

|            |              |
|------------|--------------|
| School     | 武汉理工大学       |
| Class      | 车辆1601       |
| Student ID | 072162850108 |
| Name       | 罗一楠          |

# 武汉理工大学考试试卷 (B卷)

## Test Paper of Wuhan University of Technology (B)

2018-2019 Academic Year 1<sup>st</sup> 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 | 8  | 7   | 30 | 27 |  |  |  |  |  | 82    |

|       |    |
|-------|----|
| 得分    | 10 |
| Score |    |

### 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 环保, 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 压紧机构 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 横阻尼机构.
- 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.
- The firing order of four-stroke six-cylinder engine is 1-5-3-6-2-4 or 1-4-2-6-3-5.
- 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), 前轮外倾 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 一回油间隙自动调整.

|       |  |
|-------|--|
| 得分    |  |
| Score |  |

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

- (X) 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).
- (X) When the excess air coefficient (过量空气系数)  $\alpha$  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.
- (X) When filling lubricating oil (润滑油), the more the oil is, the better for the engine.
- (X) 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).
- (X) 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.

|       |  |
|-------|--|
| 得分    |  |
| Score |  |

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

- (B) Which speed leads to the lowest fuel consumption?  
A. low speed; B. medium speed; C. full speed; D. over speed.
- (A) 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
- (A) 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 (B).  
A. Running smoothly B. High power per liter C. Compactness D. Low pollution
- (C) 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 (AB).  
A. steering knuckle B. kingpin; C. front beam; D. frame
- The designation of the diesel brand is based on the (D).  
A. evaporation B. ignition C. viscosity D. freezing point

|            |  |
|------------|--|
| Name       |  |
| Student ID |  |
| Class      |  |
| School     |  |

8、The pressure force of the diaphragm spring (膜片弹簧) is (B) 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、(C) Which is the function of the transmission system?

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

|       |    |
|-------|----|
| 得分    | 27 |
| Score |    |

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)?

①第一万向节两轴线夹角与第二万向节两轴线夹角相等。(设计要求)

②第一万向节从动叉与第二万向节主动叉处于同一平面内(装配要求)

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.

采用单向离合器起到超速保护的作用, 防止齿轮破坏。

形式有滚柱式, 弹簧式, 摩擦片式, 棘轮式。5'

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

悬架的固有频率是指悬架自身特性,  $f = \frac{1}{2\pi} \sqrt{\frac{C}{m}}$ , 应保持 1~1.6 Hz 的范围内。

$$f = \frac{1}{2\pi} \sqrt{\frac{C}{m}} = \frac{1}{2\pi} \sqrt{\frac{g}{\delta}}$$

悬架的固有频率与悬架刚度 C, 悬架质量 m, 和挠度  $\delta$  有关。5'

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: 利用地面作用力产生绕主销轴线的回转力矩, 力矩方向与车轮偏转方向相反, 使车轮能够保持直线行驶。(主销后倾偏移一个角度  $\gamma$ )

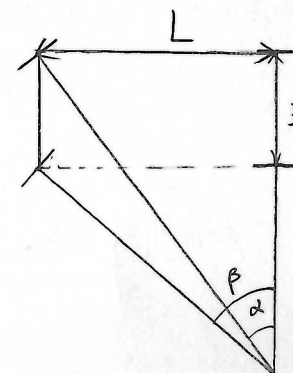
2. 主销内倾: 当汽车偏离直线运动时, 使车轮在自身重力作用下自动回正(主销内倾偏移一个角度  $\beta$ )

3. 前轮外倾: 有定位作用, 使车轮磨损均匀, 减小轴承负载。(车轮向外偏移角度  $\alpha$ ,  $\alpha \approx 1^\circ$ )

4. 前轮前束: 为消除车轮外倾的不良后果, 使前轮前边缘距离小于后边缘距离。6'

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

使所有车轮主销轴线交于一点, 提高汽车转向性能



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

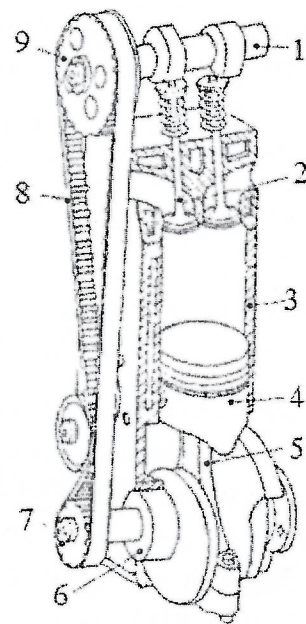
$$R = \frac{L}{\sin \alpha}$$

|            |  |
|------------|--|
| Name       |  |
| Student ID |  |
| Class      |  |
| School     |  |

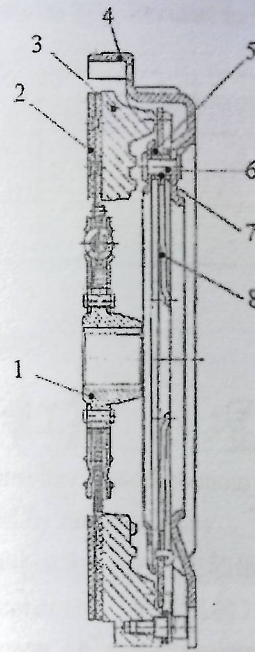
|       |  |
|-------|--|
| 得分    |  |
| Score |  |

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).



① 3-联轴器  
 4-活塞  
 5-连杆  
 6-飞轮  
 8-传动带



② 1-主动轴  
 2-主动轮  
 3-从动轮  
 5-膜片膜弹簧

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)

变速器:  $n_1 + n_2 = 2n_0$

$$\text{主减速器输入轴转速 } n_0 = \frac{n_1 + n_2}{2} = \frac{140 \text{ r/min} + 60 \text{ r/min}}{2} = 100 \text{ r/min}$$

$$\text{主减速器输出轴转速 } n_2 = 100 \text{ r/min} \times 4.63 = 463 \text{ r/min}$$

$$\text{变速器输出轴转速 } n = 463 \text{ r/min} \times 3.9 = 1805.7 \text{ r/min}$$

3. 1) How to arrange the crank angle (曲拐夹角) for four stroke and three cylinder engine?

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 (°) |          | 第 1 缸 | 第 2 缸 | 第 3 缸 |
|----------|----------|-------|-------|-------|
| 0~180°   | 0~60°    |       |       | 排气    |
|          | 60~120°  | 作功    |       |       |
|          | 120~180° |       | 压缩    |       |
| 180~360° | 180~240° |       |       | 进气    |
|          | 240~300° | 排气    |       |       |
|          | 300~360° |       | 作功    |       |
| 360~540° | 360~420° |       |       | 压缩    |
|          | 420~480° | 进气    |       |       |
|          | 480~540° |       | 排气    |       |
| 540~720° | 540~600° |       |       | 作功    |
|          | 600~660° | 压缩    |       |       |
|          | 660~720° |       | 进气    |       |

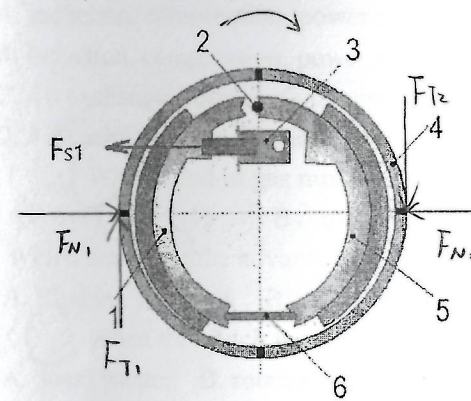
1)  $720^\circ \div 3 = 240^\circ$  1) 工作顺序 1-2-3

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) (助力)



1) 2-支点, 4-制动轮缸, 5-蹄片, 1-从蹄

前进时, 逆时针旋转, 蹄片张开方向与制动鼓旋转方向相同, 使蹄片有张紧的趋势, 达到制动作用

3) 顺时针旋转时, 受力如图, 蹄片 5 在  $F_{T2}$  和  $F_{S1}$  作用下,  $F_{N2}$  增大, 产生“增势”作用, 从蹄 1 在  $F_{T1}$  与  $F_{S1}$  作用下,  $F_{N1}$  减小, 产生“减势”作用。