BITS Pilani, Pilani Campus
Comprehensive Exam, Semester I (2022-2023)
ME F484: Automotive Technology
(Part A, **Closed book**)

Part A, Marks – 30   23rd Dec 2022, Time: 50 minutes

Note: There are 30questions and all are compulsory. There is no negative marking. Each answers carry equal mark.

Name - _____   Signature - _____

ID No. - _____

1. The overdrive is located between
(a) engine and gearbox   (b) gearbox and propeller shaft
(c) propeller shaft and differential   (d) gearbox and differential

2. Which type of gears are used in the constant mesh gearbox
(a) Spur gear bevel gear
(b) Helical gear
(c) Bevel gear
(d) Epicyclic gear

3. Automotive emission can be controlled
(a) by suitably designing the engine   (b) by improvement of lubricating technology
(c) by treatment of exhaust gas   (d) both (a) and (c)   (e) all of the above

4. Which of the following is not exhaust after treatment technology
(a) SCR   (b) DPF
(b) EGR   (c) LNT

5. Where EGR valve connected?
(a) Exhaust system and intake system   (b) Crank case and intake system
(c) Crank case and exhaust system   (d) Exhaust system and catalytic converter

6. What is the purpose of crank case ventilation?
(a) To prevent pressure build up   (b) To prevent temperature build up
(c) To increase the blow by gas   (d) To reduce the combustion leak

7. Which engine emits more amounts of nitrogen oxides (NOX)?
(a) Spark ignition engine   (b) Compressed ignition engine
(c) Two stroke engine   (d) LPG engine

8. Which component is responsible for the automotive emissions?
(a) Engine   (b) Fuel tank
(c) Carburetor   (d) All of the above

9. Whish of the following is used in automotive leaf spring suspension
(a) Semi elliptic spring
(b) quarter elliptic
(c) three quarter elliptic
(d) all of the above

10. Spring shackles are used to join
(a) spring and axle
(b) chassis frame and axle
(c) chassis frame and spring
(d) all of the above

11. Telescopic damper consists of
(a) one chamber
(b) two chamber
(c) three chamber
(d) four chamber

12. Excessive toe-in is observed by
(a) excessive tyre wear due to cornering
(b) steering wander
(c) feathering of tyres
(d) light steering

13. Wheel wobbles occur due to
(a) improper stabilizer
(b) wheel out of balance
(c) bent kingpin
(d) bent steering knuckle

14. The preferred tyre type for the sports car is
(a) disc wheel
(b) wired wheel
(c) aluminium alloy wheel
(d) magnesium alloy wheel

15. What is the purpose of tire rotation on automobiles?
a) Avoid ply separation
b) Equalize wear
c) Get better ride
d) Reduce bump

16. In which of the following camber is negative
(a) Positive scrub radius
(b) Negative scrub radius
(c) Zero scrub radius
(d) All of the above

17. If the total included angle is 8° and the KPI is 5, then camber angle would be
(a) 3°
(b) 13°
(c) 1.6°
(d) -3°

18. Which of the following suspensions have negative scrub radius
(a) Double wishbone
(b) McPherson strut
(c) Leaf spring suspension
(d) all of the above

19. The basic purpose of using epicyclic gear train in power steering is
(a) to prevent steering lock
(b) to increase the steering ratio
(c) to reduce the drivers's effort
(d) all of the above

20. In radial tyres
(a) One ply layer runs diagonally one way and another layer runs diagonally the other way
(b) All plies run parallel to one another and vertical to tyre bead

(c) Inner tubes are always used
(d) None of these

21. If the turning angle of the inner and outer front wheel of a car (wheelbase of 3m) while taking a turn is 45° and 40°, respectively. The distance between KPI would be
(a) 0.57 m   (b) 0.43 m
(c) 1.5 m   (d) 15.7 m

22. A rack-and-pinion steering gear has a movement ratio of 15 and steering wheel diameter of 300 mm. If the pitch is 13 mm, the number of teeth on the pinion would be
(a) 3   (b) 4
(c) 5   (d) 6

23. The wheel (rolling radius 200 mm) of a car has a castor angle of 6° and pneumatic trail of 20mm. The self-aligning torque for 1000 N cornering force would be roughly of the order of
(a) 41Nm   (b) 100 Nm
(c) 20 Nm   (d) 200 Nm

24. Which of the following factors are not considered in fuel-air cycle
(a) Effect of dissociation
(b) Effect of variable specific heat
(c) Effect of fuel-air mixture
(d) time loss factor

25. In an air standard diesel cycle the compression ratio and cut off ratio is, 15 and 2.12 respectively. the efficiency of the cycle is
(a) 30%   (b) 40%
(c) 50%   (d) 60%

26. Which of the following statement is false
(a) bsfc increases with increase in the engine speed
(b) bp increases with increase in the engine speed
(c) ip increases with increase in the engine speed
(d) fuel consumption increases with increase in the engine speed

27. The addition of alcohol in petrol as an automotive fuel leads to
(a) low octane number
(b) better volumetric efficiency
(c) increased overall emissions
(d) higher calorific value

28. In anti-lock braking system, the breaking valves are actuated and turned on and off through
a) pumps
b) valves
c) sensors
d) modulator

29. The function of ECU in anti-lock braking system is
(a) Monitor the wheel speed
(b) Decrease the stopping distance
(c) Provides electronic stability control
(d) Maintain the tractive force

30. A single cylinder 4-stroke engine has working mean effective pressure and pumping mean effective pressure of 6.4 bar and 0.36 bar, respectively. If the engine speed, stroke length and piston bore are 400rpm, 340 mm and 180mm, respectively. The net mean effective pressure would be
(a) 6.76 bar
(b) 6.04 bar
(c) 8.2 bar
(d) 3.2 bar

Part B, Total Marks – 50   23rd Dec 2022, Total Time: 9 am -12.00am

Instructions:

Part B will be issued after submission of Part A answer sheet. There are total 5 questions and all the questions are compulsory. Wherever required draw neat sketch. Take suitable assumption, if required, however, it should be stated clearly.

1. The following data refer to an oil engine working on Otto four-stroke cycle :   [10]
   Brake power = 14.7 kW
   Suction pressure = 0.9 bar
   Mechanical efficiency = 80%
   Ratio of compression = 5
   Index of compression curve = 1.35
   Index of expansion curve = 1.3
   Maximum explosion pressure = 24 bar
   Engine speed = 1000 r.p.m.
   Ratio of stroke : bore = 1.5
   Find the diameter and stroke of the piston.

2. The following data refer to a car engine having 4 cylinders. Bore = 75 mm ; stroke = 90 mm ; engine to rear axle ratio 39 : 8 ; wheel diameter with tyre fully inflated 650 mm. The petrol consumption for a distance of 3.2 km when car was moving at a speed of 48 km per hour was found to be 0.227 kg. If the mean effective pressure is 5.625 bar, determine the indicated power and thermal efficiency. Calorific value of the petrol may be taken as 43470 kJ/kg.   [10]

3. A car weighing 6000 kg with a wheelbase of 2.5 m has Ackerman geometry based steering system. The C.G lies in the central longitudinal plane of the car. The length of the track rod is 0.9 m and the wheel track of the car is 1.5m. The car is taking a turn with the turning angle of 30° and 25° of the inside and outside wheel, respectively, and with a speed of 40km/hr. Calculate the turning radius of the inner rear wheel of the car, also estimate the cornering force at each wheel assuming equal distribution of the lateral force.   [10]

4. An engine producing 80kW of power at 4000 rpm is connected to the 4-speed constant mesh gearbox. The gear ratio of the gearbox is 0.75, 1.6, 2.8, and 4. The diamteral pitch (ratio of no. of teeth to diameter) of each gear is same. The number of teeth on the gear mounted on the clutch shaft is 24. The number of the gear mounted on the output shaft and the lay shaft when Gear 4 is engaged is 20 and 40, respectively. Plot the gear layout and calculate the number of teeth of each gear. Also estimate the speed of the gear mounted on the output shaft when gear 3 is engaged.   [10]

5. 19.14. A car moving on a level road at a speed 50 km/h has a wheel base 2.8 metres, distance of C.G. from ground level 600 mm, and the distance of C.G. from rear wheels 1.2 metres. Find the stopping distance travelled by the car before coming to rest under limiting condition of without locking of any wheels when brakes are applied, (a) to the rear wheels, (b) to the front wheels, and (c) to all the four wheels.
   The variation of coefficient of friction between the tyres and the road with slip ratio is shown in the figure.   [10]