

武汉理工大学考试试卷 (B卷)

Test Paper of Wuhan University of Technology (B)

2018-2019 Academic Year 1st Semester, Course: Automotive Structure A
(Bilingual), Closed-book Exam

Time: 120mins, 64 class hours, 4 credits, Total Points: 100, Percent in final evaluation result: 60%, Date: 2017/xx/xx

No.	I	II	III	IV	V						Total
Full score	10	10	10	40	30						100
Score	10	6	7	40	23						86

得分	10
Score	10

I. Fill in the blanks (1 point *10=10 points)

- There are two types of cylinder liners (气缸套): 干缸套 and 湿缸套.
- Compared with petrol engine, the diesel engine has the merits of good economy, high reliability and 低排放, so all heavy-duty vehicles are powered by diesel engines.
- The friction plate-type clutch is composed of four parts: the active part (主动部分), the driven part (从动部分), the pressure assembly and the control mechanism (操纵机构).
- The suspension (悬架) is generally composed of three parts, i.e. elastic element (弹性元件), guide device (导向装置) and 减振器.
- The automobile braking system generally includes at least two separate braking units (制动系统), one is service brake (行车制动) used in ordinary driving, and the other is 驻车制动系统.
- The firing order of four-stroke six-cylinder engine is 153624 or 142635.
- Main functions of the engine lubrication system include lubrication (润滑), 清洗 cooling (冷却), sealing (密封) and rust protection (防锈).
- The automobile transmission system is mainly composed of clutch (离合器), transmission (变速器), universal joint (万向传动装置), 主减速器, differential (差速器) and half axle (半轴).
- Front wheel alignment includes four parameters: kingpin caster (主销后倾), kingpin inclination (主销内倾), 转向轮外倾 and toe-in of front wheel (前轮前束).
- The seal ring (密封圈) of the piston of disc-type wheel brake (盘式制动器) has two functions: return of piston after brake is released and 自动调节间隙.

得分	
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II. True or false questions (1 point *10=10 points)

- ☒ Non-independent suspensions (非独立悬架) are widely used in the front suspension of passenger cars because of their simple structure and reliable operation.
- ☒ The piston crown (活塞顶) is a part of the combustion chamber, the piston head (活塞头部) is mainly used to install the piston ring, and the piston skirt (活塞裙部) can play a guiding role.
- ☒ Valve clearance (气门间隙) refers to the clearance between valve (气门) and valve seat (气门座).
- ☒ When the excess air coefficient (过量空气系数) α is 1, both in theory and in fact, the combustion of gas mixture is most complete and the economy of the engine is the best.
- ☒ When filling lubricating oil (润滑油), the more the oil is, the better for the engine.
- ☒ Double-plate clutch has two discs, two pressure plates and two friction surfaces.
- ☒ The suspension (悬架) of all vehicles contains elastic component (弹性元件).
- ☒ Ply rating of tires means the actual number of plies (帘布层).
- ☒ The best braking state is the critical state when the wheels are completely locked and skid.
- ☒ The free stroke of steering wheel (转向盘自由行程) helps absorb road shocks, smoothen the manipulation and decrease driver's excessive tension.

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III. Multiple choices (single answer, 1 point *10=10 points)

- Which speed leads to the lowest fuel consumption?
A. low speed; B. medium speed; C. full speed; D. over speed.
- The four stroke of the four-stroke engine is
A. Induction, compression, power and exhaust
B. Induction, compression, power and scavenging
C. Air exchange, compression, work and scavenging
D. Air exchange, compression, work and exhaust
- Which kind of gas mixture has the lowest fuel consumption rate?
A. $\alpha=1.05\sim1.15$ B. $\alpha=1$ C. $\alpha=0.85\sim0.95$
- Which one is not the advantage of two-stroke engines?
A. Running smoothly B. High power per liter C. Compactness D. Low pollution
- When the clutch is fully engaged, the first shaft of the transmission
A. doesn't rotate; B. rotates at a speed different from that of the engine;
C. rotates at the same speed with that of the engine.
- Steering wheels swing around ().
A. steering knuckle B. kingpin; C. front beam; D. frame
- The designation of the diesel brand is based on the ().
A. evaporation B. ignition C. viscosity D. freezing point

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8、The pressure force of the diaphragm spring (膜片弹簧) is (C) when the wear of the driven disc becomes thin.

A. Bigger B. Smaller C. Almost the same D. Disappear

9、The friction plate-type clutch is composed of four parts: the active part, the driven part, the pressure assembly and (C).

A. disengaging lever; B. flywheel; C. control mechanism; D. clutch cover

10、(D) Which is the function of the transmission system?

A. steering; B. braking; C. interrupting power transmission; D. vibration reduction

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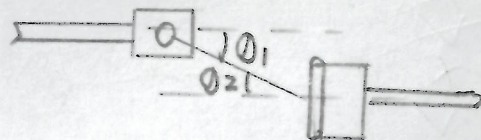
IV、Short-answer questions (6 points * 5 = 30 points)

1、To achieve the purpose of constant-angular-velocity drive (等角速度传动), what requirements should be met for common cross-axle rigid universal joint (十字轴刚性万向节)?

解: (1) $\omega_1 = \omega_2$

前后两节轴相等

(2) 在同一平面内布置



2、Why need a clutch (离合机构) mounted in the starter (起动机)? List several types of clutches usually used in starter.

解: (1) 电机带动发动机启动后, 发动机转速大于电机额定转速, 会损坏电机, 因此需加装保护装置, 即启动离合。

(2) 主要类型: 摩擦片式单向离合器
 扭簧式单向离合器
 滚柱式单向离合器

3、What is the natural frequency of the suspension (悬架固有频率)? What factors is it related to?

解: $n = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$

悬架固有频率即自然振动时的频率

m 为簧载质量

k 为悬架刚度

影响因素: 簧载质量与悬架刚度. m 大或 k 小会使 n 小.
 这又与悬架类型、材料、布置方式有关。

4、What parameters are there for steering wheel alignment (车轮定位)? What's the function of each parameter?

(1) 主销后倾: 主销在纵向向后倾斜. 可以确保车轮沿直线行驶。

(2) 主销内倾: 主销向内倾斜. 通过重力获得回正力, 使汽车能较好地沿直线行驶。

(3) 车轮外倾: 一方面弥补了由于簧载质量造成向车轮内倾, 避免内倾车轮在转弯时严重磨损。另一方面, 确保了汽车直线行驶, 但一般会加剧外侧轮胎磨损。

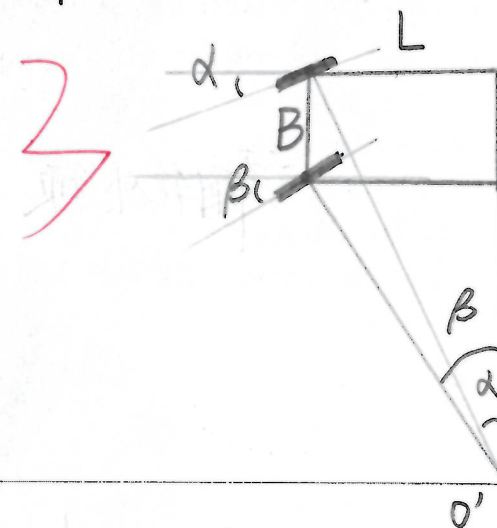
(4) 前轮前束: 消除了车轮外倾带来的不利影响, 有利于汽车的行驶性能。

5、Why should steering trapezium (转向梯形) be installed in vehicle steering system? Write Ackerman equation, and drawing description.

转向梯形是指由横拉杆、前桥以及转向臂构成梯形。

有: $\cot \alpha = \cot \beta + \frac{B}{L}$

$r_{\min} = \frac{L}{\sin \alpha_{\max}}$

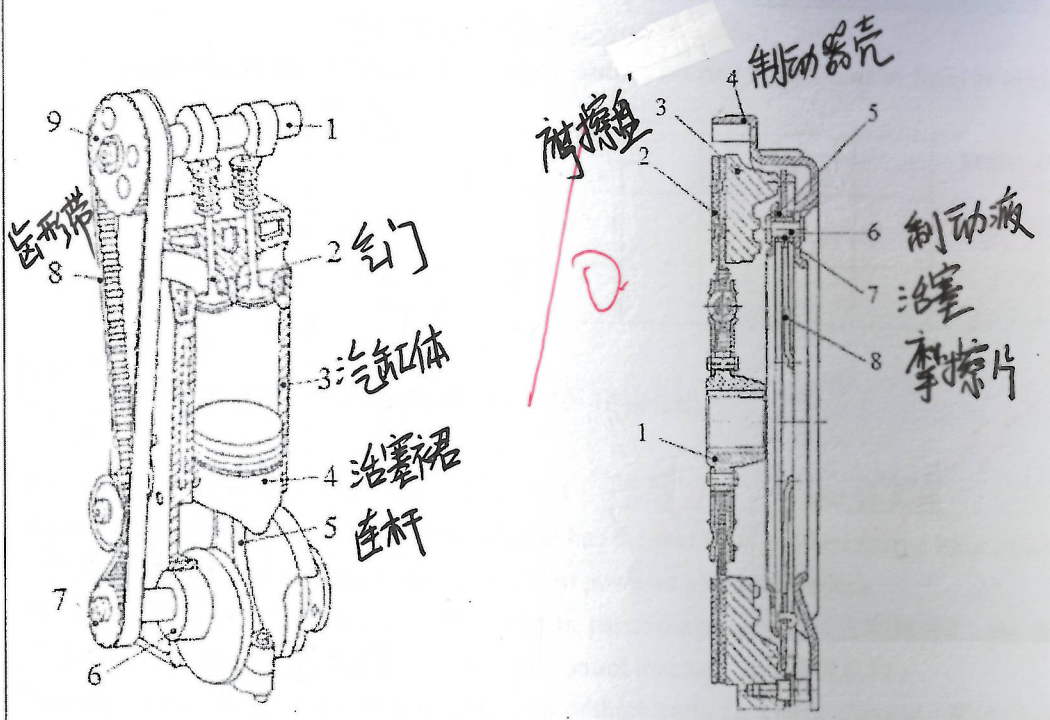


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得分	
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V. Essay-type questions (10 points*4=30 points)

1. Recognition, each diagram writes out any 5 parts name that indicate the ordinal number (10 points of the subject, 5 points per diagram).



2. For a light truck, the second gear speed ratio of the transmission (变速器) is 3.9, and the transmission ratio of the main reducer (主减速器) is 4.63. When driving in second gear on a muddy road (泥泞路面), if the left rear wheel rotates 140 turns/min and the right rear wheel rotates 60 turns/min, what is the speed of the transmission shaft (变速器输出轴)? (required to write the main calculation steps and results)

解: 有 $n_1 + n_2 = 2n_0$
 $w_1 + w_2 = 2w_0$
车速 $\rightarrow$ 主减 $\rightarrow$ 差速
即 $n_0 = \frac{1}{2}(n_1 + n_2) = 100 \text{ turns/min}$ (差速器输入轴)
则主减速器输入 $n' = n_0 \times 4.63 = 463 \text{ turns/min}$
变速器输出轴 $n = 463 \text{ turns/min}$

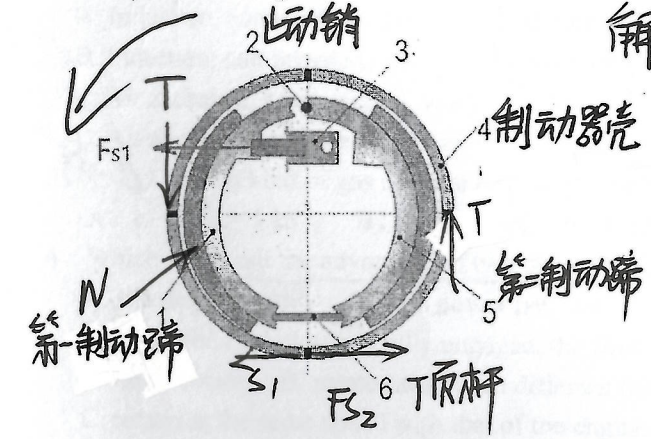
3. 1) How to arrange the crank angle (曲拐夹角) for four stroke and three cylinder engine? 240°
2) Determine the possible working order (工作顺序) of the engine (1 cylinder works first); and complete the following working cycle table according to the determined working order (if there are multiple working orders, write only one).

曲轴转角 ($^\circ$)	第1缸	第2缸	第3缸
$0 \sim 180^\circ$	作功	进气	排气
$180 \sim 360^\circ$	排气	作功	进气
$360 \sim 540^\circ$	进气	排气	作功
$540 \sim 720^\circ$	作功	进气	排气

发火顺序
只能是
1-3-2
故发火间隔
 240° 曲轴转角

4. The structure of one way self boosting brake (单向自增力制动器) is shown below.

- 1) The name of any 5 in Part 1-6 of the diagram;
- 2) The principle of self boosting when the vehicle moves forward (counterclockwise). (前进时, 逆时针旋转)
- 3) The working state of two brake shoes when the vehicle reversing (clockwise). (倒车时, 顺时针旋转)



解: (1) 如图: 2-制动蹄, 4-制动器壳, 1. 5 第一、二制动蹄, 6. 顶杆.
(2) 如图: 汽车前进时, 受转矩T作用, 制动时, 第一制动蹄受助力作用, 与摩擦片摩擦, 顶杆推动第二制动蹄压紧摩擦片制动.
(3) 倒车时, 顺时针旋转, 制动效果差, 第二制动蹄放松, 制动效果不好, 第一制动蹄压紧制动.