Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem & AY: Odd Sem 2019-20
Course Code: MEC 401
Course Name: AUTOMOTIVE VEHICLES
Program & Sem: B.Tech & VII (OE)

Date: 12.10.2019
Time: 1.30 PM to 2.30 PM
Max Marks: 40
Weightage: 20%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 2 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer the Questions. Each Question carries two marks. **(10QX2M=20M)**

1.

a) What's the position of piston and valves during beginning of exhaust stroke and suction stroke. (C.O.NO.1) [Knowledge]

b) List out two functions of piston rings. (C.O.NO.1) [Knowledge]

c) In a two stroke engine "Oil is mixed with fuel", Comment (C.O.NO.1) [Comprehension]

d) In diesel engine, how combustion of fuel takes place. (C.O.NO.1) [Knowledge]

e) With respect to valve timing diagram of a 4 stroke engine, why the suction stroke begin before piston reaches TDC. (C.O.NO.1) [Comprehension]

f) With neat sketch explain briefly how the turbocharger works. (C.O.NO.1) [Knowledge]

g) What do you mean by 4 x 4 drive chassis vehicle. (C.O.NO.1) [Knowledge]

h) List the two reasons, why 2 stroke engines are banned. Give a logical reason. (C.O.NO.1) [Comprehension]

i) Sketch and indicate salient points on p-v diagram of four stroke petrol engine. (C.O.NO.1) [Knowledge]

l) Differentiate diesel and petrol engine based on (C.O.NO.1) [Knowledge]

a. Compression ratio

b. Charge during suction stroke

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries six and half marks.

(2Qx6.5M=13M)

2. With neat sketch explain IC engine terminologies. (C.O.NO.1) [Knowledge]

3. With neat sketch explain the theoretical and actual valve timing diagram of four stroke SI engine. (C.O.NO.1) [Knowledge]

Part C [Problem Solving Questions]

Answer the Question. The Question carries seven marks. **(1Qx7M=7M)**

4. With neat sketches of all the strokes, explain the four-stroke compression ignition engine. (C.O.NO.1) [Knowledge]

SCHOOL OF ENGINEERING

Semester: 07

Course Code: MEC 401

Course Name: Automotive Vehicles

Date: 27.09.19

Time: 10.30 TO 11.30

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	CO1	Module 1	14	6		20
2	CO1	Module 1	6			6
3	CO1	Module 1	7			7
4	CO1	Module 1	7			7
5	CO1	Module 1		7 extra		7 extra
	Total Marks		34	13		40M

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SOLUTION

Semester: 07 **Date**: 27.09.19

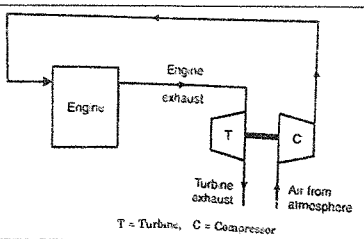
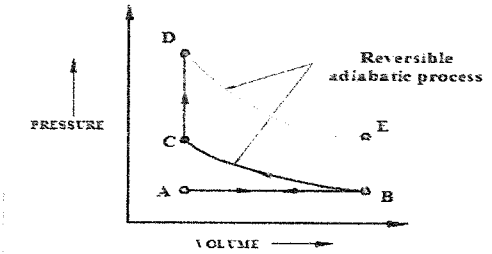
Course Code: MEC 401 **Time**: 10.30 TO 11.30

Course Name: Automotive Vehicles **Max Marks**: 40

Weightage: 20%

Part A (10Q x 2M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
a)	Exhaust stroke IV closed and EV open Suction stroke: IV open and EV closed	2 marks	1min
b)	Sealing, and material allowance	2 marks	2 min
c)	Process of removing burnt gas from cylinder	2 marks	1 min
d)	Mist Lubrication brief explanation	2 marks	2 min
e)	Combustion takes place when the temperature attained during the end of combustion stroke should be more than the self-ignitable temperature of the diesel spray	2 marks	1 min
f)	Scavenge the burnt gas left out in clearance volume	2 marks	1min
g)	Turbochargers derive their power from exhaust gasses. Turbochargers are a type of superchargers. This rotational motion of turbine drives the compressor, which draws in ambient air from the surrounding and pumps compressed air with high density and pressure into the intake manifold	2 marks	2 mins

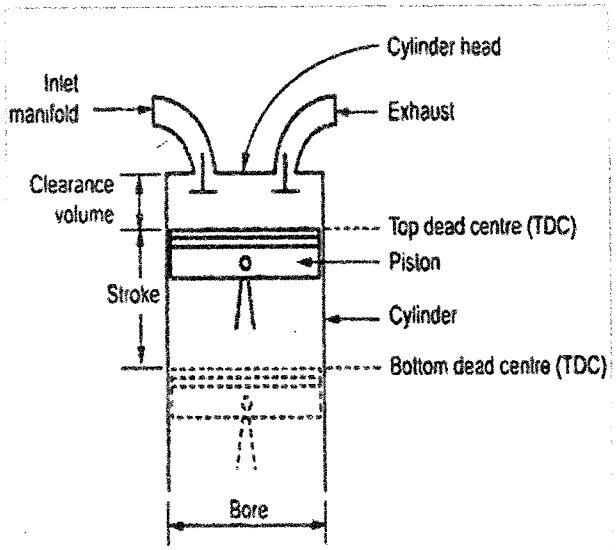
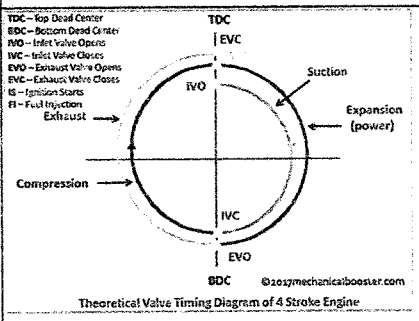
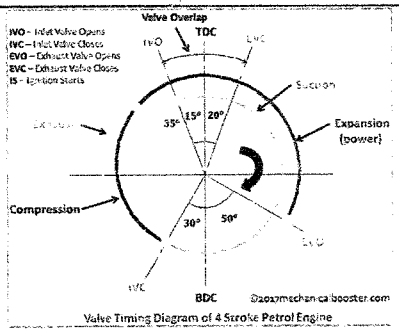
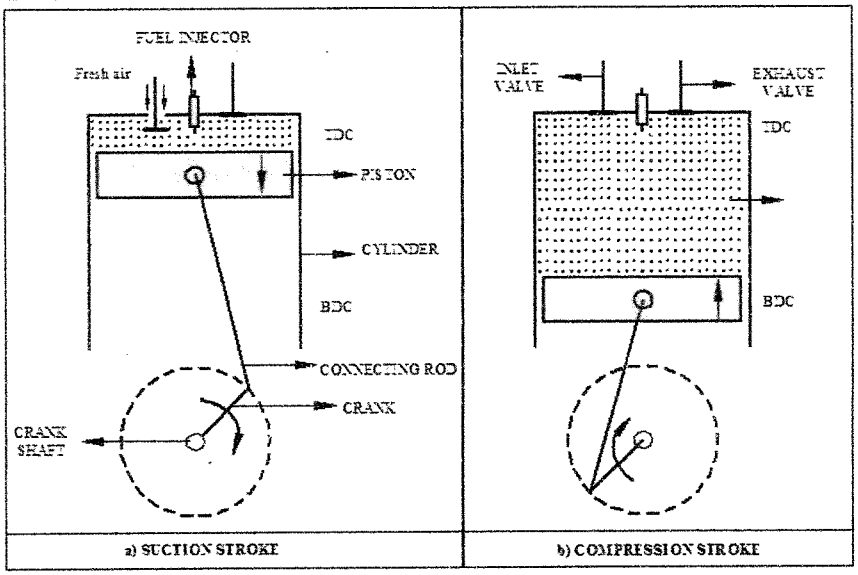
			
h)	4 wheels of a vehicle will be rotate independently	2 M	2 mins
i)	Portion of the fuel is being unused during the process, more heating, loss of lubricant	2M	2 mins
j)	 A-B: suction stroke B-C-D: compresison stroke D-E-B: poer stroke B-A: exhaust stroke	2M	2 mins
k)	A) 2S: Requires two separate strokes to complete one cycle of operation. 4S: Requires four separate strokes to complete one cycle of operation. B) 2S: The inlet, transfer and exhaust ports are opened and closed by the movement of piston itself. 4S: The inlet and exhaust are opened and closed by the valves.	2M	2 mins
l)	A) PE: Compression ratio ranges from 7: 1 to 12: 1 DE: Compression ratio ranges from 18:1 to 22:1 PE: Draws a mixture of petrol and air during suction stroke DE: Draws only air during suction stroke.	2M	2 mins

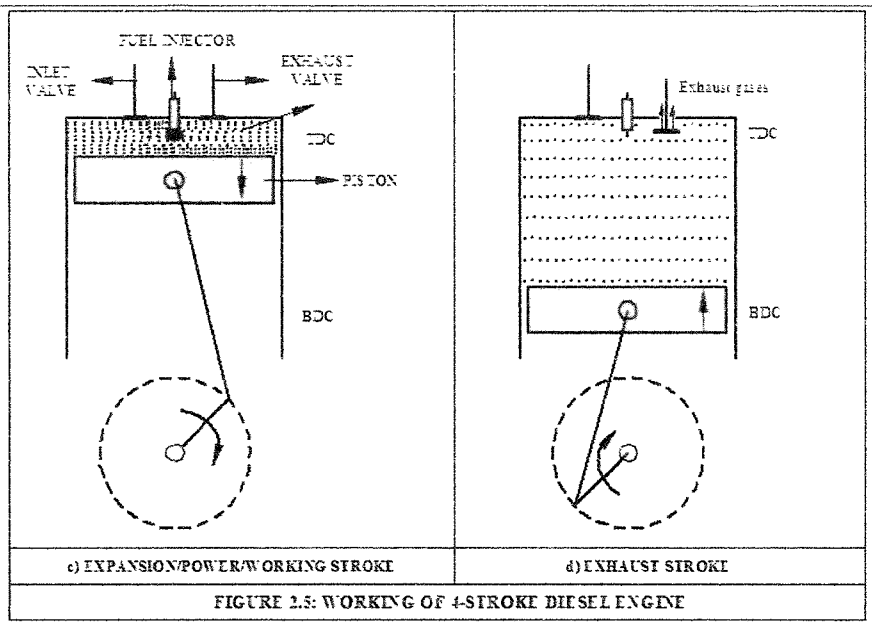
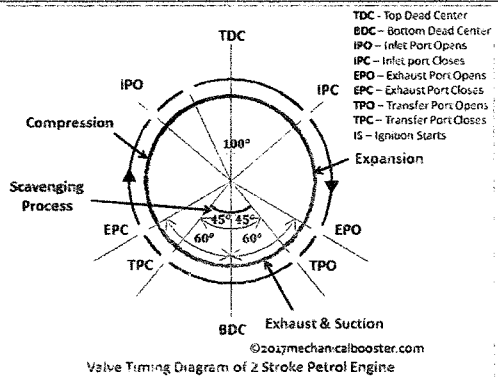
Part B

$3Q \times \frac{6M}{1M} = 20$ marks

(Q x M = Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question

2		Explanation Of Terminologies: Bore, Tdc, Bdc, Stroke, Clearence Volume, Sewpt Volume, Compression Ratio, Engine Speed	SKETCH: 3M EACH POINT 1M	15MINS
3	 Theoretical Valve Timing Diagram of 4 Stroke Engine  Valve Timing Diagram of 4 Stroke Petrol Engine	EACH sketch 2 marks Explanation 3 marks	10MINS
4		Sketch 4 marks Explanation 3 marks	15MINS

	 c) EXPANSION/POWER/WORKING STROKE d) EXHAUST STROKE FIGURE 2.5: WORKING OF 4-STROKE DIESEL ENGINE		
5	 Valve Timing Diagram of 2 Stroke Petrol Engine	Sketch 4 marks Explanation 3 marks	10MINS

Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST - 2

Sem & AY: Odd Sem. 2019-20
Course Code: MEC 401
Course Name: AUTOMOTIVE VEHICLES (OE)
Program & Sem: B.Tech (All Programs) & VII OE

Date: 16.11.2019
Time: 1:00 PM to 2:00 PM
Max Marks: 40
Weightage: 20%

Instruction:

I. Read the question properly and answer accordingly.
II. Question paper consists of 3 parts.
III. Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carry four mark. (5QX4M=20M)

1. What are the major requirements of Transmission System (C.O.NO.2) [Knowledge]
2. List the major functions of clutch in an automobile (C.O.NO.2) [Knowledge]
3. What are the 4 objective of engine cooling system (C.O.NO.2) [Knowledge]
4. Briefly explain the 4 main purposes of lubrication. (C.O.NO.3) [Knowledge]
5. Discuss "mist lubrication". (C.O.NO.2) [Application]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carry six marks (2Qx6M=12M)

6. List the types of water oolong system and with Sketch explain the forced circulation water cooling system. (C.O.NO.2) [Comprehension]
7. With sketch explain dry sump lubrication system. (C.O.NO.3) [Knowledge]

Part C [Problem Solving Questions]

Answer the Question. The Question carry eight marks (1Qx8M=8M)

8. With neat sketch explain the working principle of differential box in all the cases. (C.O.NO.2) [Application]

PRESIDENCY UNIVERSITY
BENGALURU
SCHOOL OF ENGINEERING

Semester: 07

Course Code: MEC 401

Course Name: Automotive Vehicles

Date: 16.11.19

Time: 1 TO 2 PM

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type Bloom's Levels			Thought provoking type Bloom's Levels			Problem Solving type			Total Marks
			K			C			A			
1	CO2	Module 2	4									
2	CO2	Module 2	4									
3	CO2	Module 3	4									
4	CO3	Module 3	4									
5	CO2	Module 3							4			
6	CO2	Module 3				6						
7	CO3	Module 3	6									
8	CO2	Module 2							8			
	Total Marks		22			6			12			40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU
SCHOOL OF ENGINEERING

SOLUTION

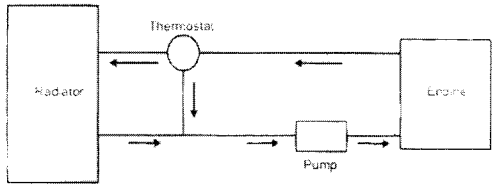
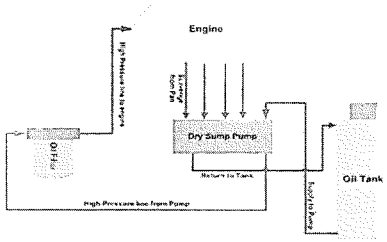
Semester: 07
Course Code: MEC 401
Course Name: Automotive Vehicles

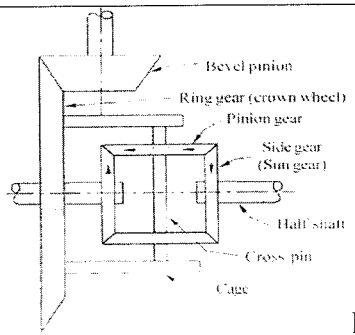
Date: 16.11.19
Time: 1 TO 2 PM
Max Marks: 40
Weightage: 20%

Part A (5Q x 4M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1 1	i. To change the speed according to load and road conditions. ii. To change the wheel rotation direction. So the vehicle can go back and forth. iii. To decide and connect the spin, so the vehicle can stop while the engine is on. iv. Enable power transmission at varied angles and varied lengths. v. Enable speed reduction between engine and the drive wheels in the ratio of 5:1. vi. Enable diversion of power flow at right angles. vii. Bear the effect of torque reaction, driving thrust and braking effort effectively.	4 marks	6min

2	An automobile clutch has following function: ❖ It can be disengaged. This allows engine cranking and permits the engine to run without delivering power to the transmission. ❖ While disengaging, it permits the driver to shift the transmission into various gear according to operating condition. ❖ While engaging, the clutch slips momentarily, this provides smooth engagement and lessens the shock on gears, shaft and other parts of automobile.	4 marks	6min
3	a) As engine temperature increases, the strength of materials used for various engine components decreases. As an example, in water cooled engines the temperature of cylinder head should not exceed 270°C, and for air cooled engines, uses light alloys, the temperature should not exceed 200°C. b) The lubricating oil used in the engine also decides the maximum temperature that can be used for different lubricating oils, this temperature range varies from 1600°C to 200°C. If the engine temperature exceeds this limit, it may deteriorates the lubricating oil or evaporate and burn to cause piston and cylinder damage. Overheating results in piston seizing also. c) High cylinder head temperature result in loss of volumetric efficiency and reduces power output. d) High engine temperature may cause pre ignition and detonation.	4 marks	6min
4	Other main purposes of lubrication are as follows **1. Cooling effect:** The lubricant absorbs heat from hot moving parts and dissipates it to the surrounding air through the crank case. **2. Cushioning effect:** The lubricant serves as a good cushion against shocks present in the engine. For example, instant combustion causes sudden pressure rise and the resultant shock goes to the bearings through piston, piston pin and connecting rod. Then the lubricant present in the main bearings absorbs this shock. **3. To act as cleaning agent:** As lubricating oil circulates, it absorbs so many impurities and oil may be further purified by filtration. Ex.: oil dissolves carbon particles during its circulation. **4. Sealing action:** It maintains an effective seal on the piston rings and avoids entry of high pressure gases into the crank case.	4 marks	6min
5	Mist Lubrication: In this method some amount of lubricating oil is directly mixed with the petrol. i.e., about 25 to 30ml. of oil mixes with one litre of petrol. If oil is less, it causes damage to the The gasoline is vaporized and the oil in the form of mist, goes via crankcase in to the cylinder. The oil which impinges on the crankcase walls lubricate the main and connecting rod bearing and rest of the oil which passes on the cylinder during the charging and scavenging periods, lubricates the	4 marks	6min

	piston and , piston rings and the cylinder. When the fuel goes into the crank chamber during the engine operation, the oil particles go deep into the bearing surfaces and lubricate them. The piston ring, cylinder walls, piston pin are lubricated in the same way. The main disadvantage of this system is that, if the engine is allowed to remain unused for a considerable time, the lubricating oil gets separated from petrol leads to clogging of passage in the carburetor, and results into starting trouble.		
6	 This system is similar in construction to the thermo-syphon system except that it makes use of a centrifugal pump to circulate the water throughout the water jackets and radiator. The water flows from the lower portion of the radiator to the water jacket of the engine through the centrifugal pump. After the circulation water comes back to the radiator, it loses its heat by the process of radiation. This system is employed in cars, trucks, tractors, etc.	6M	8 mins
7	 Dry-sump lubrication system the oil pan is single duty, it is only used to collect the oil. Oil collected in the oil pan is pumped by a scavenging pump which pumps the oil into an external storage tank. Since the oil pan is not used to store oil, it is referred as "DRY". The scavenging pump can have one or several stages, depending upon how many places it is connected to the oil pan. A secondary pump, called a pressurizing pump, sucks the oil from the external storage tank and pumps it back through the engine. The ability to move the engine lower in the chassis gives you more freedom in the placement of the engine. If you could lower your engine and subsequently lower the center of gravity in the car. The capacity of the scavenging pump is always greater than oil feed pump. The dry sump is generally used in sports cars, racing cars and extreme off-road vehicles. Dry sump lubrication system is generally adopted for high capacity engines. A dry-sump system is conversely more complicated, more expensive, heavier, and takes up more room in an engine compartment.	6M	7 mins

	This system is suitable for lubricating sport cars, jeeps etc.		
8	 It consists of a drive pinion or bevel pinion, attached to the shaft which is coupled to the propeller shaft. A crown wheel or ring gear which is bolted to the differential cage is in mesh with the bevel pinion. The cage carries a cross pin or spider (cross pin is used when two pinion gears are employed and spider is used when four pinion gears are used) to support two differential pinion gears which are in mesh with the two differential side gears (sun gears) which are splined to the axle half shafts. The ring gear (crown - wheel) is free to rotate on the half shaft as shown. When the propeller shaft turns the bevel pinion, the pinion will turn the crown wheel. The crown wheel in turn will revolve the differential cage and cross pin. The axle side gears will still not turn. By adding two differential pinion gears (The cross pin will pass through these gears) that mesh with the side gears, the revolving cage will turn the axle side gears with it. When the vehicle is going straight ahead, the crown wheel turns the cage. The differential pinion gears and axle side gears are moving around with the cage and pinion gears do not rotate on the cross pin or about its own axis (no relative movement between teeth of pinion gears and axle side gears), but apply equal torque to the two side gears. This drives both the rear wheels (half shafts) at the same speed and crown wheel, differential cage, cross pin, pinion gears and side gears all turn as a solid unit. Both half shafts rotate at the same speed and there is no relative movement among various differential gears. When the vehicle is taking a turn, the cage continuous to rotate and pull both the pinion gears around on the cross pin. The outer wheel must turn faster than the inner wheel and for this to happen the outer axle side gear has to rotate faster than the inner axle side gear. To permit this, the two differential pinion gears rotate on their axes (on cross pin). This allows them to pull on both axle side gears, while at the same time, compensating for the difference in speed by rotating around their shaft.	10M	15 mins

Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: MEC 401
Course Name: AUTOMOTIVE VEHICLES
Program & Sem: B.Tech (All Program) & VII (OE-I)

Date: 23 December 2019
Time: 9:30 AM to 12:30 PM
Max Marks: 80
Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) All questions are compulsory to attend.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 4 marks. (5Qx4M=20M)

1. Give any four advantages of IC engines over EC engines. (C.O.No.1) [Knowledge]
2. Explain the use of slip joint in power transmission with neat sketch diagram. (C.O.No.2) [Knowledge]
3. Write down any two advantages and disadvantages of air cooling system in IC engines. (C.O.No.3) [Knowledge]
4. What is chassis? Explain any two function of chassis. (C.O.No.4) [Knowledge]
5. Write down any four requirements of brakes in automobile vehicle. (C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 10 marks. (3Qx10M=30M)

6. Explain the working constant mesh gear box with neat sketch diagram. (C.O.No.2) [Knowledge]
7. With neat sketch P-V diagram briefly explain working of 4 stroke SI engine. (C.O.No.1) [Knowledge]
8. Differentiate between disc brake and drum brakes. Give any 5 points. (C.O.No.5) [Knowledge]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 15 marks. (2Qx15M=30M)

10. Explain the working of hydraulic brake with neat sketch diagram. (C.O.No.5) [Comprehension]
11. Briefly explain major function of suspension system. (C.O.No.4) [Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	CO 1 (5)	1	4			4
2	CO 1 (5)	2	4			4
3	CO 1 (5)	3	4			4
4	CO 1 (5)	4	4			4
5	CO 1 (5)	5	4			4
6	CO 2 (12.5)	2		10		10
7	CO 1 (12.5)	1		10		10
8	CO 5 (12.5)	5		10		10
9	CO 5 (18.75)	5			15	15
10	CO 4 (18.75)	4			15	15
	Total Marks		20	30	30	80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

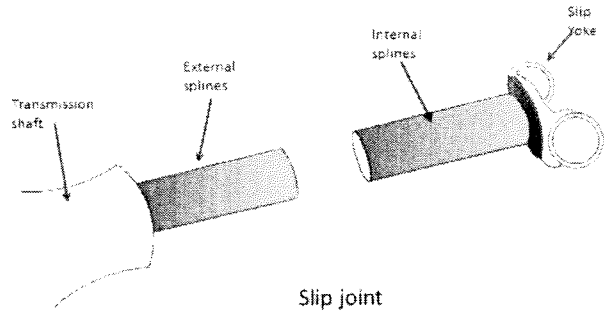
SOLUTION

Semester: Odd Sem. 2019-20
Course Code: MEC 401
Course Name: AUTOMOTIVE VEHICLE
Program & Sem: B.TECH (All Program) & VII (OE-I)

Date: 23.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

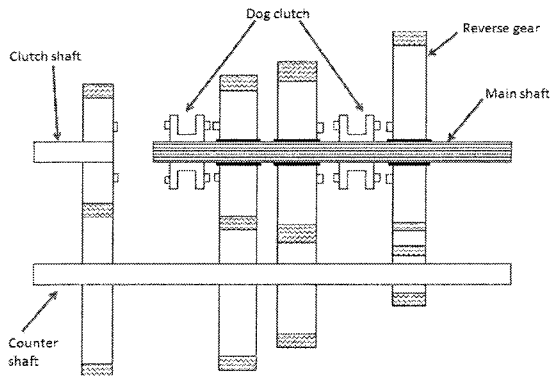
Part A (5Q x 4M = 20Marks)

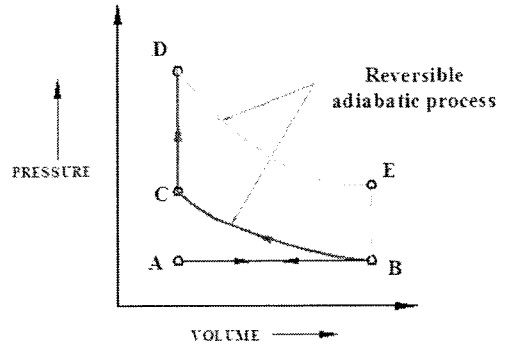
Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	i. High efficiency ii. Simplicity iii. Compactness iv. Light Weight v. Easy Starting vi. Comparatively Lower Cost	**Four points four marks**	**3**
2	Slip joint is attached to the driven yoke in order the increase or decrease the length of propeller shaft. It has outside splines on the shaft and matching internal splines in a mating hollow shaft or yoke. When assembled the splines cause the shafts to rotate together while they can move back and forth. This changes the length of	**2 mark for explanation and 2 marks for diagram**	**7**

	propeller shaft.  Slip joint		
3	**Advantages:** a) Absence of radiator cooling jackets and coolant reduces weight of the system. b) Air cooled engines are useful in extreme climates, where water may freeze. c) These engines warm up earlier than water cooled engines. d) Easy maintenance as there is no leakage problem. **Disadvantages:** a) These are noisier, because of absence of cooling water which acts as sound insulator. b) Heat transfer co-efficient for air is less. Hence less efficient cooling and results in decrease of highest useful compression ratio. c) Distortion of cylinder may occur due to uneven cooling all around the cylinder.	Each point carry one marks (2 marks for advantages and 2 marks for disadvantages)	5
4	Chassis (also known as carrying unit) is a French term and was initially used to denote the frame or main structure of a vehicle. The term chassis is now extensively used to denote the complete vehicle except the body for the heavy a separate body. Or The engine, wheels, power train, brakes and steering systems when installed on the frame, the assembly is called chassis. The main functions of the frame are 1. It should withstand the engine and transmission thrust. 2. It should withstands the torque stresses. 3. To support body weight, passengers and goods weight. 4. It provides base for mounting engine and transmission systems. 5. It provides the space for spring system.	2 marks for explanation and 2 marks for two function points	5
5	***To perform the above function, the brake system has to satisfy the following requirements.*** 1. Irrespective of vehicle speed, load conditions, type of road, the brakes must produce maximum possible retarding force and deceleration. 2. Irrespective of road condition and load, the pedal effort required should be same. 3. The response time of the braking system should be minimum possible. 4. The brakes must have good anti fade characteristics. The brake	Any four points four marks	6

	effectiveness should not decrease due to prolonged application (While descending hills). This needs efficient cooling of the brake system. 5. In an emergency, the brakes must be strong enough to stop the vehicle and in the meantime, driver must have proper control over the vehicle. The vehicle should not skid and should be consistent with safety. 6. The brake system should not be affected by water, dust, road grit etc. 7. The braking system should be as light as possible, easy to maintain and should give long, economical life.		

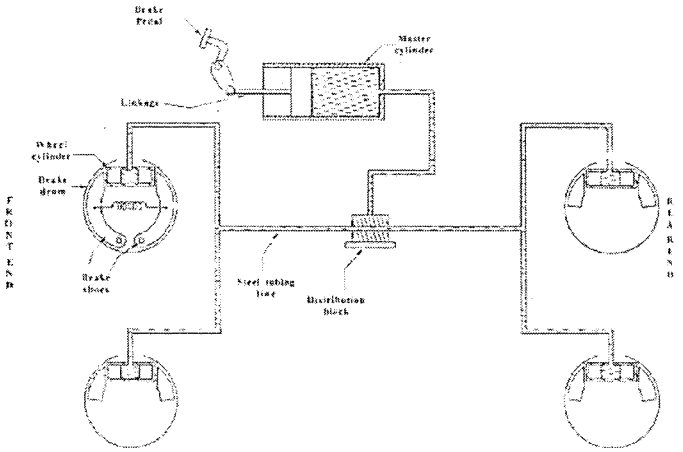
Part B (0Q x 0M = 0 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	**Constant mesh gear box:** This is one of the famous type used in twenty century. It this gearbox, all the gears are in constant mesh with each other all the time. The gears on the main shaft rotates freely without rotating the main shaft. Constant mesh gear box consists two dog clutches. These clutches are provided on the main shaft, one between the clutch gear and the second gear and the other between the first gear and reverse gear. When the left side dog clutch is made to slide left by means of gearshift lever, it meshes with the clutch gear and the vehicle runs on top speed. If this clutch slide right and mesh with second gear, then the vehicle runs on second gear speed. So in constant mesh gear box we can change the gear ratio by shifting the dog clutch. This type of gear box is more popular than sliding mesh because it creates low noise and less wear of gears.  Constant mesh gear box	5 marks for diagram 5 marks for explanation	15
7	P-V DIAGRAM	2 Marks for diagram and two marks for each stroke.	15

<table>
<tr><td></td><td> 
</td><td></td><td></td></tr>
<tr><td>8</td><td>Comparison of Disc and Drum Brakes
<table>
<tr><th>Sl. No.</th><th>Disc Brakes</th><th>Drum Brakes</th></tr>
<tr><td>1</td><td>More efficient cooling</td><td>Less efficient cooling</td></tr>
<tr><td>2</td><td>As flat friction pads are used, wear is more uniform.</td><td>Semi-circular friction linings on the brake results in non-uniform wear.</td></tr>
<tr><td>3</td><td>The weight is less, resulting in lower inertia.</td><td>Comparatively, the weight of the drum is more</td></tr>
<tr><td>4</td><td>These are more stable.</td><td>Comparatively less stable.</td></tr>
<tr><td>5</td><td>Maintenance and service of the drum is to be brakes is easy.</td><td>For service and other works, the drum should be removed which takes more time.</td></tr>
<tr><td>6</td><td>These have better anti-fade characteristics.</td><td>The braking effect decreases with prolonged application of brakes.</td></tr>
<tr><td>7</td><td>These do not have self-servo action and decreases the braking force required.</td><td>The brake shoes experience self-servo action and hence require greater operating force.</td></tr>
<tr><td>8</td><td>Total frictional area available is less.</td><td>Total frictional area available is more.</td></tr>
</table></td><td>Each point carry 2 marks</td><td>8</td></tr>
</table>

Part C (0Q x 0M = 0Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
9	Basically, the car hydraulic braking system consists of a master cylinder, steel tubing to form connecting lines and one or two wheel cylinders for each wheel. In this type, the pedal force is transmitted to the brake shoes through brake fluid. The force applied to the pedal is multiplied and is transmitted to all the brake shoes. The brake fluid is incompressible and it exerts equal pressure in all directions. The brake pedal force is equally applied on all the wheel cylinders and produces equal braking effect on all the wheels. This force transmission is based on pascal's law which states that "when pressure is exerted on a confined liquid, it transmits pressure without loss, equally in all directions". When the driver operates the brake pedal, it exerts a force on the piston of master cylinder which is being transmitted to each wheel cylinder. The piston in the wheel cylinder transfer this force [increased or decreased, depending on piston area, (mechanical advantage)] to the brake shoes. The movement of piston in master cylinder causes the pistons in wheel cylinders to move until the brake shoes engage the revolving brake drum. If an attempt is made to depress the master cylinder piston beyond this point will transmit only pressure, but not motion.	7 marks for diagram and 8 marks for explanation	20

			
10	**1. Vertical vibrations and pitching:** The damper present in suspension system eliminates the vibrations caused due to striking of front wheel to a bump. However, rear wheel also experiences similar vibrations as it reaches the bump after some time and this depends on wheel base and vehicle speed. There are three possible relations of front and rear suspension frequencies. (i) Front frequency higher than the rear - After the initial vibration i.e., after one or two vibrations the maximum amplitude occurs. (ii) Front frequency equal to rear - The amplitude collapses throughout, though pitching tendency still exists (iii) Front frequency lesser than the rear - Practically there is no pitching tendency. So, it is-clear that in order to reduce pitching tendency of the vehicle, the (iii) condition is suitable. **2. Rolling:** The center of gravity of the vehicle will be at certain height above the ground level. A turning couple about the longitudinal axis of the vehicle will be induced during cornering because of the centrifugal force acting at C.G. and forces at tyre - road contact surface. This result in a motion called rolling. The manner in which the vehicle is sprung determines the axis about which the vehicle will roll. **3. Brake dip:** When the brakes are applied, the vehicle nose has a tendency to be lowered or to dip. This in turn depends up on C.G position relative to the ground, wheel base, and other suspension characteristics. **4. Unsprung weight:** When the wheels hit a bump, they vibrate along with the unsprung parts which store the vibration energy and transmit it to the sprung parts through the springs. When the weight of unspring parts if greater, it increases energy stored due to vibrations and thus transmits greater shocks to the sprung parts. Therefore it is necessary to keep the unspring weight as low as possible.	First 3 point explanation carry 12 marks and last point carry 3 marks	20
