors influencing the maximum C.O.P. and its practical implications. 10M

OR

14. B). Compare and contrast the Li–Br absorption refrigeration system with other absorption systems. Discuss the specific characteristics and advantages of the Li–Br system in various applications. 10M

15. A). Enumerate the psychometric properties and Analyze its importance in air conditioning processes. 10M

OR

15. B). Examine recent advancements in heat pump technology. Discuss how the heat pump circuits have evolved to meet the changing demands of the industry. 10M

*****