

Program Name : Diploma in Automobile Engineering
Program Code : AE
Semester : Fifth
Course Title : Two and Three Wheeler Technologies
Course Code : 22559

1. RATIONALE

There is an increased need of public transport. The public transport systems in cities and in rural area do not meet the requirement effectively. This has led to huge demand of two and three wheelers. Presently the two wheelers are used by a large section of society as personalized transport. In view of the growth, large employment potential in this field and the manpower required to cater to the same, it is essential to inculcate the students with concept of frames, wheels, tyres, brakes and Suspension systems of two and three wheelers.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain two and three wheeler automobile systems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select frame and chassis for two and three wheeler vehicles.
- Repair engine, fuel, lubrication and emission control systems of vehicles.
- Repair transmission, steering, suspension and braking systems.
- Maintain the electrical system of vehicles.
- Rate the aerodynamics, aesthetics, ergonomics and safety aspects of vehicles.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

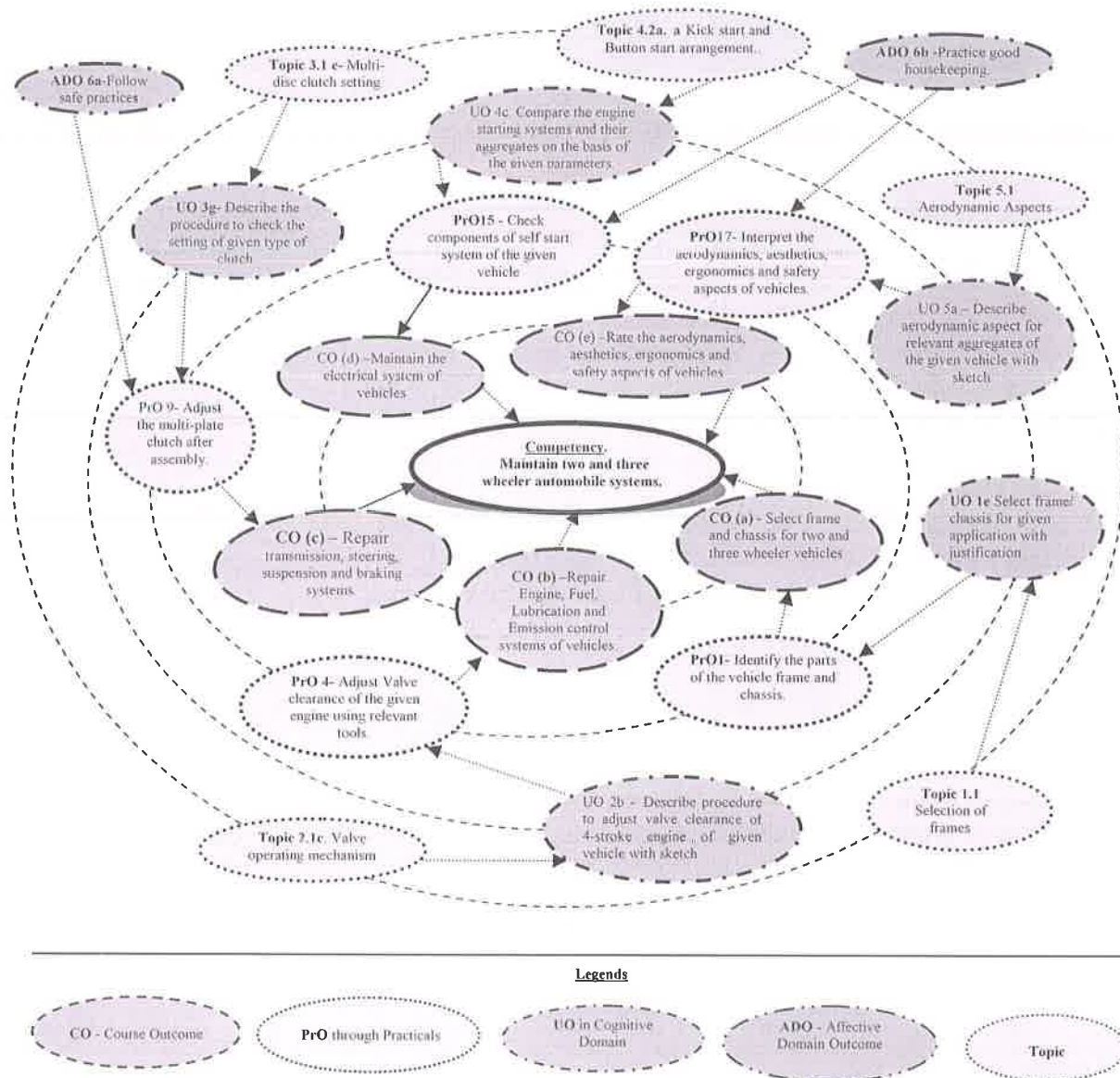


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Identify the parts of the vehicle frame and chassis. (Use relevant you-tube video)	I	02*
2.	Dismantle the given two or three wheeler engine.	II	02
3.	Assemble the given two or three wheeler engine.	II	02
4.	Adjust Valve clearance of the given engine using relevant tools.	II	02
5.	Service induction system of the given two or three wheeler	II	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	petrol engine for emission control.		
6.	Fine-tune idle speed of a two or three wheeler engine using the specified procedure. (including vehicle with centrifugal clutch)	II	02*
7.	Lubricate two or three wheeler chassis.	II	02
8.	Dismantle the given clutch assembly to check condition of components with reference to service manual.	III	02*
9.	Adjust the multi-plate clutch after assembly.	III	02*
10.	Dismantle gearbox of given vehicle.	III	02
11.	Assemble gearbox of given vehicle.	III	02
12.	Adjust handlebar arrangement for precise steering of vehicles	III	02
13.	Service brake system of the given two or three wheeler.	III	02
14.	Maintain ignition system of the given two/three wheeler.	IV	02
15.	Check components of self-start system of the given two-wheeler or three wheeler engines.	IV	02*
16.	Maintain wiring harness of the given two-wheeler or three-wheeler.	IV	02*
17.	Interpret the aerodynamic, ergonomic design and safety aspects of the given two or three wheelers.	V	02*
	Total		34

Note

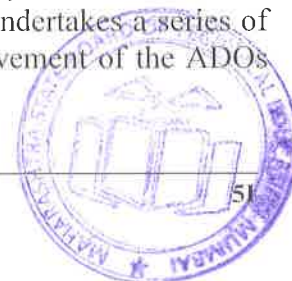
- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Follow safety rules and adopt standard practices for handling tools and equipment's.	30
b.	Refer workshop manual and include relevant data in the journal.	20
c.	Sketching, drawing layouts and conclusion.	20
d.	Answer to sample questions	20
e.	Submit report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Demonstrate working as a leader/a team member.
- d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs



according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year and
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Pro. Sr. No.
1.	Two Wheeler vehicle (Hero Moto corp.) or similar type, Three wheeler vehicle (Bajaj Auto) (4-stroke, single cylinder engine) or similar type	All
2.	Working model of Two wheeler transmission systems (4-Speed transmission)	8,9,10
3.	Working model of Three wheeler transmission systems (4-forward and 1-Reverse transmission)	8,9,10
4.	Two wheeler vehicle- frames (single and double cradle frame)	1
5.	Three wheeler vehicle- frame and body (Auto rickshaw – 4 Stroke)	1
6.	Allen (Wrench or Socket) Set - Metric (2mm - 8mm, 10mm, 12mm)	2,3,6,9,10
7.	Combination Wrenches: Standard (1/4" - 1 1/4") Metric (7mm - 24mm)	2,3,4,5,6,9, 10,12,13
8.	Feeler Gauge (Blade Type): .002" - .040" .006mm - .070mm	13
9.	Socket Set - 1/4" Drive: 1/4" - 1/2" Standard Depth 1/4" - 1/2" Deep 6mm - 12mm Standard Depth 6mm - 12mm Deep Flex/Universal Type 3", 6" Extensions Ratchet	2,3,4,5,6,9, 10,12,13
10.	Socket Set - 3/8" Drive: 5/16" - 3/4" Standard Depth (6 point) 3/8" - 3/4" Deep (6 point) 10mm - 19mm Standard Depth 10mm - 19mm Deep 3", 5", 10" Extensions	2,3,4,5,6,9, 10,12,13
11.	Magnetic Pickup Tool	14
12.	Brake Shoe Adjusting Gauge	12
13.	Wire and Terminal Repair Kit	15

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

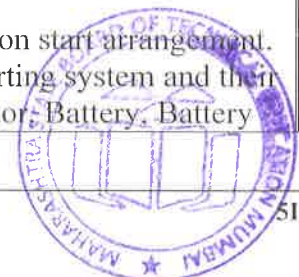
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Frame and Chassis	1a. Describe the given vehicle frame with sketch. 1b. Compare the given types of two wheeler chassis on the basis of frame construction and application. 1c. Compare the given vehicle layout on the	1.1 Frames: Single cradle frame, Double cradle frame, Tubular frame, Engine as stressed member and Twin-spar frame. 1.2 Chassis: Conventional chassis and monocoque or integral construction. 1.3 Layout of two-wheeler and three-wheeled Vehicle. 1.4 Frame material: Alloy Steel, aluminium alloy, Carbon fiber.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	basis of frame, engine location, transmission and application. 1d. Select relevant frame material for given vehicle application with justification. 1e. Select frame/ chassis for given application with justification.	
Unit– II Engine, Fuel, Lubrication and Emission systems.	2a Select an engine for the given vehicle with justification. 2b Describe procedure to adjust valve clearance of 4-stroke engine of given vehicle with sketch. 2c Select an air filter for given vehicle with justification. 2d Select an engine exhaust system component for given vehicle with justification. 2e Describe fuel supply system component/aggregate for the given two or three wheeler engine with sketch. 2f Explain lubrication system for the given two or three wheeler engine with sketch. 2g Describe the given emission control system of the given engine with sketch. 2h Describe procedure to find the fault in the emission control system of the given vehicle	2.1 Engines for two and three wheelers: a Four stroke S.I. and C.I. engines. b Engine selection criteria for two-wheeler and three-wheeler. c Valve operating mechanism. 2.2 Induction System: a Air filter/ Air Cleaner: construction and function - Washable oiled sponge element, washable Dual foam wet type. 2.3 Exhaust system: a Construction and function of Exhaust system: Header pipe, Muffler types and their application, Tail Pipe arrangement and location. 2.4 Fuel supply system a Carburetor: functions and working under various Engine operating conditions – Idling, Starting, accelerating, normal running. b Electronic petrol injection system. c Layout of throttle body injection system. 2.5 Lubrication system. Lubrication in four stroke engines 2.6 Emission Control system: a Block diagram and working of the following systems: Catalytic convertor, Exhaust Gas Recirculation, Positive Crankcase Ventilation. b Diagnosis using exhaust gas analysis-procedure.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit III- Transmission, steering, suspension and braking systems.	3a. Compare transmission system of the given vehicles on basis of gear ratio, type of primary drive, final drive and gear shift mechanism. 3b. Describe effect of steering geometry relevant parameters for the given vehicles with sketch. 3c. Select the suspension system for the given application with justification. 3d. Compare the braking system of the given vehicles on basis of the given parameters. 3e. Select wheels and tyres for the given vehicle with justification. 3f. Sketch the layouts of Transmission system of the given two-wheeler or three-wheeler. 3g. Describe the procedure to check the setting of given type of clutch. 3h. Describe the procedure to adjust damper pre-load for rear wheel suspension of motorcycle.	3.1 Transmission system: a Layout of transmission system in two and three wheeler vehicle. b Cable Actuated Wet Multi-disc clutch, Centrifugal clutch. c Multi-disc Clutch setting d Chain drive, Belt drive with variator mechanism, Gear drive. e Gearbox – Working of constant mesh gearbox. f Gear shifting mechanism- hand and foot operated shifting mechanism. 3.2 Steering system: a Steering geometry and effects. (Caster angle and Trail) b Steering fork. c Handlebar arrangement. 3.3 Suspension system: a Two wheeler suspension system- Spring and damper- swing arm and telescopic type. b Mono-shock suspension, Gas filled shock absorber. Preload adjustment procedure for motorcycle rear wheel suspension. c Three-wheeler rear suspension for Auto-Rickshaw. 3.4 Braking system: a Drum brake and disc brake (Single calipers and double caliper) b Brake control system- Hand and foot operated brake. c Braking system of Auto-Rickshaw. 3.5 Wheels and tyres: Selection criteria of wheels and tyres, their specification for motorcycles, scooters, sports bike.
Unit-IV Electrical systems	4a. Describe working of the given ignition system with sketch. 4b. Describe procedure to check aggregates of CDI system with sketch. 4c. Compare the engine starting systems and their aggregates on the basis of the given parameters.	4.1 Ignition system: a Working of capacitive Discharge Ignition (CDI) system. b Procedure to check CDI system aggregates. c Microprocessor controlled Ignition system block diagram and working. d Concept of twin sparks ignition system. 4.2 Starting system: a Kick start and Button start arrangement. b Components of starting system and their functions: D C motor, Battery, Battery



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4d. Describe working of the given charging system with sketch. 4e. Describe specification and features of the given Dash board /lighting system aggregates.	Rating for use in Button start vehicles 4.3 Charging system: Components of charging system, Schematic circuit and working of charging system. 4.4 Lighting system and accessories: a Specifications and Application of -Head Lamp, Tail and number plate Lamp, Purpose of using LED lights in tail lamp, Turn Signal Lamp, Side Stand Indicator Lamp, High Beam Indicator Lamp, Neutral Indicator Lamp, Speedometer Lamp, Horn, Mobile Charger point, Head lamp and tail lamp Reflectors used in two wheelers b Dash units - Use of Speedometer (Analog and digital), Trip meter. Use of Engine Speed indicator/ Tachometer.
Unit –V Aerodynamic, Aesthetics, Ergonomics and Safety Aspect of vehicles	5a. Describe aerodynamic aspects for relevant aggregates of the given vehicle with sketch. 5b. Describe Ergonomic aspect relevant to the given vehicle handling/ seating arrangement with sketch. 5c. Explain significance of aesthetic aspect for relevant aggregates of the given vehicle with justification. 5d. Describe safety aspects of given two wheeler relevant to rider.	5.1 Aerodynamic Aspects. a Head lamp shape (Sealed beam and conventional). b Tail lamp and indicator light arrangements- body enclosed and separate. c Shape of Fuel Tank in Motorcycles 5.2 Ergonomic Aspects. a Seat Arrangement for rider and pillion rider. b Handle bar position. c Floor/ Foot rest for driver and pillion rider. 5.3 Aesthetics Aspects. a Headlamp fairing of motorcycles. b Side panels for scooter/ scooterate and motorcycle. c Ground clearance. d Mud guard shape and position. 5.4 Safety Aspects. a Crash bar, Saree guard b Driving Habits. c Drive gear – Jacket, Helmet, Day night goggle.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application' Level' of Bloom's 'Cognitive Domain Taxonomy'.



9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Frame and Chassis	6	02	04	04	10
II	Engine, Fuel, Lubrication and Emission systems.	12	02	04	10	16
III	Transmission, Steering, Suspension and Braking system	12	02	04	10	16
IV	Electrical Systems	10	02	04	08	14
V	Aerodynamic, Aesthetics, Ergonomics and Safety Aspect of vehicles	08	02	04	08	14
Total		48	10	20	40	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer different websites to have deeper understanding of the subject.



- h. Observe continuously and monitor the performance of students in Lab.
- i. Demonstrate students thoroughly before they start doing the practice.
- j. Encourage students to refer different websites to have deeper understanding of the subject.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a. Variator Assembly service: Identify need to service the variator assembly. Check components using relevant tools. Record Do's and don'ts. Prepare a report on the same.
- b. Disc brake service: Identify need to replace friction pads of disc brake. Follow dismantling and assembly using relevant tools. Record Do's and don'ts. Prepare a report on the same.
- c. Double acting damper service: Identify need to service double acting damper. Follow dismantling and assembly using relevant tools. Record Do's and don'ts. Prepare a report on the same.
- d. Positive Crankcase Ventilation system service: Identify the need of PCV system service. Check PCV system using relevant tools. Record Do's and don'ts. Prepare a report on the same.
- e. Collect data of any three two or three wheelers of same category and compare them on the basis of their technical specification and other relevant parameters. Prepare a report on the same.
- f. Collect data of Indian two or three wheeler manufacturers and their products and prepare a report based on product range, market share, product innovation, emission control technology and economy.
- g. Explore innovative and latest technology/features provided in two and three wheeler vehicle. Prepare a report containing relevant aspects of the technology /features.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Two and Three Wheeler Technology	Panchal, Dhruv, U.	PHI Learning Private Limited, Delhi, 2015, third edition ISBN-978-81-203-5143-1
2	Two Wheeler and Three Wheeler	Ramalingam, K.K.	SCITECH Publication, Chennai. Second edition. ISBN-978-93-85983-30-6



S. No.	Title of Book	Author	Publication
3	Automobile Engineering Vol-1	Dr. Kripal, Singh	Standard Publishes-Distributors-Delhi; 13th Edition (2012), ISBN-13: 978-8180141966
4	Automotive Mechanics	William, Crouse; Donald, Anglin	McGraw Hill Education; 10 edition (1 July 2017), ISBN-13: 978-0070634350

14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.youtube.com/watch?v=kTuybtMAiN8>
- b. <https://www.youtube.com/watch?v=DUK6gjbsLpQ>
- c. <https://www.youtube.com/watch?v=zvU6HeEobo0>
- d. <https://www.youtube.com/watch?v=K0QA vF2PLsY>
- e. https://www.youtube.com/watch?v=m6AZ7_mACUg
- f. <https://www.youtube.com/watch?v=-Rup463OFHA>
- g. <https://www.youtube.com/watch?v=QWAhLyL2lBk>
- h. <https://www.youtube.com/watch?v=2EjW-iSP-Q8> for variator service

