Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)
END SEMESTER EXAMINATIONS, MAY 2024

VEHICLE DESIGN AND PERFORMANCE [AAE 5423]

REVISED CREDIT SYSTEM

Time: 3 Hours **07/05/2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

Q.NO	Questions	Marks	CO	BTL
1A.	Illustrate the following processes of hardening treatment for the engine crank shafts. (i) Carburising (ii) Nitriding	***(04)***	***1***	***III***
1B.	Discuss the following techniques for piston slap optimization: (i) Cam ground pistons (ii) Bimetal pistons	***(03)***	***1***	***III***
1C.	A bus chassis with overall length 5400 mm consists of two side members and a number of cross members, fastened at right angle to the long members. Each side member can be considered as a beam, simply supported at the front and rear axles, 3.6 m apart. Front axle is at 900 mm from the front end and subjected to following concentrated loads. Engine support (front) 2 kN; Engine support (rear) 2.5 kN; Gearbox support 0.5 kN; Body W kN. distances of the loads from front end of the frame are 0.6 m, 1.8 m,2.4 m and 3 m respectively. If the reaction at front axle is 8.5 kN, Determine (i) The magnitude of load W due to vehicle body (ii) The magnitude of support reaction at rear axle (iii) Show the free body diagram choosing an appropriate scale.	***(03)***	***5***	***IV***
2A.	With neat labeled diagram, explain the features of the following types of piston connecting rod fastening techniques. (i) Semi floating piston pin (ii) Full floating piston pin	***(03)***	***1***	***III***
2B.	Illustrate the construction and working of a recirculating ball type steering gear with a relevant diagram.	***(03)***	***2***	***III***
2C.	A motor car weighs 13000 N and has a wheel base of 2.7 m. The center of gravity is 1.25 m behind the front axle and 0.75 m above the ground level. Maximum braking on all four wheels on level ground will bring the vehicle uniformly to rest from a speed of 60 km/hr in a distance of 25 m. Calculate the value of coefficient of adhesion between the tyre and	***(04)***	***3***	***IV***

	the road. Under the same road condition, the vehicle descends a hill of gradient 1 in 20 and is braking on the front wheels only. Determine the load distributed between the front and rear wheels and the distance required to bring the car to rest.			
3A.	Illustrate with a neat sketch, the details of a MacPherson strut type independent suspension system. What are its merits?	***(04)***	***2***	***II***
3B.	With a neat sketch, explain the working principle of a Heated exhaust gas oxygen sensor. Plot its working characteristics.	***(04)***	***4***	***III***
3C.	An aluminum alloy piston is machined to a diameter of 90 mm and the temperature during this operation is 293 K. Calculate the increase in area of piston top when the piston reaches 543 K under engine running conditions. Assume a coefficient of linear expansion for aluminum= $22*10^{-6}$/K	***(02)***	***5***	***IV***
4A.	Discuss the features of the following types of fuel injection systems. (i) Simultaneous injection (ii) Sequential Injection (iii) Grouped double fire injection Which of these is inferior and superior. Justify your response.	***(04)***	***4***	***III***
4B.	Discuss the response of the engine management system (fuel) during the following modes of operations. (i) Starting (ii) Acceleration	***(03)***	***4***	***III***
4C.	Find the nominal gas speed through the inlet valve of a TATA 1210 engine having 92 mm bore and 120 mm stroke, operating at 2800 rpm. There is a valve per cylinder having a port diameter equal to 45 % of bore diameter and has a lift of 12 mm, which opens 14 degrees earlier and closes 48 degrees late w r t standard valve timing. Coefficient of discharge= 0.6. Volume of gas flow through valve- $\pi D^2L/4$, m^3 Valve opening duration= 60 Δ/ 360 N, s Area of flow through the valve(s)= C_d π d l n, m^2	***(03)***	***5***	***IV***
5A.	Explain the essential features of the following types of chassis frames with appropriate sketches. (i) Monocoque chassis (ii) Ladder chassis	***(04)***	***1***	***III***
5B.	With a neat sketch, explain the working principle of waste spark method of ignition system management.	***(03)***	***4***	***III***
5C.	Illustrate the working of an acoustic sensor that can be used for the airflow measurement in engine management systems.	***(03)***	***3***	***IV***