

Program Name : Diploma in Automobile Engineering
Program Code : AE
Semester : Third
Course Title : Automobile Transmission System
Course Code : 22309

1. RATIONALE

This course provides knowledge about the various components of vehicle layout and the power transmission train used. This course will also help the students during inspection, installation, operation and maintenance of transmission system of automobile. This course is therefore a core course for automobile engineers and they should develop desired knowledge and skills over it.

2. COMPETENCY

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

- Check the functioning of the automobile power transmission system components.

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 proper tools and equipment to check automobile transmission system components.
- Select relevant vehicle layout and chassis for specific purpose.
- Check automobile transmission system components.
- Dismantle/assemble automobile transmission system components.
- Diagnose simple problems pertaining to wheels and tyres of automobiles.

4. TEACHING AND EXAMINATION SCHEME

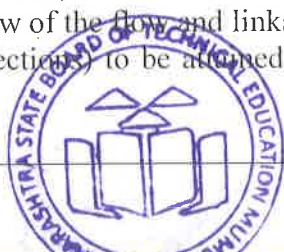
Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks 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 cognitive domain 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



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
8	Assemble a Synchromesh gear box	III	02
9	Dismantle a Vario-drive used in mopeds.	III	02*
10	Assemble a Vario-drive used in mopeds.	III	02
11	Identify the components of the sequential automatic transmission.	III	02*
12	Dismantle a Propeller shaft - Universal Joint assembly.	IV	02*
13	Assemble a Propeller shaft - Universal Joint assembly.	IV	02
14	Dismantle the Differential and Rear axle assembly.	V	02*
15	Assemble the Differential and Rear axle assembly.	V	02
16	Dismantle/ Assemble a Wheel assembly.	VI	02*
	Total		32

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. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is 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 equipments.	20
b.	Refer workshop manual and include relevant data in the journal.	10
c.	Sketching, Drawing layouts and conclusion.	40
d.	Answer to sample questions/Demonstration ability	20
e.	Timely submission of journal.	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:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- 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
- 'Organising Level' in 2nd year
- 'Characterising 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. S. No.
1	Vehicles – a) Two Wheeler – Minimum 100 cc motorcycle of make Bajaj/Hero/Honda/Yamah/ TVS or alike. b) Three wheeler – RERWD Auto Rickshaw of Make Bajaj/ Piaggio or alike in good working condtion. c) Four wheeler vehicle – Car (FEFWD)/LMV (FERWD) of make Maruti/TATA/Mahindra or alike in good running condtion.	All
2	Cut – section working model of Single Plate dry clutch: Coil spring/Diaphragm type single plate clutch assembly used in car/LMV/HMV suitably mounted on M.S. stand and in good operating condition.	3
3	Cut – section working model of Multi-Plate Wet type clutch: Multi-Plate Wet type clutch used in motorcycle suitably mounted on M.S. stand and in good operating condition.	3
4	Cut – section working model of simple Pulley based vario-drive used in mopeds.	3
5	Cut – section working model of four wheeler transmission system: Synchromesh gear box used in LMV/HMV suitably mounted on M.S. stand and in good operating condition.	5
6	Cut – section working model of Sequential automatic transmission system.	7
7	Cut – section working model of Final drive and differential used in Car/LMV/HMV and suitably mounted on M.S. stand and in good operating condition.	9
8	Four wheeler chassis – Cut section working model of chassis of Front Engine Rear wheel drive/Four wheel drive vehicle with Engine, transmission, steering, brakes, suspension and electrical systems.	All
9	Four wheeler chassis – Cut section working model of chassis of Front Engine Front wheel drive car of any make with MPFI engine, transmission, steering, brakes, suspension and electrical systems.	

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 Overview of Automotive Transmission System	1a. Identify tool/equipment to check the given component of automotive transmission system. 1b. Interpret the given vehicle layout for functional relationship of the given components of	1.1 Tools and equipment required to check automotive transmission system components. 1.2 Vehicle layout and its types: (a) Introduction of related terms- an automobile, Chassis, Body, Types of vehicles and Vehicle layout. (b) Classification of vehicle layout with respect to i) Location of engine, ii) No of live axles, iii)



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	transmission system. 1c. Describe layout and chassis frame used in the given vehicle. 1d. Select the relevant frame for the given capacity of vehicle with justification. 1e. Identify the materials of the given types of frames.	Arrangement of Engine, Passenger and Luggage section, iv) Application (c) Layout of the front engine rear wheel drive vehicle- Location and functions of major components of transmission system. 1.3 Chassis Frames: Necessity of frame. (a) Loads acting on frame. (b) Types of frames- conventional (ladder and x-member type), semi integral and integral types. Sub frames. (c) Frame sections-channel, box and tubular sections. (d) Materials for frames.
Unit- II Automotive Clutches	2a. Describe with sketches the construction and working of the given type of clutch. 2b. Describe with sketches the operation of the given clutch actuating mechanism. 2c. Compare with sketches the types of clutches on the basis of construction, torque transmission, size.	2.1 Clutch: Necessity of clutch, Requirements of automotive clutches, Classification - Friction and Non friction type clutches 2.2 Construction and Operation of Different type of clutches a. Construction and Operation of a Single plate (coil and Diaphragm) dry clutch, Multi-plate – Dry and wet clutch, Centrifugal clutch. b. Construction details of Clutch plate. Clutch lining materials. c. Clutch operating mechanisms-mechanical, hydraulic, vacuum. d. Fluid Coupling – Principle, Construction and Working
Unit- III Automotive Gear boxes	3a. Describe with sketches the construction and working of the given type of gear box. 3b. Determine the gear ratio for the given type of gear arrangement. 3c. Describe the power flow diagrams for the given type of gear box when forward and reverse gears are in engaged positions. 3d. Describe with sketches the method of lubrication for the given type of gearbox.	3.1 Necessity of Gear Box 3.2 Types of automotive Gear Boxes -Construction and operation of - Sliding Mesh, Constant Mesh, Synchromesh gear box, Power flow diagrams for forward and reverse gears in engaged position. 3.3 Torque Converter- Construction and working and application. 3.4 Concept of Semiautomatic and automatic transmission. 3.5 Variator Drive, Continuously variable transmission 3.6 Gear selector mechanism with gear lever mounted on top of gear box. 3.7 Transfer case – Purpose, construction and working. 3.8 Lubrication of gear box.
Unit-IV Propeller shaft and	4a. Describe with sketches the constructional details of the given type of	4.1 Propeller shaft - Necessity and Types. Constructional details of Hollow and solid propeller shaft.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Universal joints	propeller shaft. 4b. Compare with sketches the given type of axle drives based on construction, working, loads acting on it and applications. 4c. Describe with sketches the construction, working and applications of the given type of universal joint.	4.2 Types of rear axle drives – construction, working and applications of Torque tube drive and Hotchkiss drive. 4.3 Universal Joint – Functions, Types, Construction and Operation of simple Hooke's joint, Constant velocity joints – Inboard Tripod Joint and outboard Rezappa joint. 4.4 Functions and construction of slip joint.
Unit –V Final drive, Differential and Rear axle	5a. Explain with sketches the construction and working of the given type of final drive and differential. 5b. Compare with sketches the given types of rear axles used in the given four wheeler based on construction, working and application. 5c. Describe with sketches the method of lubrication for the given type of rear axle assembly.	5.1 Final drive and Differential a. Necessity and types of final drive. b. Necessity and types of differential. c. Construction and working of final drive and differential. 5.2 Rear Axle a. Necessity of Rear Axle. b. Loads acting on the rear axle c. Types of rear axles- semi floating, Three quarter floating and full floating type. d. Rear axle casing- split and banjo type. e. Double reduction axle. f. Method of lubrication for rear axle assembly.
Unit-VI Wheels and Tyres	6a. Describe construction and working of the given type of wheel with sketches. 6b. Compare with sketches the the given types of tyres based on specifications, construction and performance. 6c. Select the suitable tyre and its inflation for the given application. 6d. Interpret the specifications for the given type of tyre.	6.1 Wheels: Functions, Types of wheels - construction and applications of Wired spoke wheel, Disc wheel and Alloy wheels. 6.2 Tyres a. Functions of tyre, Types of Tyres - Construction and working of tubed tyre and Tubeless tyres. Radial ply, Cross ply, Belted bias types of tyres, Tyre Specifications. b. Concept of Aspect ratio. c. Types of tread patterns. d. Tyre inflation –Types and effects of incorrect tyre inflation. e. Tyre rotation – Necessity.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above 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	Overview of Automotive Transmission System	08	04	04	04	12
II	Automotive Clutches	10	02	08	06	16
III	Automotive Gearboxes	10	02	08	06	16
IV	Propeller shaft and Universal joints	06	02	04	02	08
V	Final drive, Differential and Rear axle	08	02	04	04	10
VI	Wheels and tyres	06	02	04	02	08
Total		48	14	32	24	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 journal of practicals.
- Undertake micro-projects.
- Compare clutches used in a two wheeler, four wheeler and moped.
- Write down the parts of transmission system of your bike with detailed specification and manufacturer's name.
- List examples/situations where universal joints are used.
- Write down the specification of tube less tyres for three leading tyre manufacturers.
- Compare broad base and narrow base tyres.
- Visit a nearby vehicle repair shop and observe the construction and working of two and four wheeler gear boxes.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various 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.



- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

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 are given here. Similar micro-projects could be added by the concerned faculty:

- a. Observe the number of vehicles running on road and classify them according to different bases.
- b. Collect the data of any three vehicles of same category and compare them.
- c. Collect the data of Indian Motor vehicle manufacturers and their products and write a report on it.
- d. Collect the data of different types of clutches commonly used in vehicles and compare it.
- e. Collect the different types of universal joints from scrap/garage and write report with their comparison.
- f. Identify the advance systems used in modern vehicle and prepare report on it.
- g. Prepare cut-section models of any one used transmission system component/assembly.
- h. Collect the data of different types of tyres from market and compare it.
- i. Collect the different types of tyre tread sections and demonstrate their applications.
- j. Prepare display boards or charts for clutch, gear box, propeller shaft and universal joints. differential and types of rear axle, wheels and tyres etc.

13. SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Automobile Engineering	Gupta, R. B.	Satya Prakashan, New Delhi, 2010 ISBN-13: 9788176843799
2	Automobile Engineering	Gupta K. M.	Umesh Publication, New Delhi, 2011, ISBN-13: 5551234002614
3	Automobile Engineering	Jain, K.K.; Asthana, R.B.	TATA McGraw Hill Publications, New Delhi, 2015, ISBN-007044529X, 97800705291.
4	Automobile Engineering	Narang, G.B.S	Khanna Publishers, New Delhi, 2012, ISBN-13: 1234567144518
5	Automobile	Singh, Kirpal	Standard Publishers distributors, New



S. No.	Title of Book	Author	Publication
	Engineering Vol. II		Delhi, 2009, ISBN-13: 978-8180142062
6	Automotive Mechanics	Srinivasan, S.	Tata McGraw-Hill Education – 2 nd Edition, 2003, ISBN 13: 9780070494916
7	Motor Automotive Technology	Schwaller, Anthony E.	Delmar Publishers Inc. New Delhi, 2009, ISBN-13: 978-0827351004
8	Automotive Mechanics	Crouse, William H; Anglin Donald L	McGraw Hill Education (India) Pvt. Ltd. 2006 ISBN 13: 9780070148604
9	Automobile Mechanics	Giri, N. K.	Khanna Publishers, New Delhi, 8 th Edition, 2008, ISBN: 9788174092168
10	Basic Automobile Engineering	Nakra, C. P.	Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2009, ISBN-13: 9788187433224

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- https://www.youtube.com/watch?v=H7Iay0Ke_t4-For Clutch
- <https://www.youtube.com/watch?v=OQ9eI7mEmxw>-For Clutch
- <https://www.youtube.com/watch?v=F8W5hp1Y2XE>-For Synchromesh Gear box
- https://www.youtube.com/results?search_query=Differential+
- https://www.youtube.com/results?search_query=Rear+axle

