Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	**Semester**	III
Course Code	20AT31P	**Type of Course**	Programme Core
Course Name	Automobile Chassis and Transmission	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1.Rationale:

Automobile chassis and transmission forms the core of Automobile Engineering. The course is designed to impart knowledge and skills regarding chassis and transmission that make a complete automobile. The major systems include clutch system, transmission system, drive system, steering mechanism, suspension system, braking system and wheels and tyres without which propulsion of vehicle is not possible.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Examine a given chassis frame, document all frame measurements, compare and align the frame to predefined standards.
CO-02	Repair and/or service a given transmission system, steering system, braking system, suspension system and braking system.
CO-03	Check wheel alignment for a given vehicle and perform the alignment to pre-defined standards.
CO-04	Design or identify alloy wheels after studying the chassis frame and demonstrate repair and replacement of tyres for a given vehicle.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,2	1,2,4	1. **Frames**- purpose- loads acting - types –construction-ladder type-x type-integral, sections used in frames- Channel-Box-Tubular. 2. Materials used for frames & sub frames-need. Checking the alignment of chassis frame. 3.**Clutch**-Requirements-Classifications. Principle of friction clutch, Clutch Lining materials.	Refer Table 1.	1.a) Instruction on Personal Protection Equipment, Workshop Safety, First Aid, Safety Charts of dos and Don'ts in work area. b) Identification of different sections of chassis frame. 2.a) Analyse different loads acting on the frame. b) Checking the alignment of chassis frame and align it to the predefined standards.
2	2	1,2,4	1. Construction and working -single plate (Coil Spring type & Diaphragm type)	Refer Table 1.	1. Service & troubleshoot a single plate clutch (coil spring type) with faults,

			2.Construction and Working of Centrifugal clutch and Multiplate clutch. 3.Clutch adjustment, clutch troubles and their causes.		causes and remedies. 2. a) Service and troubleshoot a centrifugal clutch by removing it from the vehicle with faults, causes and remedies. b) Clutch adjustment - free play adjustment – adjustment of lever. Replacement of clutch cable.
3	2	1,2,4	1.**Gearbox**-Necessity-classification. 2. Construction and working of synchromesh gear box. Comparison of synchromesh gear box with other type. 3.Synchroniser-need-construction and working.	0	1. Service & troubleshoot of a multiplate clutch by removing it from the vehicle with faults causes and remedies. 2. Overhauling of a 2-wheeler gearbox & calculation of gear ratio w.r.t number of teeth. (**3HRS**)
4	2	1,2,4	1. Gear box troubles shooting and their causes. 2. Planetary gear train-construction and working. 3. Front Axle – Types – Construction – Materials - Live (drive shaft) - Dead axle (conventional), Stub axles - Types - construction.	Refer Table 1.	1. Overhauling of a synchromesh gearbox & calculation of gear ratio w.r.t number of teeth. Gearbox troubles shooting and their causes. 2. Demonstration of servicing of planetary gear train/video.
5	2	1,2,4	1. **Steering system** -mechanisms-types –Ackerman mechanism, steering gear box-need-types. 2. Construction and working- Rack & Pinion 3. Construction and working of recirculating ball type steering gearbox.	Refer Table 1.	1. Overhauling of a front axle & hub greasing. 2. Overhauling of rack & pinion type of steering system.

6	2	1,2,4	1. Steering geometry-definition, define and explain-camber-caster-king pin inclination 2. Define and explain-combined angle toe in and toe out, correct steering angle, under steer and over steer 3. Define and explain-Wheel base, wheel track, Toe-in, Toe-out, over length, over all height, front over-hang, rear over-hang, ground clearance.	Refer Table 1.	1. Overhauling of a Worm &nut/ Recirculating steering system with different steering gear box with backlash, end-play Adjustment. 2.a) Practice on wheel balancing. b) Measurement of Wheel base, wheel track, Toe-in, Toe-out, overall length, over all height, front over-hang, rear over-hang, ground clearance.
7	2	1,2,4	1. Define and explain-Cornering force, self-righting torque, steering linkages, special steering columns (tilt, length & collapsible). 2. Wheel alignment and wheel balancing-need- procedure. 3. **Propeller shaft** – function - construction, universal joints & slip joints.	Refer Table 1.	1. Practice on checking of wheel alignment and adjustment (computerized/mechanical) & prepare the detailed trouble shooting chart. 2. Servicing of a propeller shaft & universal joint.
8	2	1,2,4	1. Function- types construction & working - cross or spider type - flexible ring type - Rzeppa joint - Tripod joint. 2. **Final drive**- Purpose- types. Differential- necessity- principle 3. Differential - construction & working. backlash, differential lock, inter-axle differential, transaxle types.	Refer Table 1.	1. Checking of constant velocity joint for wear & tear and replace it with new one. 2. Overhauling of differential with backlash adjustment & calculate the gear ratio.
9	2	1,2,4	1. **Rear axle**- loads acting- types - construction and operation - hotch	Refer Table 1.	1. Servicing and troubleshooting of Rear axle of fully floating axle housing.

			kiss - torque tube drive, rear axle drive. 2. Construction of rear axle shaft supporting- fully floating and semi floating arrangements, axle housings, trouble shooting. 3. **Brakes** - Type. Internal expanding Drum Brake- Construction & Working. Disc Brake (Calliper types) – Construction & Working (slider calliper type). Parking Brake- Types-Operating Mechanism.		2. Servicing and troubleshooting of Rear axle of semi -floating axle housing.
10	2	1,2,4	1. Hydraulic Brakes- principle. Master Cylinder- Working. 2. Tandem Master Cylinder- working. 3. wheel cylinder- Types- Working.	Refer Table 1.	1. Servicing & trouble shooting of a drum brake & Disc brake. 2. Servicing of a Tandem master cylinder.
11	2	1,2,4,7	1. Bleeding of brakes– Brake lining materials- Brake adjustment. 2. **Suspension System** - Construction & Working of Leaf spring and Coil Spring Suspension system. 3. Working of - Hydraulic Suspension & Telescopic suspension.	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	1. Bleeding of hydraulic brake system, free-play & brake shoe adjustments. 2. Overhauling leaf spring & re-cambering.
12	2,3,4	1,2,4,7	1. Working of Independent Suspension- Front Wheel & rear Wheel.	Refer Table 1, Study the latest technological changes in	1. Overhauling of an independent suspension system. 2. a) Practice on using different jacks to remove

			2. **Wheels**- Types of wheels, construction, structure and function, wheel dimensions. 3. Constructional details-wire-disc. Alloy wheel- Construction, choosing right alloy wheel for the vehicle, changing of the steel wheel to alloy wheel.	this course in this course and present the impact of these changes on industry.	wheels from (different) vehicle(s).
13	3,4	1,2,4,7	1.**Tyres**-Types- Construction (Tube & Tubeless). Cross ply tire construction, Radial ply tire construction. 2. Tyre thread pattern, Tyre selection. Tyre pressure and Wear, Tyre maintenance 3. Changing of the tyre, Precaution to be taken while removing tyre. Rotation of the tyre - Need-procedure.	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	1.Practice on Changing the steel wheel to alloy wheel. 2. a) Practice on removal of tyre from disc and mending the punctured tubes using hot patch and cold patch. b) Repair of tubeless tyre.
Total in hours			**39**	**13**	**52**

Note: At the end of each practical student has to prepare trouble shooting chart and prepare repair estimation.

*** PO= = Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course Co-Ordinator. (Above only suggestive)**

Table 1: = Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl.no	Week	Suggested Activities
1	1	Sketch/draw the layout of chassis frames of cars, bus (front engine & rear engine), truck and articulated vehicles
2	2	Study and present at least one of the latest technologies in clutch, transmission, suspension and brakes.
3	3	Integrated with practical.
4	4	List the factors that helps you decide type of axle or CVT transmission for a given vehicle and submit it as an assignment.
5	5	Create 10 groups in class so that each group will present at least one type of steering gearbox used in a vehicle.

6	6	Select a race track and an appropriate car model to calculate the turning circle radius of that car and demonstrate the suitability for that race track.
7	7	Study the effects of worn steering linkages from available incident reports and present remedial solutions to identify the wearing along with appropriate materials and suggest right lubricant.
8	8	Study and propose alternative materials for differential and justify the benefits of using such material.
9	9	Study any two research papers about different loads acting on the rear axle and present the impact of those loads for any given vehicle.
10	10	Study and present at least one of the latest technologies on braking systems.
11	11	Study and present the suspension system used in modern heavy commercial vehicles.
12	12	Visit the nearest alloy wheel replacement center,identify the different type of alloy wheels used and understand how alloy wheels were replaced for given vehicle types.
13	13	Study the different treading patterns used in different vehicle models and justify why certain patterns are used for specific purposes like sports, adventure, off road, farming, earthmoving, etc.

4.CIE and SEE Assessment Methodologies

Sl. No	**Assessment**	**Test Week**	**Duration** In minutes	**Max marks**	**Conversion**
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. a) Format for CIE written Test

Course Name	**Automobile Chassis and Transmission**	Test	I/II/III	Sem	III/IV
Course Code	**20AT31P**	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. b) CIE Skill Test-I Scheme of Evaluation **Duration: 180 min.**

SL. No.	CO	Particulars/Dimension	Marks
1	1	One question on "chassis frames used in Automobile and alignment of the frame". a) Identification of the chassis frame – 5 marks b) Skill based question - 5 marks.	10
2	2	One questions on "Troubleshoot, Repair and service transmission system". a) Identification of the defect. – 10 m b) Troubleshooting. –35 m	45
3	2	One questions on "Troubleshoot, Repair and service steering system". a) Identification of the defect. – 05 m b) Service/Troubleshooting. –20 m	25
4	1,2	Viva-voce	10
5	1,2	Portfolio evaluation of practical session (1-6 weeks)	10
		Total Marks	**100**

5. c) CIE Skill Test-II Scheme of Evaluation **Duration: 180 min.**

SL. No.	CO	Particulars/Dimension	Marks
1	2	One questions on "Troubleshoot, Repair and service propeller shaft/ final drive rear axle". a) Identification of the defect. – 05m b) Service/Troubleshooting. –20 m	25
2	2	One questions on "Troubleshoot, Repair and service Brakes/Suspension system". a) Identification of the defect. – 10 m b) Troubleshooting. –20 m	30
3	2,3,4	One question on "wheels / tyres" for the given case a) Skill test question on wheels/ tyres/ alloy wheels – 20 m b) Setting the alignments - 05 m	25
4	2,3,4	Viva-voce	10
5	2,3,4	Portfolio evaluation of practical session (6-12 weeks)	10

	Total Marks	**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
						Average Marks=(8+6+2+2)/4=4.5	**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7.Reference:

Sl. No.	Description
1	Automobile Engineering by R B Gupta (Satya Publication)
2	Automobile Engineering Vol I By Kirpal Singh (Standard publication).
3	The Automobile Engineering Vol-2 By K.M Guptha (Umesh publications)
4	Automobile Engineering by Er S K Gupta (S Chand)
5	Automotive Technology by Jack Erjavec (CENGAGE Learning)

8. SEE Scheme of Evaluation **Duration: 180 min.**

SL. No.	CO	Particulars/Dimension	Marks
1	1,3,4	One question on "chassis frames used in Automobile and alignment of the frame". a) Identification of the chassis frame – 05 marks b) Skill based question - 15 marks. **Or** One question on "wheels / tyres" for the given case a) Skill test question on wheels/ tyres/ alloy wheels – 10 marks. b) Alignment - 10 marks.	20
2	2	One questions on "Troubleshoot, Repair and service transmission system/ Steering system/ Suspension system / Braking system". a) Identification of defects - 10 m b) Servicing/ Troubleshooting. – 40 m	50
3	1,2,3,4	Portfolio evaluation of practical session (1-13)	10
4	1,2,3,4	Viva-voce	20
		Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Chassis frames of different types (ladder type, x type, integral type).		2 each
2	Different types of clutches (single plate, multiplate and centrifugal clutches).		5 each
3	Gear boxes (motor cycle & synchromesh mesh).		5 each
4	Front axle assembly with wheels.		5
5	Steering gearbox assemblies (Worm and nut, rack and pinion, recirculating ball type)		5 each
6	Computerized wheel balancing machine.		1
7	Computerized wheel alignment machine.		1
8	Propeller shaft assembly.		5
7	Rear axle housings (fully floating and semi-floating)		3 each
8	Mechanical brake assemblies		3
9	Hydraulic brake system.		3
10	Master Cylinder-Single piston and Tandem master cylinder.		5 each
11	Wheel cylinders-single piston and double piston.		5 each
12	Drum brake assemblies.		5
13	Disc brake assemblies.		5
14	Hydraulic brake bleeding kit.		5
15	Independent & leaf spring suspension system.		3
16	Telescopic shock absorber (cut-section model).		2
17	Conventional and Radial tyres with tubes & wheels.		5 Each
18	Tubed and tubeless tyre puncture kit.		5
19	Major tool kit		3
20	Alloy Wheels		2
21	Automatic tyre changing machine		5
22	Vulcanizing machine		5
23	Two post lift		1

24	Tyre pressure gauge		5
25	Vehicle: Four-wheeler (Scrap with all parts)		1