Course Title: **Automobile Transmission & control systems**	Course Code: **15AT32T**
Credits (L:T:P) : 4**:0:0**	Core/ Elective: **Core**
Type of course: : **Lectures**	Total Contact Hours: **52**
25 Marks	**100 Marks**

Prerequisites:

Knowledge of Automobile Engineering-I & II studied in I and II semesters.

Course Objectives:

The student should be able to

1. Identify various components of Automobile chassis components and understand their functions.
2. Classify various systems of chassis.
3. Understand construction and working of various systems of chassis and their components.
4. Compare different types of systems in vehicle chassis.

On successful completion of the course, the students will be able to attain CO'S:

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the purpose and constructional features of various chassis frames.	***R/U***	1,2,10	**03**
CO2	Understand the principle, construction and working of different types of clutches and gearboxes and compare them.	***R/U/A***	1,2,3,10	**10**
CO3	Explain the functions, construction and working of propeller shaft, final drive, differential and rear axle and compare different types.	***R/U/A***	1,2,3,10	**10**
CO4	Understand the purpose, construction and working of different components of front axle, steering system and steering geometry.	***R/U/A***	1,2,3,10	**11**
C05	compare types of brakes and braking systems, understanding their purpose, construction and working.	***R/U/A***	1,2,3,10	**10**
CO6	Compare and list merits and demerits of different components of suspension, wheels and tyres, understanding their purpose, construction and working.	R/U/A	1,2,3,10	**08**
		Total sessions		**52**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Automobile transmission and control systems	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set			Marks weightage (%)
			R	U	A	
I	**Chassis Frames**	**03**	**5**	**5**		**6.89**
II	**Clutch and Gear box**	**10**	**5**	**15**	**10**	**20.68**
III	**Propeller shaft, Final drive, differential and rear axle**	**10**	**5**	**15**	**10**	**20.68**
IV	**Front axle and steering system**	**11**	**5**	**15**	**10**	**20.68**
V	**Braking system**	**10**		**15**	**10**	**20.68**
VI	**Suspension system, Wheels and tyres**	**08**	**5**	**15**		**10.34**
	Total	**52**	**145**			**100**

Legend: R; Remember, U: Understand A: Application

Course Delivery: The course will be delivered through lectures, presentations and classroom discussions.

Course Content:

UNIT-I

Chassis Frames **03hrs**

Frames- purpose- loads acting - types –construction-ladder type-x type-integral, sections used in frames- Channel-Box-Tubular, materials used for frames, sub frames-need.

UNIT-II

Clutch and Gear box **10hrs**

Clutch-purpose-requirements-classifications- principle of friction clutch, construction and working -single plate- multi plate- centrifugal, advantages and disadvantages-single plate-multi plate-centrifugal clutch, Clutch Lining materials, Clutch operating mechanisms-mechanical- hydraulic.

Gear box-necessity- Classification-construction and working - constant mesh-synchromesh gear box, synchroniser-need-construction and working, gear selector mechanisms-types-construction and working –floor mounted mechanism.

UNIT-III

Propeller shaft, Final drive, differential and rear axle **10hrs**

Propeller shaft-function-construction, universal joints & slip joints- function- types-construction & working- cross or spider type-flexible ring type-Rzeppa joint-Tripod joint.

Final drive- Purpose- types

Differential- necessity- principle- construction & working.

Rear axle- loads acting- types - construction and operation - hotch kiss - torque tube drive, rear axle drive-construction-semi-floating -3/4 floating -fully floating rear axle drives, double reduction axle-necessity-types

UNIT IV

Front axle and steering system **11hrs**

Front Axle-types-construction-live (drive shaft)-dead axle (conventional)**,** stub axles-types-construction - Elliot, reverse-Elliot, lemoine and reverse - lemoine.

Steering system-purpose- requirements-mechanisms-types-details –Ackerman mechanism, layouts-rigid axle-independent suspension system, steering gear box-need-types-construction and working- Rack & Pinion-worm and wheel re-circulating ball and nut type, steering geometry-definition, define and explain-camber-caster-king pin inclination-combined angle-toe in and toe out, wheel alignment and wheel balancing-need.

UNIT V

Braking system **10hrs**

Braking system- purpose- requirements- types, construction and working-internal expanding drum brake, mechanical brakes-layout, hydraulic brake-principle-layout-advantages and disadvantages, master cylinder-types-construction and working –conventional –tandem, wheel cylinder-types-construction and working –single and double piston type, parking brake-purpose, brake lining materials, disc brakes-types-merits and demerits-construction and working –fixed-sliding-swinging type.

UNIT VI

Suspension system, Wheels and tyres **08hrs**

Suspension System-necessity-types, springs-types, construction and working-rigid axle suspension with leaf spring-McPherson strut-double wishbone-trailing link, sprung and un sprung weight-definition, shock absorber-need-construction and working of double acting shock absorber

Wheels- requirements-types, Constructional details-wire-disc-alloy wheel.

Tyres-function-types-construction-tube-tubeless, carcass-types-construction-cross ply –radial - bias type, treads pattern – need - types, aspect ratio, and specification.

Resources:

Reference Books:

SlNO	Title of the book	Author	Publisher
1	Automotive Mechanics	W. H. Crouse & Anglin	Tata MC Graw-Hill
2	Diesel Engineering	Sean Bennett	CENGAGE Learning
3	The Automobile Engineering Vol-2	K.M Guptha	Umesh publications
4	Automotive Technology	Jack Erjavec	CENGAGE Learning
5	Automobile Engineering	K.M Gupta	Umesh publications
6	Automobile Engg Vol I	Kirpal Singh	Standard publication
7	Automobile Engineering	**Er S K Gupta**	S Chand
8	Automobile Engineering	Er A K Babu Er Ajit pal singh	S Chand
9	Automobile engineering	R B Gupta	Kanna Publications

Websites:

- https://www.youtube.com/watch?v=Lys93UK4DV
- https://www.youtube.com/watch?v=pqF-aBtTBnY
- https://www.youtube.com/watch?v=TcYsV063lk8
- https://www.youtube.com/watch?v=6BaECAbapRg
- https://www.youtube.com/watch?v=zd69cDTZDco
- https://www.youtube.com/watch?v=kpVdQ8CIFsI
- https://www.youtube.com/watch?v=agLa0A8GAfc

- https://www.youtube.com/watch?v=QPaUJfA1KsY
- https://www.youtube.com/watch?v=vOo3TLgL0kM
- https://www.youtube.com/watch?v=IKywZ730JFs
- https://www.youtube.com/watch?v=gIGvhvOhLHU
- https://www.youtube.com/watch?v=pmWbei6beBg
- https://www.youtube.com/watch?v=R-hk9NvFang
- https://www.youtube.com/watch?v=SOgoejxzF8c
- https://www.youtube.com/watch?v=8qeaNQABPQk
- https://www.youtube.com/watch?v=bMg_j5_AGMg
- https://www.youtube.com/watch?v=bnc3VnQ8kUY
- https://www.youtube.com/watch?v=bBwQ-UiveTs
- https://www.youtube.com/watch?v=oUchfOF6EMs
- https://www.youtube.com/watch?v=uTqU35K_8AU
- https://www.youtube.com/watch?v=BIM1AyxfYkw
- https://www.youtube.com/watch?v=-4b39-pbHN4
- https://www.youtube.com/watch?v=PZ6i46XleqE
- **https://www.youtube.com/watch?v=u6ssbkt7_kw**

Student Activities to be performed to award five marks in continuous internal evaluation:

Visit nearby two wheel/four wheeler service stations/garages and make report of different automotive chassis components seen with dimensional specification, materials used and manufacturing processes used along with photographs.

Note:

1. **Student should prepare a report on any one of the above/similar activity, which helps in achieving above course outcomes.**
2. **The report prepared should be approved by the concerned staff and HOD.**
3. **The activity group should consist of maximum of three students.**

MODEL OF RUBRICS FOR ASSESSING STUDENT ACTIVITY

Note: The dimensions given in below table are only representatives and the lecturer has to design/ decide suitable dimensions based on the activity given.

Dimension	Scale					Students Score				
	Unsatisfactory 1 marks	Developing 2marks	Satisfactory 3 marks	Good 4marks	Exemplary 5marks	1	2	3	4	5
1. Research and gather information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	2				
2.Full fills teams roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	3				
3.Shares work equally	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	4				
4. listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	5				
Grand Average/Total=2+3+4+5/4=14/4=3.5=4						4				

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE(Continuous Internal Evaluation)	IA	Students	Three IA Tests; (Average of three Tests)	20	Blue books	1,2,3,4,5,6
				Activities	05	Activity reports	1,2,3,4,5,6
	SEE (Semester End Examination)	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2 & 3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5 & 6 Effectiveness of Delivery of instructions & Assessment Methods

***CIE** – Continuous Internal Evaluation ***SEE** – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20
	Year:		
Name of Course coordinator : CO's:____			Units:__

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Note: The Lecturer has to fallow the question paper blue print given in above table to prepare CIE Question papers also.

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	III semester	Automobile transmission and control systems	20
	Year: 2015-16	Course code:15AT32T	

Name of Course coordinator : Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	CL	CO	PO
1	State the functions of Chassis frame and list loads acting on it. 5marks	R	1	1,2,10
2	Compare single plate clutch with multi plate clutch. 5marks	A	1	3,10
3	Explain the construction and working of diaphragm type single plate clutch. 10Marks or Explain the construction of constant mesh gear box with a sketch. 10marks	U U	2	1,2,10

Legend: R; Remember, U: Understand A: Application

MODEL QUESTION BANK

CO1: Understand the purpose and constructional features of various chassis frames.

FIVE MARKS QUESTIONS

1. State the functions of Chassis frame and list loads acting on it. (R)
2. State different types of Chassis frames and list materials used to construct chassis frame. (R)
3. Draw the sketch of conventional frame (ladder type) and label the parts. (R/U)
4. Draw the sketch of X type frame and label the parts. (R/U)
5. List the different sections used in members of chassis frame and explain need of sub frame. (R/A)
6. Write a short note on integral type chassis construction. (U)

TEN MARKS QUESTIONS

1. Explain the construction of ladder type chassis with a sketch. (U)
2. Explain the construction of X type chassis with a sketch. (U)

CO2: Understand the principle, construction and working of different types of clutches and gearboxes and compare them.

FIVE MARKS QUESTIONS

1. Explain the requirements of a good clutch. (A)
2. State the classifications of friction clutch. (A)
3. Explain the working principle of friction clutch. (U)
4. Mention the factors affecting torque transmitted by friction clutch. (R)
5. Compare single plate clutch with multi plate clutch. (A)
6. Compare diaphragm type clutch with coil spring type clutch. (A)
7. Compare wet clutch with dry clutch. (A)
8. List different friction materials used for clutch. (R)
9. Explain the mechanical clutch operating mechanism with a sketch. (U)
10. State the functions of gear box. (R)
11. Classify the automotive gear box. (A)
12. Explain the necessity of synchronizer in the gear box. (U/A)
13. Explain the methods used to prevent accidental gear shifting and double gearing in gear box. (A)

TEN MARKS QUESTIONS

1. Explain the construction and working of coil type single plate clutch.(U)
2. Explain the construction and working of diaphragm type single plate clutch.(U)
3. Explain the construction and working of multi plate type single plate clutch. (U)
4. Explain the construction and working of centrifugal type single plate clutch. (U)
5. Explain the hydraulic actuating mechanism of clutch with a sketch. (U)
6. Explain the construction of constant mesh gear box with a sketch. (U)
7. Explain the process of gear changing in constant mesh gear box with sketches. (U)
8. Explain the construction and working of synchronizer with a neat sketch. (U)
9. Explain the construction and working of floor mounted gear shifting mechanism. (U)
10. Explain the interlocking mechanism used in a gearboxes with a sketch. (U)

CO3:Explain the functions, construction and working of propeller shaft, final drive ,differential and rear axle and compare different types.

FIVE MARKS QUESTIONS

1. State the functions of universal joint and slip joint. (R)
2. Explain the constructional details of propeller shaft. (U)
3. State the purpose of final drive and mention different types. (A)
4. List the loads acting on the rear axle and mention different types of rear wheel drives. (R)
5. State the functions of differential. (A)
6. Compare fully floating axle with semi floating type. (A)
7. Compare fully floating axle with 3/4floating type. (A)
8. Explain the necessity of constant velocity joints and list types. (A)

TEN MARKS QUESTIONS

1. Explain the constriction and working of spider type universal joint with a sketch. (U)
2. Explain the constriction and working of Rzeppa type constant velocity joint with a sketch. (U)
3. Explain the constriction and working of Tripod type constant velocity joint with a sketch. (U)
4. Explain the constriction and working of differential with a sketch. (U)
5. Explain the constriction and working of hotch kiss drive with a sketch. (U)
6. Explain the constriction and working of torque tube drive with a sketch (U).
7. Explain the constriction and working of semi floating with sketch. (U)
8. Explain the constriction and working of ¾ floating with sketch. (U)
9. Explain the constriction and working of fully floating with sketch. (U)

CO4: Understand the purpose, construction and working of different components of front axle, steering system and steering geometry.

FIVE MARKS QUESTIONS

1. Explain the constructional features of front axle with a sketch. (U)
2. Explain the constructional features of Elliot stub axle. (U)
3. Explain the constructional features of reverse-Elliot stub axle. (U)
4. Explain the constructional features of Lemoine stub axle. (U)
5. Explain the constructional features of reverse – Lemoine stub axle. (U)
6. State the functions of steering system and list different steering mechanisms. (A)
7. List the requirements of steering system. (A)
8. State the need of steering gear box and list different types. (A)
9. State the need of wheel alignment and wheel balancing. (A)
10. Define camber angle and state its need. (R/A)
11. Define caster angle and state its need. (R/A)
12. Define king-pin inclination and state its need. (R/A)
13. Define toe-in /toe –out and state its need. (R/A)
14. Draw the layout of Ackerman steering mechanism. (U)
15. Draw the layout of steering linkages for rigid axle suspension system. (U)
16. Draw the layout of steering linkages for independent suspension system. (U)

TEN MARKS QUESTIONS

1. Explain the layout of steering linkages for rigid axle suspension. (U)
2. Explain the layout of steering linkages for independent suspension (U).
3. Explain Ackerman steering mechanism with a layout. (U)
4. Explain the construction and working of rack pinion steering system. (U)
5. Explain the construction and working of worm and wheel system. (U)
6. Explain the constant and working of re-circulating ball and nut type steering system. (U)

CO5: compare types of brakes and braking systems, understanding their purpose, construction and working.

FIVE MARKS QUESTIONS

1. State the requirements of Braking system. (A)
2. Classify brakes in detail. (A)
3. Draw the layout of mechanical braking system and label the parts. (U)
4. Draw the layout of hydraulic braking system and label the parts. (U)
5. List the advantages and disadvantages of hydraulic braking system. (A)
6. Compare disc brakes with drum brakes. (A)
7. Draw the layout of parking brake system. (U)

TEN MARKS QUESTIONS

1. Explain the construction and working of internal expanding drum brake with a sketch. (U)
2. Explain the construction and working of fixed calliper type disc brake. (U)
3. Explain the construction and working of sliding calliper type disc brake. (U)
4. Explain the construction and working of swinging calliper type disc brake. (U)
5. Explain the working of hydraulic braking system with a layout. (U)
6. Explain the construction and working of master cylinder with a sketch. (U)
7. Explain the construction and working of tandem master cylinder with a sketch. (U)
8. Explain the construction and working of wheel cylinder with a sketch. (U)

CO6:Compare and list merits and demerits of different components of suspension, wheels and tyres, understanding their purpose, construction and working.

FIVE MARKS QUESTIONS

1. State the functions of suspension system and list different types. (R)
2. List different types of springs used in suspension system. (R)
3. Define sprung and un sprung weight with examples. (R)
4. Compare coil spring with leaf spring. (A)
5. Explain the need of shock absorber and state its working principle. (A)
6. State the requirements of wheels and list different types. (A)
7. State the functions of tyres and list different types. (A)
8. Explain cross ply carcass construction in tyre. (U)
9. Explain radial ply carcass construction in tyre. (U)
10. Explain bias ply carcass construction in tyre. (U)
11. Explain specification of tyre. (U)
12. Explain the construction of wire wheel with sketch. (U)
13. Explain the construction of alloy wheel with sketch. (U)
14. Compare disc wheel with wire and alloy wheel. (A)
15. Compare radial tyres with bias tyre. (A)

TEN MARKS QUESTIONS

1. Explain the construction of leaf spring with sketch. (U)
2. Explain the construction and working of McPherson strut with sketch. (U)
3. Explain the construction and working of double wishbone suspension system with sketch. (U)
4. Explain the construction and working of trailing link suspension system with sketch. (U)
5. Explain the construction and working of double acting telescopic shock absorber with sketch. (U)
6. Explain the construction of tube tyre with sketch. (U)
7. Explain the construction of tubeless tyre with sketch. (U)
8. Explain the construction of disc wheel with sketch. (U)

BOARD OF TECHNICAL EXAMINATION

MODEL QUESTION PAPER

AUTOMOBILE TRANSMISSION AND CONTROL SYSTEMS

Max Marks: 100 **Time: 3 Hr**

Note: **1.** Answer any **six** questions from **PART-A** and each question carries **five** marks.
2. Answer any **seven** questions from **PART-B** and each question carries **ten** marks.

PART-A

1. State different types of Chassis frames and list materials used to construct chassis frame.
2. Write a short note on integral type chassis construction.
3. Explain the working principle of friction clutch
4. List different friction materials used for clutch.
5. State the purpose of final drive and mention different types.
6. Compare fully floating axle with 3/4floating type.
7. Draw the layout of steering linkages for rigid axle suspension system.
8. Explain the constructional features of lemoine stub axle.
9. Draw the layout of mechanical braking system and label the parts.

PART-B

1. Explain the hydraulic actuating mechanism of clutch with a sketch.
2. a. Compare wet clutch with dry clutches. 5marks
   b. Classify automotive gearboxes. 5marks

3. Explain the constriction and working of Tripod type constant velocity joint with a sketch.
4. a. Explain the purpose of differential. 5marks
   b. Explain the construction details of propeller shaft. 5marks
5. Explain Ackerman steering mechanism with a layout.
6. Sketch and explain the construction and working of rack pinion steering system.
7. Sketch and explain the construction and working of swinging calliper type disc brake.
8. Explain the working of hydraulic braking system with a layout.
9. Explain the construction and working of McPherson strut with sketch.
10. a. List different types of springs used in suspension system. 5marks
    b. Explain the construction of wire wheel with a sketch. 5marks