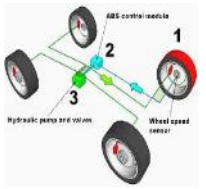
Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: ADVANCED AUTOMOTIVE SYSTEMS		
	Scheme (L:T:P) : 4:0:0	Total Contact Hours: 52	Course Code: 15AT52T
	Type of Course: Lectures, Self Study & Quiz	Credit: (L:T:P) 4:0:0	Core/ Elective: Core
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Basic knowledge of Science, Auto mobile Electrical and Electronics and Automobile chassis and control systems.

Course Objective:

Appreciate and explain advancements in different components and systems of Automobile.

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

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Describe the construction, working, merits and demerits of different combustion chamber of S I and C I engines.	U/A	2,6,9	08
CO2	Explain the need, construction and working of different advancements in Air intake systems of engine.	U/A	2,5,6,9	07
CO3	Explain the need, construction and working of different alternate/modern propulsion systems of Auto mobiles.	U/A	2,5,6,9	08
CO4	Explain the need, construction and working of different alternate/modern transmission systems of Auto mobiles.	U/A	2,6,9	10
C05	Explain the need, construction and working of different alternate/modern suspension and steering systems of Automobile.	U/A	2,5,9	09
C06	Explain the need, construction and working of different alternate/modern Final drive and Braking systems of Automobiles.	U/A	2,5,9	10
			Total sessions	52

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Advanced Automotive 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 CO's 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 Level 2.
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed 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	Combustion Chambers and Stratified engines.	08	---	05	15	13.7
II	Advancements in air induction systems	07	-----	10	10	13.7
III	Alternate propulsion technology.	08	----	10	10	13.7
IV	Advancements in transmission systems	10	----	10	20	20.6
V	Advanced steering and suspension	09	-----	10	15	17.2
VI	Advancements in Final drives and Brakes.	10	-----	10	20	20.6
	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

Combustion chambers and Stratified engines: 08hrs

Petrol engine combustion Chambers-types-construction, merits and demerits- T head, L head, F head and I head

Air swirl-need-methods of generating swirl, Diesel engine combustion Chambers-open combustion chamber-pre-combustion chamber-M combustion chamber- construction and working. Stratified charge engines-concept-need-methods-construction and working- Volkswagen PCI stratified charge engine.

UNIT-II

Advancements in air induction systems: 07hrs

Variable geometry intake manifold-concept-need-working principle. Variable valve timing-concept-need-types-working principle of cam changing VVT (Honda VTEC)-Cam phasing VVT (Toyota VVT)-advantages, supercharging-concept-need-types of superchargers, turbo charging-concept-need-types, constant pressure turbo charging- construction and working-merits-demerits, pulse pressure turbo charging- construction and working-merits-demerits.

UNIT-III

Alternate propulsion technology: 08hrs

Petrol wankel engine-construction and working- advantages and disadvantages.

Fuel cells-types, proton exchange membrane type fuel cell- working principle -advantages and disadvantages.

Hybrid propulsion-concept, traction motors-concept-types, brush less DC motor- working principle with speed control, 3phase AC induction motor- working principle with speed control, series hybrid-working principle-merits-demerits, parallel hybrid-working principle-advantages and disadvantages.

Battery operated vehicle-working principle-advantages and disadvantages, regenerative braking-need-working principle.

UNIT-IV

Advancements in Transmission Systems: 10 hrs.

Planetary gear train-construction and working-advantages, torque converter- construction and working, torque converter lock up control-need-types, centrifugal type- construction working double clutch type- construction working, Automatic transmission-concept-types, Continuously variable transmission-construction and working-merits-demerits, hydraulic automatic transmission-gear shifting process –merits-demerits, Semi and fully automatic manual transmissions-working principle-merits-demerits, viscous coupling-need-working principle, four wheel drive system-need-types-construction and working of permanent 4 wheel drive with viscous coupling-advantages and disadvantages.

UNIT-V

Advancements in Steering and Suspension system **09hrs**

Air spring-types-advantages, bellows air spring- construction and working, piston air spring-construction and working, air suspension-layout and working- advantages, hydro-elastic spring-construction and working, hydro-elastic suspension-layout and working-advantages.

power steering-need-types, integral- construction and working , linkage power steering-construction and working, Spool valves-types, rotary spool valve- working principle, collapsible steering column-need-types, ball type-mesh type-tilt-telescopic steering columns- construction and working.

UNIT-VI

Advancements in Final drives and brakes: **10hrs**

Limited slip differential-need-types-construction and working of clutch type LSD, Differential lock-need-construction and working of dog clutch type differential lock.

Servo brakes-need-types, vacuum servo brakes-layout-working, vacuum servo booster-construction and working, power brakes-need -types, air brake system-layout and working, air brake valve-brake chamber- unloader valve- construction and working, air assisted hydraulic system-layout-working, exhaust brakes-need-layout and working.

Resources

Reference books:

Sl No	Title of the book	Author	Publisher
1	Understanding Automotive electronics	William Ribben	Butterworth-Heinemann
2	A Systems Approach to Automotive technology	Jack Erjavec	Cengage Learning
3	Electronic Engine Controls	Steve.V.Hatch	Cengage Learning
4	Truck engines Fuel& computerized management systems	Sean Bennett	Cengage Learning
5	Advanced vehicle technology	Heinz Heisler	Butterworth-Heinemann
6	Automobile enginnering Vol I	Anil Chikara	Satya Prakashan
7	Automotive mechanics 10thEdi	W H Crouse and Anglin	Tata mcGraw Hill
8	Automobile electrical and electronic systems	Tom Denton.	Butterworth-Heinemann
9	Automobile Technolgy	R B Gupta	Satya Prakashan
10	Automobile Technology	Dr N K Giri	Kanna Publications
12	Automotive Computer Controlled Systems (Diagnostic tools and techniques)	Allan. W. M Bonnick	Butterworth-Heinemann

Website

Variable length intake manifold:

http://www.globalsuzuki.com/marine/tech175_150.html
https://en.wikipedia.org/wiki/Variable-length_intake_manifold
http://www.techsmartparts.com/en/products/content/read-and-repair-disa-valve/

Variable valve timing:

http://blog.caranddriver.com/timing-changes-how-hondas-vtec-variable-timing-system-works/
http://www.carbibles.com/fuel_engine_bible_vvt.html
http://www.austincc.edu/wkibbe/vvt.htmVariable valve timing:
https://takemebeyondthehorizon.wordpress.com/2009/12/02/the-variable-valve-timing-and-lift-electronic-control-v
http://toyota-club.net/files/faq/16-01-01_faq_vvt_3_eng.htm
http://www.ej9.ru/art/vtec_sohc/

Brush less DC Motor (Traction Motor):

http://www.learnengineering.org/2014/10/Brushless-DC-motor.html

3 phase Induction motor:

http://www.learnengineering.org/2013/08/three-phase-induction-motor-working-squirrel-cage.html

Automatic transmission:

http://www.mogi.bme.hu/TAMOP/jarmurendszerek_iranyitasa_angol/math-ch07.html
https://www.youtube.com/watch?v=8S7jQYzRJkw

Electronic suspension:

http://www.autoserviceprofessional.com/article/94036/Advances-in-ride-control-Getting-up-to-speed-on-electronic-suspension-control?Page=2
http://www.motor.com/newsletters/20131010/WebFiles/ID1_TheEyesHaveIt.html
https://www.youtube.com/watch?v=W5zblLY4R3Y
https://www.youtube.com/watch?v=zkado-fNddo

Semi active suspension system working:

CVT Transmission:

https://www.youtube.com/watch?v=PEq5_b4LWNY

Automatic transmission:

https://www.youtube.com/watch?v=u_y1S8C0Hmc
https://www.youtube.com/watch?v=cn-ryXUYSek

Planetary gear train:

https://www.youtube.com/watch?v=ea3qSccR90s
https://www.youtube.com/watch?v=YBW4EYVSzPI

Limited slip differential:

https://www.youtube.com/watch?v=WeLm7wHvdxQ
https://www.youtube.com/watch?v=PEdnH7_7_yc

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

1. Visit nearby two wheel/four wheeler service stations/garages/websites and make report of different automotive advanced engine components/systems seen with specification, materials used, need and manufacturing processes used along with photographs.
2. Visit nearby two wheel/four wheeler service stations/garages/websites and collect information on advanced steering, suspension, transmission and braking systems with photographs/sketch/layouts/circuits and working principle.

3. Visit nearby two wheel/four wheeler service stations/ websites and collect information on different electrical and hybrid vehicles with photographs/sketch/layouts/circuits, working principle and specifications.

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.

RUBRICS MODEL

Student Name:			Reg NO:			
RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1 Mark	**2 Mark**	**3 Mark**	**4 Mark**	**5 Mark**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
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	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example for one student. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

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
				Activity	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

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

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

.

MODEL QUESTION PAPER (CIE)

Note : The course coordinator has to follow the question paper blue print given in above table

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	V semester	Advanced Automotive systems	20
	Year: 2016-17	Course code:15AT52T	

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

Note: Answer all questions

Q No	Question	Mark	CL	CO	PO
1	a. Compare T head to L head combustion chambers.	5	A	1	2,6
	b. Explain the meaning and need of air swirl in CI engine combustion chambers.	5	U	1	2,6
	OR				
	a. Explain the working principle of variable geometry intake manifold.	5	U	2	2
	b. Compare supercharging to turbo charging.	5	A	2	2,6
2	Explain the construction and working of any one type open combustion chamber with a sketch.	10	U/A	1	2
	OR				
	Explain the construction and working of constant pressure turbo charging with a neat sketch.	10	U/A	2	2

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

MODEL QUESTION BANK

CO:1. Appreciate the social responsibilities of engineer and ways to protect our environment.

FIVE MARKS QUESTIONS

1. Explain the construction of T head combustion chamber with a sketch(A)
2. Explain the construction of L head combustion chamber with a sketch(A)
3. Explain the construction of F head combustion chamber with a sketch(A)
4. Explain the construction of I head combustion chamber with a sketch(A)
5. Compare T head to L head combustion chambers. U/A)
6. Compare F head to I head combustion chambers.(U/A)
7. List merits and demerits of T head combustion chamber.(A)
8. List merits and demerits of L head combustion chamber.(A)
9. List merits and demerits of F head combustion chamber.(A)

10. List merits and demerits of I head combustion chamber.(A)
11. Explain the meaning and need of air swirl in CI engine combustion chambers.(U)
12. Sketch any one type of open combustion chamber and label the parts.(A)
13. Sketch pre-combustion chamber and label the parts.(A)
14. Sketch M combustion chamber and label the parts.(A)
15. Write a short note on stratified charge engines.(A)
16. Sketch the Volkswagen PCI combustion chambers and label parts.(A)

TEN MARKS QUESTIONS

1. Explain the construction and working of any one type open combustion chamber with a sketch.(U/A)
2. Explain the construction and working of pre – combustion chamber with a sketch.(U/A)
3. Explain the construction and working of M combustion chamber with a sketch.(U/A)
4. Explain the construction and working of Volkswagen PCI combustion chamber with a sketch.(U/A)

CO2: Describe the construction, working, merits and demerits of different combustion chamber of S I and C I engines.

FIVE MARK QUESTIONS

1. write a short note on variable geometry intake manifold.(A)
2. Explain the working principle of variable geometry intake manifold.(U)
3. State the advantages of variable geometry intake manifold.(U/A)
4. write a short note on variable valve timing system.(A)
5. List types of variable valve timing systems.(R)
6. Explain the working principle of Cam changing VVT.(U)
7. Explain the phase changing VVT working principle.(U)
8. List merits and demerits of Variable Valve Timing Diagram
9. Write a short note on supercharging.(A)
10. List the advantages of supercharging.(A)
11. State different types of superchargers.(R)
12. Write a short note on turbo charging.(A)
13. Compare supercharging to turbo charging.(U/A)
14. Compare constant pressure turbo charging to pulse pressure turbo charging.(U/A)

TEN MARKS

1. Explain the construction and working of constant pressure turbo charging with a neat sketch.(U/A)
2. Explain the construction and working of pulse pressure turbo charging with a neat sketch.(U/A)

CO3: Explain the need, construction and working of different advancements in Air intake systems of engine.

FIVE MARKS QUESTIONS

1. Write a short note on fuel cell.(U)
2. List merits and demerits of wankel engine(A)
3. Draw the sketch of wankel engine and label the parts(A)
4. State different types of fuel cells.(R)
5. Explain the working principle of fuel cell with a sketch.(U)
6. List the advantages and disadvantages of fuel cell.(U/A)
7. Write a short note on hybrid vehicle.(A)
8. Draw the sketch of brush less motor and label the parts.(A)
9. Draw the sketch of 3 phase AC induction motor and label the parts.(A)
10. List the advantages and disadvantages of series hybrid system.(A)
11. List the advantages and disadvantages of parallel hybrid.(A)
12. Sketch the layout of series hybrid and label the parts.(A)
13. Sketch the layout of parallel hybrid and label the parts.(A)
14. Write a short note on battery operated vehicle.(A)
15. List the advantages and disadvantages of battery operated vehicle compared to IC engine vehicle.(U/A)
16. Compare electric vehicle to hybrid vehicle.(U/A)
17. Explain the need of regenerative braking system.(U/A)
18. Sketch the layout of regenerative braking system and label parts.(A)

TEN MARKS QUESTIONS

1. Explain the construction and working of petrol wankel engine with neat sketch.(U/A)
2. Explain the construction and working of PEM Fuel cell with a neat sketch.(U/A)
3. Explain the construction and working of DC brush less motor with a neat sketch.(U/A)
4. Explain the construction and working of 3 phase AC induction motor with a neat sketch(U/A)
5. Explain the construction and working of series hybrid propulsion with a lay-out (U/A)
6. Explain the construction and working of parallel hybrid propulsion with a lay-out(U/A)
7. Explain the construction and working of battery operated vehicle with a lay-out(U/A)
8. Explain the construction and working of regenerative brake system with a lay-out(U/A)

CO4: Explain the need, construction and working of different alternate/modern propulsion systems of Auto mobiles.

FIVE MARKS QUESTIONS

1. Draw the sketch of planetary gear system and label the parts.(U)
2. State the advantages and disadvantages of planetary gear system.(U/A)
3. Draw the sketch of torque converter and label the parts.(U)
4. Explain the need of lock up control in torque converter and state different types.(U/A)
5. Draw the sketch of centrifugal clutch type lock up control and name the parts.(U)
6. Draw the sketch of double clutch type lock up control and name the parts.(U)
7. Draw the sketch of continuously variable transmission and name the parts.(U)
8. Explain the process of gear shifting in Automatic transmission.(U)
9. Write a short note on semi automatic transmission.(U)
10. Write a short note on automated manual transmission.(U)
11. State the advantages of automated manual transmission.(U/A)
12. Compare hydraulic automatic transmission to automated manual transmission.(U/A)
13. Explain the working principle of viscous coupling and state its applications.(U)
14. State advantages and disadvantages of four wheel drive system.(U/A)
15. Draw the layout of four wheel drive system and label the parts.(U)

TEN MARKS QUESTIONS

1. Explain the construction and working of planetary gear system with a sketch(U/A)
2. Explain the construction and working of torque converter with a sketch(U/A)
3. Explain the construction and working of centrifugal clutch type lock up control in torque converter with a sketch(U/A)
4. Explain the construction and working of centrifugal clutch type lock up control in torque converter with a sketch(U/A)
5. Explain the process of gear shifting in automatic transmission with a sketch.(U/A)
6. Explain the construction and working of four wheel drive with viscous coupling with a sketch(U/A)
7. Explain the construction and working of Continuously variable transmission with a sketch(U/A)

CO5: Explain the need, construction and working of different alternate/modern transmission systems of Auto mobiles.

FIVE MARKS QUESTIONS

1. List the advantages of air spring and state different types of air spring.(A)
2. Explain the working of bellows type air spring with a sketch.(A)
3. Explain the working of piston type air spring with a sketch.(A)
4. Draw the air suspension layout and label the parts.(A)
5. List the advantages of air spring suspension.(A)
6. Draw the sketch of hydro elastic spring and label the parts.(A)
7. Draw the layout of hydro elastic suspension and label the parts.(A)
8. List the advantages and disadvantages of hydro elastic suspension.(A)
9. Explain the need of power steering and state different types.(U)
10. Draw the layout of integral power steering and label the parts.(A)

11. Draw the layout of linkage power steering and label the parts.(A)
12. Explain the need of collapsible steering column and list types of collapsible columns.(U/A)
13. Explain the working of ball type steering column with a sketch.(U/A)
14. Explain the working of mesh type steering column with a sketch.(U/A)
15. Explain the working of tilt type steering column with a sketch.(U/A)
16. Explain the working of telescopic steering column with a sketch.(U/A)

TEN MARKS QUESTIONS

1. Explain the construction and working of air suspension with a lay-out.(U/A)
2. Explain the construction and working of hydro elastic spring with a neat sketch.(U/A)
3. Explain the construction and working of hydro elastic suspension system with a lay-out.(U/A)
4. Explain the construction and working of integral power steering system with a lay-out.(U/A)
5. Explain the construction and working of linkage type steering system with a lay-out.(U/A)
6. Explain the construction and working of rotary spool valve with a sketch.(U/A)
7. Explain the need of collapsible steering columns and explain working principle of any two with sketch.(U/A)

CO6: Explain the need, construction and working of different alternate/modern suspension and steering systems of Automobile.

FIVE MARKS QUESTIONS

1. Explain the need of limited slip differential.(U/A)
2. Draw the sketch of clutch type LSD and label the parts.(A)
3. Explain the need of differential lock.(U/A)
4. Draw the sketch of dog clutch type differential lock and label the parts.(A)
5. Explain the need of servo brakes and list different types of servo mechanisms.(U)
6. Draw the layout of vacuum servo brakes and label the parts.(A)
7. Draw the sketch of vacuum servo booster and label the parts.(A)
8. Explain the need of power steering system and list different power steering systems.(U/A)
9. Draw the layout of air brake system and label the parts.(A)
10. Draw the sketch of air brake valve and label the parts.(A)
11. Draw the layout of air over hydraulic brake system and name the parts.(A)
12. List the advantages and disadvantages of air brake system.(A)
13. Write a short note on exhaust brake system.(A)
14. Draw the layout of exhaust braking system and label the parts.(A)
15. Draw the sketch of un-loader valve and name its parts.(A)
16. State the functions of brake valve and un-loader valve.(R)

TEN MARKS QUESTIONS

1. Explain the construction and working of clutch type LS Differential.

2. Explain the construction and working of dog clutch type differential clutch with a sketch.
3. Explain the construction and working of vacuum servo brake booster with a sketch.
4. Explain the construction and working of air brake system with a layout.
5. Explain the construction and working of air brake valve with a sketch.
6. Explain the construction and working of un loader valve with a sketch.
7. Explain the construction and working of air assisted hydraulic brake system with a layout.
8. Explain the construction and working of exhaust brake system with a layout.

Board Of Technical Examination

MODEL QUESTION PAPER

Advanced Automotive 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. Explain the meaning and need of air swirl in CI engine combustion chambers.(U)
2. Explain the construction of T head combustion chamber with a sketch(A)
3. write a short note on variable geometry intake manifold.(A)
4. write a short note on variable valve timing system.(A)
5. List merits and demerits of Wankle engine(A)
6. List the advantages and disadvantages of battery operated vehicle compared to IC engine vehicle.(U/A)
7. Draw the sketch of planetary gear system and label the parts.(U)
8. Write a short note on automated manual transmission.(U)
9. List the advantages of air spring and state different types of air spring.(A)

PART-B

1. Explain the construction and working of M combustion chamber with a sketch.(U/A)
2. Explain the construction and working of pulse pressure turbo charging with a neat sketch.(U/A)
3. Explain the construction and working of petrol Wankle engine with neat sketch.(U/A)
4. Explain the construction and working of torque converter with a sketch(U/A)
5. Explain the construction and working of Continuously variable transmission with a sketch(U/A)
6. Explain the construction and working of hydro elastic spring with a neat sketch.(U/A)
7. Explain the construction and working of rotary spool valve with a sketch.(U/A)
8. Explain the need of collapsible steering columns and explain working principle of any two with sketch.(U/A)
9. Explain the construction and working of clutch type LS Differential.(U/A)

10. Explain the construction and working of air brake valve with a sketch.(U/A)
