Kandula Srinivasa Reddy Memorial College of Engineering (Autonomous)

Kadapa-516003. AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 9001-2008 Certified Institution)

Department of Mechanical Engineering

Certification Course

on

"ENGINE COMBUSTION"

Resource Persons : 1.Sri A.Harikrishna,Assistant Professor, Dept.of ME,KSRMCE

2. Sri K.SurehKumar.Associate Professor, Dept.of ME, KSRMCE

Course Coordinators: 1. Sri K.SurehKumar.Associate Professor, Dept.of ME, KSRMCE

2. Sri A.Harikrishna, Assistant Professor, Dept.of ME, KSRMCE

Date: 20/06/22 to 02/07/22

K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

Lr./KSRMCE/ME/2021-22/ Date: 14-06-2022

To
The Principal,
KSRMCE,
Kadapa.

Sub: Permission to Conduct Certificate Course on "ENGINE COMBUSTION" from 20-06-202 to 02-07-2022 – Reg.

Respected Sir,

The Department of Mechanical Engineering is planning to offer a certification course on "ENGINE COMBUSTION" to B. Tech. students. The course will be conducted from 20-06-2022 to 02-07-2022. In this regard, we are requesting you to grant permission to conduct certificate course.

Thanking you

Forwarded to Principal Sir. 14/06/2022

Yours faithfully

K.Su.k.

(Sri K.Sureshkumar,Asso.Professor

A.Harikrishna

Sri.A.Harikrishna, Asst.Professor)

Permitted
V. S. S. Murthy
14/06/2022

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KSNR
lives on..

Cr./KSRMCE/ME/2021-22/

Date: 15/06/2022

Circular

The Department of Mechanical Engineering is offering a certification course on "ENGINE COMBUSTION" From 20-06-2022 to 02-07-2022 to B.Tech students. In this regard, interested students are required to register for the Certification Course. The registration link is given below.

https://forms.gle/EU3uxhQGw2Mmisr6A

The Course Coordinators and Resource Persons
Sri K.Sureshkumar,Asso.Professor
Sri A.Harikrishna,Asst.professor
Dept. of Mechanical Engg.-KSRMCE.

HOD

Cc to:

IQAC-KSRMCE

Registration for Certificate Course on "ENGINE COMBUSTION" from 20-06-22 to 02-07-22

* Required

1. Full Name *

2. College Name *

3. Branch&Year *

4. Roll.Number *

5. Phone Number

6. College ID Proof

   Files submitted:

Registration list of Certification Course on "Engine Combustion" from 20th June 2022 to 2nd July 2022

S.No	Timestamp	Full Name	College Name	Branch&Year	Roll.Number
1	6/10/2022 18:45:01	SIDDHAMSETTY MADHAVA	K.S.R.M COLLEGE OF	Mechanical 2 year	209y1a0358
2	6/13/2022 10:46:08	SHAIK ANSAR BASHA	KSRM COLLEGE OF E	MECHANICAL & 2ND YEA	219Y5A0334
3	6/13/2022 10:48:01	Shaik Acchukatla Mahammad	KSRMCE	Mechanical 2nd year	219y5a0333
4	6/13/2022 20:57:48	Budigolla pavan kumar	KSRMCE	Mechanical/ 2nd year	219Y5A0307
5	6/13/2022 21:04:09	Shaik Ghouse Basha	Ksrm college of enginee	Mechanical 2nd year	219Y5A0336
6	6/13/2022 21:08:50	c.vandana Evangeline	Ksrmce	Mechanical/2 nd yr	209y1a0310
7	6/13/2022 21:19:38	GORLA SRIHARAI	KSRM college of engine	Mechanical	219y5a0312
8	6/14/2022 21:23:03	B.kiran	K s.r.m	Mechanical 2nd year	219y5a0304
9	6/14/2022 21:26:59	Alankaram pavankumar	Ksrm college of enginee	Mechanical 2nd year b/s	219y5a0301
10	6/14/2022 21:27:11	SURA SANDEEP KUMAR	KSRM COLLEGE OF E	Mechanical 2nd	219Y5A0338
11	6/14/2022 22:13:33	Badugu Karthik	KSRM	Mechanical B 2nd year	219y5A0302
12	6/14/2022 22:29:38	P Obula Vamsidhar	K.S.R.M college of engi	Mechanical,2nd year	209Y1A0346
13	6/14/2022 11:28:48	VANAJA SRIHARI	K.S.R.M.COLLEGE OF	MECHANICAL 2ND YEAR	219Y5A0340
14	6/14/2022 13:09:13	Syed waseem	KSRM COLLEGE OF E	2nd year mechanical	209Y1A0361
15	6/14/2022 8:20:23	Uday kumar reddy	Ksrm college of enginee	Mechanical engineering (2	209Y1A0328
16	6/14/2022 11:10:10	P.Anil kumar	KSRM college of engine	Mechanical & 2nd year	209y1a0347
17	6/15/2022 11:10:45	Putta mahadeva reddy	Ksrm college of enginee	Mechanical/2nd year	209Y1A0349
18	6/15/2022 11:12:33	Korivi venkat pavan tanuj	KSRM engineering colle	Mechanical,2 year	209y1a0327
19	6/15/2022 11:13:03	Malepadu Ranjith kumar	KSRM	Mechanical 2nd year 4th se	209y1a0333
20	6/15/2022 11:13:09	P.N.indrasena reddy	Ksrmce	Mech&2nd	209y1a0345
21	6/15/2022 11:13:41	A.Thulasi deepa	Ksrm college of enginee	Mechanical 2	209y1a0301
22	6/15/2022 11:14:48	Panjam ramireddy	Ksrmcollege	Mechanical 4th sem	209y1a0343
23	6/15/2022 11:15:20	Rayapati Valeedh	KSRM college of engine	ME&2nd	209y1a0350
24	6/15/2022 11:18:48	C.dinesh reddy	KSRM college of engine	Mechanical &2year	209y1a0306
25	6/15/2022 11:26:07	mekala Krupakar raju	Ksrm college of enginee	Mechanical 2nd	209y1a0337
26	6/15/2022 11:26:58	VELLIPALEM BHARATH NAR	KSRMCE	Mechanical/2nd year	219y5a0341
27	6/15/2022 11:27:39	Syed shahid hussain	K.S.R.m college of engi	Mechanical_ 2nd year	219Y5A0339
28	6/15/2022 11:28:23	MALLEPOGU ANADARAJU	KSRMCE	MECHANICAL ENGINEER	219Y5A0321
29	6/16/2022 11:28:42	MOPURI KRISHNA VAMSI	KSRMCE	Mechanical/2nd year	219Y5A0322
30	6/16/2022 11:29:32	Potham venkateswar reddy	Ksrm college of enginee	Mechanical engineering/20	219Y5A0331
31	6/16/2022 11:29:49	BUDIGI GANDHI	KSRM COLLEGE OF E	MECHANICAL & 2nd Year	219Y5A0306
32	6/16/2022 11:30:31	BOYA HARIKRISHNA	KSRMCE college	Mechanical 2nd year B/s	219y5a0305

33	6/16/2022 11:30:36	DASARA SATHISH	KSRM collage of Engine	Mechanical 2nd year	219Y5A0308
34	6/16/2022 11:30:42	M yerakondappa	KSRM	Mechanical 2	219y5a0317
35	6/16/2022 11:31:04	DASARI SREEKANTH	K.S.R.M COLLEGE OF	Mechanical 2nd year	219Y5A0309
36	6/16/2022 11:31:24	Malleboyina Kiran	K.S.R.M.COLLEGE OF	Mechanical 2nd year	219y5a0320
37	6/16/2022 11:32:01	GALLA MUKESH SAI	KSRM COLLEGE OF EI	MECHANICAL ENGINEER	219y5A0311
38	6/16/2022 11:32:48	D VENKATESWARLU	KSRMCE	Mechanical 2 year	219y5a0310
39	6/16/2022 11:37:57	V.Akhil Kumar	k.s.r.m college of engine	Mechanical 2 nd year	209y1a0364
40	6/16/2022 11:40:38	Shaik moula	Ksrm college of enginee	Mech 2nd year	209y1a0355
41	6/16/2022 11:41:53	M.Masood khan	Ksrm college of enginee	Mechanical -2	209Y1A0336
42	6/16/2022 12:00:45	K.BHAGEERATHA SHANKAR	KSRM college	Mechanical &2022	219Y5A0315
43	6/16/2022 12:12:58	Shaik sadiq ali	KSRM	mechanical 2nd year	209y1a0357
44	6/16/2022 12:13:06	Shaik Mohammed Umar	Ksrm college of enginee	Mechanical-2year	209Y1a0354
45	6/16/2022 12:15:35	Pathan shoaib khan	Ksrm college of enginee	Mechanical&2nd yr	209y1a0344
46	6/16/2022 12:38:19	KAKARLA PAVAN KUMAR RE	KSRM	MECHANICAL/ 2nd year	209Y1A0324
47	6/16/2022 13:58:53	Karumanchi prakash raj	Ksrm college of enginee	Mechanical	219Y5A0313
48	6/16/2022 15:14:20	Sagabala Bhanu prakash	Ksrm college of enginee	Mechanical 2nd year 4th se	209y1a0351
49	6/16/2022 17:19:54	Bandi Rama Krishna	Ksrm college	Mechanical, second year	209Y1A0303
50	6/16/2022 17:20:12	Sriramadasu sreenu	Ksrm college of enginee	Mechanical & B	219y5a0337
51	6/16/2022 17:00:18	Yarravagari Mohana sree	KSRMCE	ME-2ndyear	209Y1A0367
52	6/16/2022 16:02:19	Narayana. Pottendla	KSRM college of Engine	Mechanical Engineering, 2r	209y1a0348
53	6/16/2022 16:12:04	PATIMA AJAY	KSRM	MECHANICAL&2ND YEAR	219y5a0329
54	6-18-2022 10:54:12	A Charan Teja	ksrm college of enginee	Mech 2nd Yr	209Y1a0302
55	6-18-2022 10:56:53	Beere Bharath	ksrmce	Mechanical & IInd	209y1a0304
56	6-18--2022 11:06:06	B Dinesh Kumar	ksrm engineering colleg	Mecha & 2nd	209y1a0305
57	6-18-2022 11:07:30	C Dinesh Reddy	ksrmce	Mechanical & 2nd	209y1a0306
58	6-18-2022 11:08:34	Chakali Sekhar	ksrm engineering colleg	mech & 2nd	209y1a0307
59	6-18-2022 11:17:02	C Yaswanth kumar	ksrmce	mechanical & 2nd	209Y1A0308
60	6-18-2022 11:17:43	CHAVVA SRINIVASULA REDI	ksrm	mecha 2nd	209Y1A0309
61	6-18-2022 11:18:25	DADE SIDDIQ	ksrm	mech & iind	209Y1A0311
62	6-18-2022 11:19:05	D VAMSIDHAR REDDY	ksrmce	mechanical 2nd	209Y1A0312
63	6-18-2022 11:20:14	D B SAI KUMAR YADAV	ksrmce	mechanical 2nd year iind s	209Y1A0313
64	6-18-2022 11:20:55	E VIJAYASENA REDDY	ksrm	Mech and 2nd	209Y1A0314
65	6-18-2022 11:22:39	ETUKURI GIRIDHAR KUMAR	ksrm college of enginee	mchanical & 2nd year	209Y1A0315
66	6-18-2022 11:25:00	GALIGARI MADHAN MOHAN	KSRMCE	MECH & 2ND	209Y1A0316
67	6-18-2022 11:25:56	G C GUNAVARDHAN REDD	ksrmcollege	Mechanical and second	209Y1A0317
68	6-18-2022 11:26:38	GAVIREDDY LANKESWAR R	ksrm	mechanical & 2nd year	209Y1A0318
69	6-18-2022 11:27:29	GHANTASALA SREEHARI	ksrmce	mechanical 2nd year	209Y1A0319
70	6-18-2022 11:28:32	G YUGANDHAR CHOWDARY	ksrmce	mech and 2nd	209Y1A0320
71	6-18-2022 11:29:23	G VENKATAKRISHNA	ksrm college of enginee	mechanical 2nd year	209Y1A0321

72	6-18-2022 11:30:16	JAMMALAMADUGU YUVARA	ksrm college of enginee	mechanical II year	209Y1A0322
73	6-18-2022 11:31:10	K KARTHIK SARMA	ksrm college of enginee	Mechanical 2nd year	209Y1A0323
74	6-18-2022 11:32:13	K NAVEENK NAVEEN	ksrm college of enginee	Mech & 2year	209Y1A0325
75	6-18-2022 11:33:31	K POLI REDDY	ksrm college of enginee	Mechanical 2nd yr	209Y1A0326
76	6-18-2022 11:34:29	KOTTE VENKATA SUNIL KUM	ksrmce,kadapa	Mechanical 2nd year	209Y1A0329
77	6-18-2022 11:35:32	K PRAVEEN KUMAR RAJU	ksrm	Mechanical second year	209Y1A0330
78	6-18-2022 11:36:14	MADATHALA GURIVI REDDY	ksrmce	mechanical and 2nd yr	209Y1A0331
79	6-18-2022 11:43:35	MADIGA PRAKASH	ksrmce	mecha and 2nd	209Y1A0332
80	6-18-2022 11:47:40	M SAI DEEKSHITH	ksrm college of enginee	Mechanical and 2nd year	209Y1A0334
81	6-18-2022 11:48:34	MARRIPALLI LOKESHWAR	KSRMCE	MECHANICAL & II	209Y1A0335
82	6-18-2022 11:49:38	MULA NAVEEN KUMAR REDI	ksrm college of Enginee	Mechanical and second	209Y1A0338
83	6-18-2022 11:50:18	MUNAGALA ANIL KUMAR RE	Ksrm college	Mechanical 2nd	209Y1A0339
84	6-18-2022 11:51:04	P GANESWARA REDDY	KSRMCE	Mech 2nd	209Y1A0342
85	6-18-2022 11:51:59	SHAIK ABUBAKAR SIDDIQ	KSRM COLLEGE OF EI	MECH 2ND	209Y1A0352
86	6-18-2022 11:53:04	SHAIK MASOOD AHAMED	Ksrm college	mechanical secomd	209Y1A0353
87	6-18-2022 11:54:07	SHAIK RASOOL	ksrm college of enginee	Mechanical and second ye	209Y1A0356
88	6-18-2022 11:54:59	SYED MOHAMMED	ksrm college of enginee	Mechanical and 2nd	209Y1A0359
89	6-18-2022 11:56:08	SYED SOHAIL	ksrmce,kadapa	Mechanical & 2nd	209Y1A0360
90	6-18-2022 11:57:35	V ENKATA SIVA SAI BHAVAN	ksrmce engineering coll	Mechanical 2nd year	209Y1A0362
91	6-18-2022 11:58:24	VASAGIRI NAGA GOKUL	ksrm	mech 2nd year	209Y1A0363
92	6-18-2022 11:59:22	V ADI KESHAVA REDDY	ksrm college	mech 2nd yr	209Y1A0365
93	6-18-2022 12:00:19	YARRADODDY MAHESH	ksrm college of Enginee	Mech 2nd yr	209Y1A0366
94	6-18-2022 12:01:18	KUMMARI JAYA SURYA	ksrmce	Mechanical and second ye	219Y5A0314
95	6-18-2022 12:02:12	MADIGA PAVAN KUMAR	KSRM COLLEGE OF EI	Mech 2nd year	219Y5A0318
96	6-18-2022 12:03:26	MALA GOVARDHAN	KSRMCE	MECHANICAL 2ND	219Y5A0319
97	6-18-2022 12:08:09	MURUSU YELLAREDDY	ksrmcollege	Mechanical 2nd year	219Y5A0323
98	6-18-2022 12:09:36	NAGASANDRAM SIVAKESAV	KSRM	Mechanical 2nd year	219Y5A0324
99	6-18-2022 12:10:34	NAGELLA NAGABHUSHAN R	K.S.R.M COLLEGE OF	MECHANICAL SECOND	219Y5A0325
100	6-18-2022 12:11:33	P RAMA SAI	ksrm college	mechnaical Engineering,ka	219Y5A0326
101	6-18-2022 12:12:25	PAMIDI ARUNKUMAR REDDY	ksrmce	Mechanical 2nd	219Y5A0327
102	6-18-2022 12:13:24	PANDIBOTI SAI KRISHNA	ksrmce	mechanic al 2nd year	219Y5A0328
103	6-18-2022 12:14:04	PETA DINESH KUMAR	ksrm college	Mech 2nd	219Y5A0330
104	6-18-2022 12:14:56	R PRAVEEN KUMAR REDDY	ksrm college of enginee	Mechanical second	219Y5A0332
105	6-18-2022 12:15:35	SHAIK ASRARUDDIN	KSRMCE	MECHANICAL 2ND	219Y5A0335

Coordinators

1) K. Sr[illegible]

2) A. Hari Krishna

Syllabus of Certification Course

Course Name: Engine Combustion

Duration: 30 Hours

Introduction to air pollutants and pollution; Thermo-chemistry and thermodynamics of combustion; In-cylinder air motion; Laminar and turbulent premixed flames, Premixed engine combustion; Spray formation and atomization, Direct injection and CI engine combustion; Combustion systems and management; Genesis and formation of engine emissions, NO kinetics, Soot formation and oxidation.

Emission standards and measurement; Control of emissions in SI and CI engines, engine design parameters, exhaust after treatment, lean de-NOx catalysts, DISC and HCCI engines; Alternative propulsion systems e.g., HEV,FCV etc.; Engine fuel impacts on emissions, alternative fuels e.g., CNG, Alcohols, biodiesel, hydrogen.

Text Books:

1. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.

2. B. P. Pundir, Engine Emissions: Pollutant Formation and Advances in Control Technology, Narosa Publishing House, New Delhi, 2007.

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SCHEDULE

Department of Mechanical Engineering

Certification Course
on
"Engine Combustion"

Date	Timing	Course Instructor	Topic to be covered
20/06/2022	4 PM to 6 PM	A.HARIKRISHNA	Introduction to air pollution from IC engines, photochemical smog,primary and secondary pollutants.
21/06/2022	4 PM to 6 PM	A.HARIKRISHNA	Thermodynamics of combustion : Stoichiometry of combustion,heats of reaction and formation, adiabatic flame temperature. Chemical equilibrium, properties of equilibrium combustion products of air-fuel mixtures, application to IC engines.
22/06/2022	4 PM to 6 PM	K.SURESH KUMAR	Conceptual SI engine combustion models, features of SI engine combustion processes, combustion process characterization.
23/06/2022	4 PM to 6 PM	K.SURESH KUMAR	Thermodynamic analysis of burned and unburned mixture states, mixed and unmixed combustion models.
24/06/2022	4 PM to 6 PM	A.HARIKRISHNA	Combustion variations, factors affecting it and their effect on performance and emissions, effect of EGR.
25/06/2022	10AM to12Noon	A.HARIKRISHNA	Features of CI engine combustion process, conceptual CI engine combustion models, combustion process characterization.
25/06/2022	2 PM to 6 PM	K.SURESH KUMAR A.HARIKRISHNA	Fuel injection, spray structure, atomization, penetration, drop size distribution, spray evaporation. Ignition delay, factors affecting delay. Mixing controlled combustion, heat release rates , effect of engine design variables, swirl, injection rates.
27/06/2022	4 PM to 6 PM	K.SURESH KUMAR	Thermodynamic analysis of CI engine combustion. Formation of NO and NO2 in SI Engines, Prompt and thermal NO, kinetics of NO formation. Formation of NO

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Department of Mechanical Engineering

Attendance sheet of Certification course on "Engine Combustion" from 20th June 2022 to 2nd July 2022

Sl. No.	Roll No.	Name	20/6	21/6	22/6	23/6	24/6	25/6	25/6	27/6	28/6	29/6	30/6	01/7	02/7
1	209Y1A0358	Siddhamsetty Madhava	P	P	P	A	P	P	A	P	P	P	P	P	P
2	219Y5A0334	Shaik Ansar Basha	P	P	P	P	P	P	P	A	A	P	P	P	P
3	219Y5A0333	Shaik Acchukatla Mahammad Jubair	P	P	P	P	A	A	P	A	P	P	P	P	A
4	219Y5A0307	Budigolla Pavan Kumar	P	P	A	P	P	P	P	P	P	P	A	P	P
5	219Y5A0336	Shaik Ghouse Basha	P	P	P	P	P	P	P	P	P	A	P	A	P
6	209Y1A0310	C.Vandana Evangeline	P	P	P	P	P	P	P	P	P	P	P	P	P
7	219Y5A0312	Gorla Sriharai	P	P	A	P	P	P	P	P	P	A	P	P	P
8	219Y5A0304	B.Kiran	P	P	P	P	P	P	P	P	P	P	P	P	P
9	219Y5A0301	Alankaram Pavankumar	A	P	P	P	P	P	P	P	P	P	P	A	P
10	219Y5A0338	Sura Sandeep Kumar	P	P	P	P	P	P	P	P	P	P	P	A	P
11	219Y5A0302	Badugu Karthik	P	A	P	P	P	P	P	P	P	P	P	A	P
12	209Y1A0346	P Obula Vamsidhar	P	P	P	A	P	P	P	P	P	P	P	P	P
13	219Y5A0340	Vanaja Srihari	P	P	P	P	P	P	P	A	P	P	A	P	P

14	209Y1A0361	Syed Waseem	P	P	P	P	P	P	P	P	A	P	P	P	P
15	209Y1A0328	Uday Kumar Reddy	P	P	P	P	P	P	P	P	A	P	A	P	P
16	209Y1A0347	P.Anil Kumar	P	P	P	P	P	P	P	P	P	P	P	P	P
17	209Y1A0349	Putta Mahadeva Reddy	P	P	P	P	P	P	P	P	P	P	P	P	P
18	209Y1A0327	Korivi Venkat Pavan Tanuj	P	P	P	P	P	P	P	P	P	P	P	P	P
19	209Y1A0333	Malepadu Ranjith Kumar	P	P	P	P	P	P	P	P	A	P	P	P	P
20	209Y1A0345	P.N.Indrasena Reddy	A	P	P	P	P	P	P	P	P	P	P	P	P
21	209Y1A0301	A.Thulasi Deepa	P	P	P	P	P	P	P	P	P	P	P	P	P
22	209Y1A0343	Panjam Ramireddy	P	P	P	P	P	P	P	P	P	P	P	P	P
23	209Y1A0350	Rayapati Valeedh	P	P	P	A	P	P	P	P	P	P	P	P	P
24	209Y1A0306	C.Dinesh Reddy	P	P	P	A	P	P	P	P	A	P	P	P	P
25	209Y1A0337	Mekala Krupakar Raju	P	P	A	P	P	P	P	P	P	A	P	P	P
26	219Y5A0341	Vellipalem Bharath Narayana Reddy	P	P	P	P	P	P	P	P	P	P	P	P	P
27	219Y5A0339	Syed Shahid Hussain	P	P	P	P	P	P	P	P	P	P	P	P	P
28	219Y5A0321	Mallepogu Anadaraju	P	A	P	P	P	P	P	P	P	P	P	P	P
29	219Y5A0322	Mopuri Krishna Vamsi	A	P	P	P	P	P	P	P	A	A	P	P	P
30	219Y5A0331	Potham Venkateswar Reddy	P	P	P	P	P	P	P	P	P	P	A	P	P
31	219Y5A0306	Budigi Gandhi	P	P	P	A	P	P	P	P	A	P	P	P	P
32	219Y5A0305	Boya Harikrishna	P	A	P	P	P	P	P	P	P	P	A	P	P
33	219Y5A0308	Dasara Sathish	P	P	P	P	P	P	P	P	P	A	A	P	P
34	219Y5A0317	M Yerakondappa	P	P	P	P	P	P	P	P	P	A	P	P	P
35	219Y5A0309	Dasari Sreekanth	P	P	P	P	P	A	P	P	P	P	P	P	P

36	219Y5A0320	Malleboyina Kiran	P	A	P	P	P	P	P	A	P	P	P	P	P
37	219Y5A0311	Galla Mukesh Sai	P	P	P	P	P	P	P	P	P	P	P	P	P
38	219Y5A0310	D Venkateswarlu	P	P	P	P	P	P	P	P	P	P	P	P	P
39	209Y1A0364	V.Akhil Kumar	P	A	A	P	P	P	P	A	P	P	P	P	P
40	209Y1A0355	Shaik Moula	P	P	P	P	P	P	P	P	P	P	A	P	P
41	209Y1A0336	M.Masood Khan	A	P	P	P	P	A	P	P	P	P	P	P	P
42	219Y5A0315	K.Bhageeratha Shankar	A	P	P	P	P	A	P	P	P	P	P	P	P
43	209Y1A0357	Shaik Sadiq Ali	P	P	P	P	P	P	P	P	P	P	P	P	P
44	209Y1A0354	Shaik Mohammed Umar	P	P	P	P	P	A	P	P	A	P	P	P	P
45	209Y1A0344	Pathan Shoaib Khan	P	P	P	P	P	P	P	P	P	P	A	A	P
46	209Y1A0324	Kakarla Pavan Kumar Reddy	P	A	P	P	P	P	P	P	P	P	P	A	P
47	219Y5A0313	Karumanchi Prakash Raj	P	P	P	P	P	P	P	P	A	P	P	P	P
48	209Y1A0351	Sagabala Bhanu Prakash	P	P	P	P	P	P	P	P	A	P	P	A	P
49	209Y1A0303	Bandi Rama Krishna	P	P	P	P	P	A	P	P	P	A	A	A	P
50	219Y5A0337	Sriramadasu Sreenu	P	P	P	P	P	P	P	P	P	P	P	A	P
51	209Y1A0367	Yarravagari Mohana Sree	A	A	P	P	P	P	P	P	P	P	P	P	A
52	209Y1A0348	Narayana. Pottendla	P	P	A	P	P	A	P	P	P	P	P	P	A
53	219Y5A0329	Patima Ajay	P	P	P	P	P	P	P	A	A	A	P	A	P
54	209Y1A0302	A Charan Teja	P	P	A	P	P	P	P	P	P	A	P	P	P
55	209Y1A0304	Beere Bharath	A	P	A	P	P	P	P	P	P	A	P	P	P
56	209Y1A0305	B Dinesh Kumar	P	P	P	P	P	A	P	P	P	P	P	A	P
57	209Y1A0306	C Dinesh Reddy	A	P	P	P	P	P	P	P	P	A	P	P	P
58	209Y1A0307	Chakali Sekhar	P	P	P	P	P	P	P	P	P	P	P	P	P

59	209Y1A0308	C Yaswanth Kumar	P	P	P	P	P	P	P	P	P	P	P	A	P
60	209Y1A0309	Chavva Srinivasula Reddy	P	P	P	P	P	P	P	P	P	P	P	A	P
61	209Y1A0311	Dade Siddiq	P	P	P	P	P	P	A	P	P	P	P	P	P
62	209Y1A0312	D Vamsidhar Reddy	P	A	P	P	P	P	A	P	P	P	P	P	P
63	209Y1A0313	D B Sai Kumar Yadav	A	P	P	P	P	P	P	P	P	P	P	P	P
64	209Y1A0314	E Vijayasena Reddy	A	P	P	P	P	P	P	P	A	A	P	P	P
65	209Y1A0315	Etukuri Giridhar Kumar	A	P	P	P	P	P	P	A	P	P	P	A	P
66	209Y1A0316	Galigari Madhan Mohan	A	P	A	P	P	P	A	P	P	P	P	P	P
67	209Y1A0317	G C Gunavardhan Reddy	A	P	P	P	P	A	P	P	P	P	P	P	P
68	209Y1A0318	Gavireddy Lankeswar Reddy	A	P	P	P	P	A	P	P	P	P	P	P	P
69	209Y1A0319	Ghantasala Sreehari	P	P	P	P	P	A	A	P	P	P	P	P	P
70	209Y1A0320	G Yugandhar Chowdary	P	P	P	A	P	P	A	P	A	P	P	P	P
71	209Y1A0321	G Venkatakrishna	P	A	P	P	P	A	P	P	P	P	P	P	P
72	209Y1A0322	Jammalamadugu Yuvaraju	P	A	P	A	P	A	P	P	P	P	P	P	P
73	209Y1A0323	K Karthik Sarma	A	P	P	A	P	P	P	P	P	P	P	P	P
74	209Y1A0325	K Naveenk Naveen	A	P	P	A	A	P	P	A	P	P	P	P	P
75	209Y1A0326	K Poli Reddy	A	P	P	P	P	P	P	A	A	A	P	P	P
76	209Y1A0329	Kotte Venkata Sunil Kumar	P	P	P	P	P	P	P	P	A	P	P	P	P
77	209Y1A0330	K Praveen Kumar Raju	P	A	P	A	P	P	P	A	P	P	P	P	P
78	209Y1A0331	Madathala Gurivi Reddy	P	P	P	P	P	P	P	A	P	P	P	P	P

79	209Y1A0332	Madiga Prakash	A	P	P	P	P	P	P	P	P	P	P	P	P
80	209Y1A0334	M Sai Deekshith	P	P	P	P	P	P	P	P	P	P	P	P	P
81	209Y1A0335	Marripalli Lokeshwar	P	P	P	P	P	P	P	P	P	P	A	P	P
82	209Y1A0338	Mula Naveen Kumar Reddy	P	P	P	P	P	P	P	P	P	A	P	P	P
83	209Y1A0339	Munagala Anil Kumar Reddy	P	P	P	P	P	P	P	P	P	A	P	P	P
84	209Y1A0342	P Ganeswara Reddy	P	P	A	P	P	P	A	P	P	P	A	P	P
85	209Y1A0352	Shaik Abubakar Siddiq	P	P	P	P	A	P	P	P	P	P	P	A	P
86	209Y1A0353	Shaik Masood Ahamed	P	P	P	P	P	P	A	P	P	P	A	P	P
87	209Y1A0356	Shaik Rasool	P	A	P	P	A	P	P	P	P	A	P	P	P
88	209Y1A0359	Syed Mohammed	P	A	P	P	P	P	A	P	P	P	A	P	P
89	209Y1A0360	Syed Sohail	P	P	A	P	P	P	P	P	P	P	A	P	P
90	209Y1A0362	V Enkata Siva Sai Bhavani	A	P	A	P	A	P	P	A	P	A	P	P	P
91	209Y1A0363	Vasagiri Naga Gokul	P	P	A	P	P	P	P	P	P	P	A	P	P
92	209Y1A0365	V Adi Keshava Reddy	P	A	P	P	P	P	P	P	P	P	A	P	P
93	209Y1A0366	Yarradoddy Mahesh	P	A	P	P	P	P	A	P	P	P	A	P	P
94	219Y5A0314	Kummari Jaya Surya	A	P	P	P	P	P	P	A	P	P	P	A	P
95	219Y5A0318	Madiga Pavan Kumar	P	P	P	A	A	P	P	P	P	A	P	P	P
96	219Y5A0319	Mala Govardhan	P	P	P	A	A	P	P	P	P	A	A	P	P
97	219Y5A0323	Murusu Yellareddy	P	P	A	P	P	P	P	P	P	P	P	P	P
98	219Y5A0324	Nagasandram Sivakesava	P	P	P	P	P	P	P	P	P	P	P	P	P

99	219Y5A0325	Nagella Nagabhusan Reddy	P	A	P	P	P	A	P	P	P	A	P	P	P
100	219Y5A0326	P Rama Sai	P	P	P	P	P	A	P	P	P	P	A	P	P
101	219Y5A0327	Pamidi Arunkumar Reddy	P	P	P	P	A	P	P	P	P	P	P	A	P
102	219Y5A0328	Pandiboti Sai Krishna	P	P	P	P	P	P	A	A	P	P	A	A	P
103	219Y5A0330	Peta Dinesh Kumar	P	P	A	P	P	P	P	P	P	P	P	P	P
104	219Y5A0332	R Praveen Kumar Reddy	P	P	A	P	A	P	P	P	P	P	P	P	P
105	219Y5A0335	Shaik Asraruddin	A	P	P	P	P	A	P	P	P	P	A	P	P

K.S. ... (signature)

A. Hari Krishna (signature)

Coordinators

(signature)

HoD-Mechanical Engg.

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

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DEPARTMENT OF MECHANICAL ENGINEERING

CERTIFICATION COURSE ON "ENGINE COMBUSTION"

Department of ME

20-06-2022 to 02-07-2022

Seminar Hall

Coordinators

Sri. K.SURESH KUMAR,
Asso.Prof, Dept.of ME
Sri. A.HARIKRISHNA,
Asst.Prof,Dept.of ME

Resource Persons

Sri. A.HARIKRISHNA,
Asst.Prof,Dept.of ME
Sri. K.SURESH KUMAR,
Asso.Prof, Dept.of ME

Registration Link: https://forms.gle/EU3uxhQGw2Mmisr6A

Dr. D. Ravikanth (HOD)	Dr. V.S.S. Murthy (Principal)	Dr. Kandula Chandra Obul Reddy (Managing Director)	Smt. K.Rajeswari (Correspondent Secretary, Tresurer)	Sri K. Madan Mohan Reddy (Vice - Chairman)	Sri K. Raja Mohan Reddy (Chairman)

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Report of
Certification Course on "Engine Combustion"
From 20/06/2022 to 02/07/2022

Target Group	:	**Students**
Details of Participants	:	**105 Students**
Co-coordinator(s)	:	**Sri K.Sureshkumar & Sri A.Harikrishna**
Resource Persons	:	**Sri A.Harikrishna & Sri K.Sureshkumar**
Organizing Department	:	**Mechanical Engineering**
Venue	:	**Seminar Hall, Mechanical Department**

Description:

The Department of Mechanical Engineering conducted a certification course on "Engine Combustion" from 20th June 2022 to 02nd July 2022. The course duration was 30 hours .The course Resource Persons are Sri A.Harikrishna, Assistant Professor and Sri K.SureshKumar, Asso. Professor Department Mechanical Engineering, KSRMCE.

The main objective of this course is to introduce the fundamental concepts of Engine and its combustion behavior in both CI and SI Engines. Combustion, also known as burning, is the basic chemical process of releasing energy from a fuel and air mixture. In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to work. The engine consists of a fixed cylinder and a moving piston. The expanding combustion gases push the piston, which in turn rotates the crankshaft. Ultimately, through a system of gears in the powertrain, this motion drives the vehicle's wheels.

There are two kinds of internal combustion engines currently in production: the spark ignition gasoline engine and the compression ignition diesel engine. Most of these are four-stroke cycle engines, meaning four piston strokes are needed to complete a cycle. The cycle includes four distinct processes: intake, compression, combustion and power stroke, and exhaust.

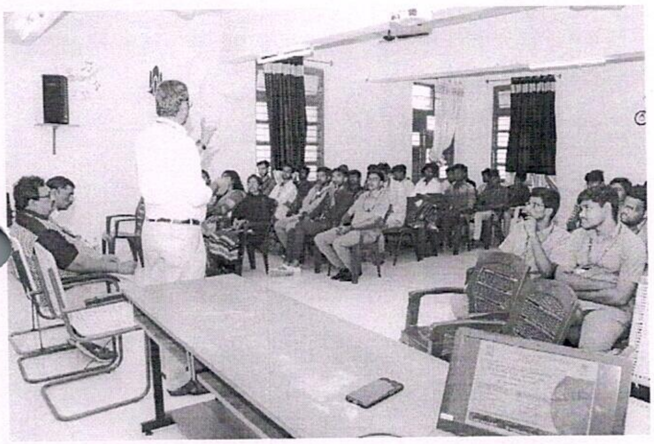
Spark ignition gasoline and compression ignition diesel engines differ in how they supply and ignite the fuel. In a spark ignition engine, the fuel is mixed with air and then inducted into the cylinder during the intake process. After the piston compresses the fuel-air mixture, the spark ignites it, causing combustion.

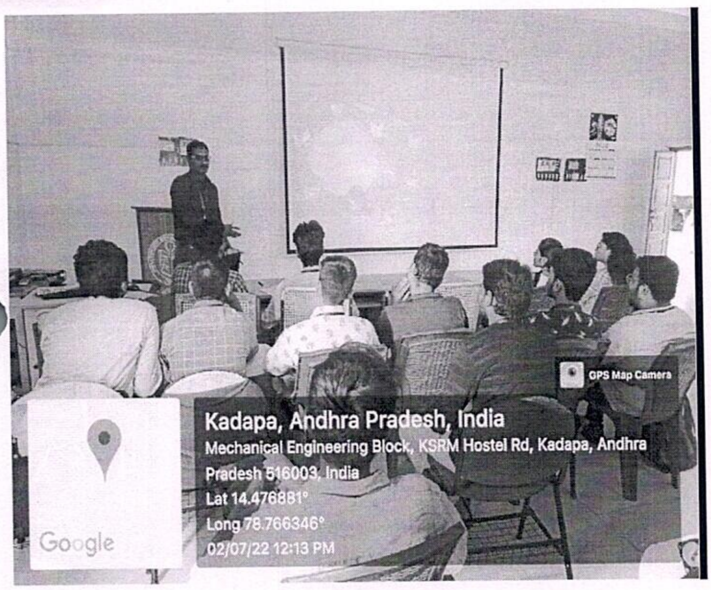
The expansion of the combustion gases pushes the piston during the power stroke. In a diesel engine, only air is inducted into the engine and then compressed. Diesel engines then spray the fuel into the hot compressed air at a suitable, measured rate, causing it to ignite.

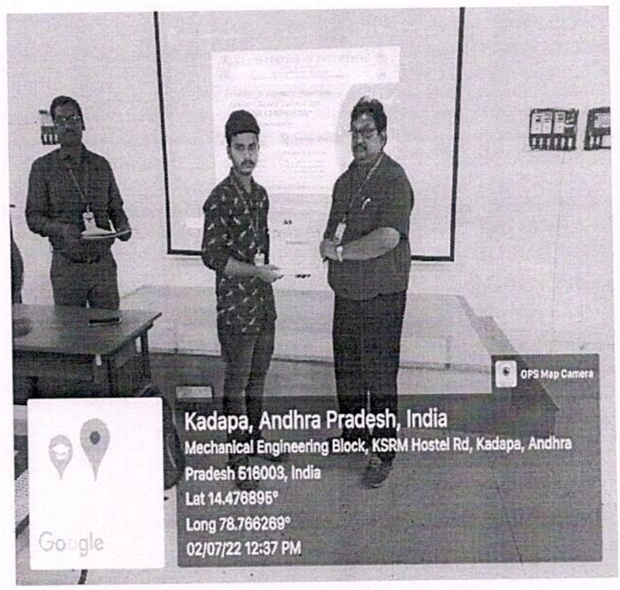
With this Certificate course students enhanced their knowledge in the area of Engine combustion and emission and its control.

Photos

The pictures taken during the course are given below:







Coordinators

HoD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

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Certificate of Completion

This to certify that Mr/Mrs. S.A.MD. JUBAIR Bearing the Roll Number 219Y5A0333 has Successfully Completed Certification Course on "ENGINE COMBUSTION" from 20th June 2022 to 02 July 2022, Organized by Department of Mechanical Engineering, KSRMCE, Kadapa.

A. Hari Krishna		V. S. S. Murthy
Coordinator	*HOD ME*	*Principal*

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Certificate of Completion

This to certify that Mr/Mrs. S. ANSAR BASHA Bearing the Roll Number 219Y5A0334 has Successfully Completed Certification Course on "ENGINE COMBUSTION" from 20th June 2022 to 02 July 2022, Organized by Department. of Mechanical Engineering, KSRMCE, Kadapa.

Coordinator   HOD ME   Principal

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Certificate of Completion

This to certify that Mr/Mrs. S. SHAHID HUSSAIN Bearing the Roll Number 219Y5A0339 has Successfully Completed Certification Course on "ENGINE COMBUSTION" from 20th June 2022 to 02 July 2022. Organized by Department of Mechanical Engineering, KSRMCE, Kadapa.

A. Hari Krishna
Coordinator

HOD ME

V. S. S. Murthy
Principal

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Certificate of Completion

This to certify that Mr/Mrs. C. VANDANA EVANGELINE Bearing the Roll Number 209Y1A0310 has Successfully Completed Certification Course on "ENGINE COMBUSTION" from 20th June 2022 to 02 July 2022, Organized by Department of Mechanical Engineering, KSRMCE, Kadapa.

K.S...	(signature)	V. S. S. Murthy
Coordinator	HOD ME	Principal

Feedback on Certificate Course on "ENGINE COMBUSTION" From 20-06-22 to 02-07-22

* Required

1. Student Name(Optional)

2. Roll Number(Optional)

3. The objectives of the course were met(Objective) *

Mark only one oval.

Excellent
Good
Satisfactory
Poor

4. The pace of the course was appropriate to the content and attendees(Content) *

Mark only one oval.

Excellent
Good
Satisfactory
Poor

5. The content of the course was organized and easy to follow(Delivery) *

Mark only one oval.

Excellent

Good

Satisfactory

Poor

6. The Resource Persons were well prepared and able to answer any questions(Interaction) *

Mark only one oval.

Excellent

Good

Satisfactory

Poor

7. The exercises/role play were helpful and relevant(Syllabus Coverage) *

Mark only one oval.

Excellent

Good

Satisfactory

Poor

8. The venue was appropriate for the course (About Venue) *

Mark only one oval.

Excellent

Good

Satisfactory

Poor

9. The Course satisfy my expectation as a value added Programme (Course Satisfaction) *

Mark only one oval.

- Excellent
- Good
- Satisfactory
- Poor

10. Any Other comments

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Feedback on Certificate Course on"Engine Combustion" from 20/06/22 to 02/07/22

S.No	Timestamp	The objec	The pa	The conten	The Reso	The exercis	The venu	The Course	Student Nam	Roll Number(C	Any Other comments
1	7/12/2022 15:40:36	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
2	7/12/2022 15:40:46	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent	K Karthik sar	209y1a0323	
3	7/12/2022 15:40:55	Excellent	Good	Excellent	Excellent	Good	Excellent	Good			
4	7/12/2022 15:41:01	Good	Good	Good	Good	Good	Good	Good	Lokeshwar	209y1a0335	--
5	7/12/2022 15:41:07	c	Excelle	Excellent	Good	Excellent	Excellent	Excellent			
6	7/12/2022 15:41:16	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
7	7/12/2022 15:41:16	Excellent	Excelle	Excellent	Excellent	Excellent	Good	Good			We need some more certi
8	7/12/2022 15:41:20	Excellent	Excelle	Excellent	Good	Excellent	Good	Good			
9	7/12/2022 15:41:25	Satisfacto	Satisfa	Satisfactory	Satisfacto	Satisfactory	Satisfacto	Satisfactory	SIDDHAMSE	209y1a0358	No
10	7/12/2022 15:41:27	Good	Excelle	Good	Excellent	Good	Excellent	Excellent			
11	7/12/2022 15:41:27	Excellent	Excelle	Excellent	Excellent	Excellent	Good	Good			
12	7/12/2022 15:41:28	Excellent	Good	Good	Excellent	Good	Good	Excellent			
13	7/12/2022 15:41:28	Good	Good	Good	Good	Good	Satisfacto	Satisfactory	Sagabala Bh	209y1a0351	
14	7/12/2022 15:41:30	Good	Good	Good	Good	Good	Good	Good	Shaik Moula	355	It is useful for us
15	7/12/2022 15:41:32	Good	Good	Good	Good	Good	Good	Good			--
16	7/12/2022 15:41:36	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
17	7/12/2022 15:41:38	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
18	7/12/2022 15:41:46	Excellent	Good	Excellent	Good	Excellent	Excellent	Good			i Learned something new
19	7/12/2022 15:41:49	Excellent	Excelle	Excellent	Excellent	Good	Good	Good			
20	7/12/2022 15:41:53	Good	Good	Good	Excellent	Good	Good	Excellent	Shaik jubair	219y5a0333	
21	7/12/2022 15:42:01	Excellent	Excelle	Good	Excellent	Good	Excellent	Good			
22	7/12/2022 15:42:03	Good	Good	Good	Good	Good	Good	Good			--
23	7/12/2022 15:42:11	Excellent	Good	Good	Satisfacto	Excellent	Excellent	Excellent			
24	7/12/2022 15:42:18	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			-
25	7/12/2022 15:42:23	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent	VELLATUR A	209Y1A0364	Nothing to say
26	7/12/2022 15:42:33	Good	Satisfa	Excellent	Excellent	Excellent	Satisfacto	Satisfactory	Sagabala Bh	209y1a0351	
27	7/12/2022 15:42:36	Good	Excelle	Excellent	Good	Excellent	Good	Excellent			
28	7/12/2022 15:42:39	Good	Good	Good	Good	Good	Good	Good			--
29	7/12/2022 15:42:42	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
30	7/12/2022 15:42:42	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
31	7/12/2022 15:42:45	Excellent	Excelle	Good	Good	Good	Excellent	Good			
32	7/12/2022 15:42:52	Good	Good	Excellent	Good	Good	Good	Good	GALLA MUK	219y5A0311	

33	7/12/2022 15:42:54	Excellent	Excelle	Good	Good	Good	Good	Good			
34	7/12/2022 15:42:56	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			-
35	7/12/2022 15:42:56	Good	Good	Good	Good	Good	Good	Good	SIDDHAMSE	209y1a0358	No
36	7/12/2022 15:43:02	Excellent	Good	Good	Good	Satisfactor	Excellent	Excellent			
37	7/12/2022 15:43:19	Good	Good	Good	Good	Good	Good	Good			No
38	7/12/2022 15:43:24	Excellent	Excelle	Good	Good	Good	Good	Good			
39	7/12/2022 15:43:27	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
40	7/12/2022 15:43:33	Good	Good	Good	Good	Good	Good	Good			
41	7/12/2022 15:43:49	Good	Good	Good	Good	Good	Good	Good			
42	7/12/2022 15:43:54	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent	Korivi venkat	209y1a0327	
43	7/12/2022 15:44:03	Good	Good	Good	Good	Good	Good	Good			
44	7/12/2022 15:44:04	Good	Good	Good	Good	Good	Good	Good			--
45	7/12/2022 15:44:11	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
46	7/12/2022 15:44:17	Good	Good	Good	Good	Good	Good	Good			
47	7/12/2022 15:44:17	Excellent	Excelle	Good	Good	Excellent	Excellent	Good			Nothing
48	7/12/2022 15:44:24	Good	Good	Good	Good	Good	Good	Good			___
49	7/12/2022 15:44:24	Excellent	Good	Excellent	Good	Good	Excellent	Excellent	Sagabala Bh	209y1a0351	
50	7/12/2022 15:44:28	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
51	7/12/2022 15:44:30	Good	Excelle	Good	Good	Good	Good	Good	Shaik Moula	355	Ok
52	7/12/2022 15:44:33	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
53	7/12/2022 15:44:38	Excellent	Excelle	Good	Good	Good	Good	Good			
54	7/12/2022 15:44:48	Good	Good	Excellent	Good	Excellent	Excellent	Excellent			
55	7/12/2022 15:44:49	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
56	7/12/2022 15:44:56	Good	Excelle	Excellent	Good	Good	Good	Good			
57	7/12/2022 15:45:07	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
58	7/12/2022 15:45:08	Excellent	Excelle	Good	Good	Good	Good	Good			
59	7/12/2022 15:45:14	Excellent	Good	Excellent	Good	Excellent	Good	Excellent			
60	7/12/2022 15:45:17	Excellent	Excelle	Good	Satisfacto	Good	Good	Good			
61	7/12/2022 15:45:24	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
62	7/12/2022 15:45:27	Good	Good	Excellent	Excellent	Excellent	Excellent	Excellent		209y1a0351	
63	7/12/2022 15:45:37	Excellent	Excelle	Excellent	Good	Excellent	Excellent	Excellent			
64	7/12/2022 15:45:51	Excellent	Excelle	Good	Good	Good	Excellent	Good			
65	7/12/2022 15:45:57	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
66	7/12/2022 15:45:57	Good	Excelle	Good	Excellent	Good	Excellent	Good			
67	7/12/2022 15:46:06	Good	Good	Excellent	Satisfacto	Satisfactory	Good	Good			
68	7/12/2022 15:46:07	Excellent	Good	Excellent	Good	Excellent	Good	Good			
69	7/12/2022 15:46:10	Good	Good	Good	Good	Good	Good	Good			
70	7/12/2022 15:46:24	Excellent	Excelle	Good	Good	Good	Excellent	Excellent			
71	7/12/2022 15:46:27	Good	Excelle	Good	Excellent	Good	Excellent	Good			

72	7/12/2022 15:46:28	Good	Good	Good	Good	Good	Good	Good			
73	7/12/2022 15:46:32	Good	Good	Good	Good	Satisfactory	Satisfacto	Satisfactory	P Obula Vam	209y1a0346	Nothing
74	7/12/2022 15:46:35	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
75	7/12/2022 15:46:40	Good	Good	Good	Satisfacto	Good	Good	Satisfactory			
76	7/12/2022 15:46:46	Excellent	Good	Excellent	Good	Excellent	Good	Excellent			
77	7/12/2022 15:46:48	Excellent	Excelle	Good	Excellent	Excellent	Good	Good			
78	7/12/2022 15:46:57	Good	Good	Good	Good	Excellent	Good	Excellent			
79	7/12/2022 15:46:57	Excellent	Good	Satisfactory	Excellent	Excellent	Good	Satisfactory			Nothing
80	7/12/2022 15:46:58	Good	Excelle	Good	Excellent	Good	Excellent	Good			
81	7/12/2022 15:47:02	Good	Excelle	Good	Excellent	Excellent	Good	Satisfactory			
82	7/12/2022 15:47:15	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent	Mekala krupa	2091ya0337	
83	7/12/2022 15:47:15	Good	Satisfa	Good	Excellent	Good	Satisfacto	Good			
84	7/12/2022 15:47:16	Excellent	Good	Good	Excellent	Excellent	Excellent	Excellent			
85	7/12/2022 15:47:17	Good	Excelle	Excellent	Good	Good	Excellent	Good			
86	7/12/2022 15:47:27	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent	Sagabala Bh	209y1a0351@ksrmce.ac.in	
87	7/12/2022 15:47:29	Excellent	Excelle	Excellent	Excellent	Good	Excellent	Excellent			
88	7/12/2022 15:47:46	Excellent	Excelle	Good	Good	Good	Good	Good			
89	7/12/2022 15:47:52	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
90	7/12/2022 15:48:08	Excellent	Good	Good	Good	Good	Good	Good			
91	7/12/2022 15:49:27	Good	Good	Excellent	Excellent	Excellent	Excellent	Good	DASARA SA	219y5a0308	
92	7/12/2022 15:54:18	Good	Excelle	Good	Good	Satisfactory	Good	Satisfactory			
93	7/12/2022 16:04:51	Excellent	Excelle	Good	Good	Good	Excellent	Good			
94	7/12/2022 16:05:51	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
95	7/12/2022 16:05:59	Good	Excelle	Good	Excellent	Good	Excellent	Good			
96	7/12/2022 16:06:12	Good	Good	Excellent	Satisfacto	Satisfactory	Good	Good			
97	7/12/2022 16:06:56	Excellent	Good	Good	Good	Good	Good	Good			
98	7/12/2022 16:07:18	Good	Good	Good	Good	Good	Good	Good			
99	7/12/2022 16:07:26	Excellent	Excelle	Good	Good	Good	Good	Excellent			
100	7/12/2022 16:07:34	Good	Excelle	Good	Excellent	Good	Excellent	Good	B.Dinesh kur	209Y1A0305	
101	7/12/2022 16:08:43	Good	Good	Good	Good	Good	Good	Good			
102	7/13/2022 16:08:59	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
103	7/14/2022 16:09:19	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			
104	7/15/2022 16:09:36	Excellent	Good	Excellent	Excellent	Good	Excellent	Good			
105	7/16/2022 16:10:39	Excellent	Excelle	Excellent	Excellent	Excellent	Excellent	Excellent			

K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516003
DEPARTMENT OF MECHANICAL ENGINEERING
VALUE ADDED/CERTIFICATE COURSE ON
"ENGINE COMBUSTION" FROM 20/06/22 to 02/07/22

AWARD LIST

S.NO	Roll Number	Name of the Student	Marks Obtained
1	209Y1A0358	SIDDHAMSETTY MADHAVA	16
2	219Y5A0334	SHAIK ANSAR BASHA	17
3	219Y5A0333	SHAIK ACCHUKATLA MAHAMMAD JUBAIR	18
4	219Y5A0307	BUDIGOLLA PAVAN KUMAR	16
5	219Y5A0336	SHAIK GHOUSE BASHA	17
6	209Y1A0310	C.VANDANA EVANGELINE	18
7	219Y5A0312	GORLA SRIHARAI	16
8	219Y5A0304	B.KIRAN	14
9	219Y5A0301	ALANKARAM PAVANKUMAR	18
10	219Y5A0338	SURA SANDEEP KUMAR	17
11	219Y5A0302	BADUGU KARTHIK	12
12	209Y1A0346	P OBULA VAMSIDHAR	18
13	219Y5A0340	VANAJA SRIHARI	15
14	209Y1A0361	SYED WASEEM	15
15	209Y1A0328	UDAY KUMAR REDDY	18
16	209Y1A0347	P.ANIL KUMAR	16
17	209Y1A0349	PUTTA MAHADEVA REDDY	17
18	209Y1A0327	KORIVI VENKAT PAVAN TANUJ	15
19	209Y1A0333	MALEPADU RANJITH KUMAR	15
20	209Y1A0345	P.N.INDRASENA REDDY	15
21	209Y1A0301	A.THULASI DEEPA	15
22	209Y1A0343	PANJAM RAMIREDDY	18
23	209Y1A0350	RAYAPATI VALEEDH	17
24	209Y1A0306	C.DINESH REDDY	16
25	209Y1A0337	MEKALA KRUPAKAR RAJU	15
26	219Y5A0341	VELLIPALEM BHARATH NARAYANA REDDY	15
27	219Y5A0339	SYED SHAHID HUSSAIN	18
28	219Y5A0321	MALLEPOGU ANADARAJU	18
29	219Y5A0322	MOPURI KRISHNA VAMSI	12
30	219Y5A0331	POTHAM VENKATESWAR REDDY	13
31	219Y5A0306	BUDIGI GANDHI	14
32	219Y5A0305	BOYA HARIKRISHNA	12
33	219Y5A0308	DASARA SATHISH	13
34	219Y5A0317	M YERAKONDAPPA	15
35	219Y5A0309	DASARI SREEKANTH	18
36	219Y5A0320	MALLEBOYINA KIRAN	17
37	219Y5A0311	GALLA MUKESH SAI	16
38	219Y5A0310	D VENKATESWARLU	15
39	209Y1A0364	V.AKHIL KUMAR	15

40	209Y1A0355	SHAIK MOULA	18
41	209Y1A0336	M.MASOOD KHAN	18
42	219Y5A0315	K.BHAGEERATHA SHANKAR	12
43	209Y1A0357	SHAIK SADIQ ALI	13
44	209Y1A0354	SHAIK MOHAMMED UMAR	17
45	209Y1A0344	PATHAN SHOAIB KHAN	16
46	209Y1A0324	KAKARLA PAVAN KUMAR REDDY	17
47	219Y5A0313	KARUMANCHI PRAKASH RAJ	16
48	209Y1A0351	SAGABALA BHANU PRAKASH	15
49	209Y1A0303	BANDI RAMA KRISHNA	15
50	219Y5A0337	SRIRAMADASU SREENU	18
51	209Y1A0367	YARRAVAGARI MOHANA SREE	18
52	209Y1A0348	NARAYANA. POTTENDLA	12
53	219Y5A0329	PATIMA AJAY	13
54	209Y1A0302	A CHARAN TEJA	18
55	209Y1A0304	BEERE BHARATH	18
56	209Y1A0305	B DINESH KUMAR	12
57	209Y1A0306	C DINESH REDDY	13
58	209Y1A0307	CHAKALI SEKHAR	16
59	209Y1A0308	C YASWANTH KUMAR	17
60	209Y1A0309	CHAVVA SRINIVASULA REDDY	12
61	209Y1A0311	DADE SIDDIQ	13
62	209Y1A0312	D VAMSIDHAR REDDY	16
63	209Y1A0313	D B SAI KUMAR YADAV	18
64	209Y1A0314	E VIJAYASENA REDDY	18
65	209Y1A0315	ETUKURI GIRIDHAR KUMAR	18
66	209Y1A0316	GALIGARI MADHAN MOHAN	12
67	209Y1A0317	G C GUNAVARDHAN REDDY	13
68	209Y1A0318	GAVIREDDY LANKESWAR REDDY	17
69	209Y1A0319	GHANTASALA SREEHARI	18
70	209Y1A0320	G YUGANDHAR CHOWDARY	12
71	209Y1A0321	G VENKATAKRISHNA	13
72	209Y1A0322	JAMMALAMADUGU YUVARAJU	12
73	209Y1A0323	K KARTHIK SARMA	11
74	209Y1A0325	K NAVEENK NAVEEN	12
75	209Y1A0326	K POLI REDDY	13
76	209Y1A0329	KOTTE VENKATA SUNIL KUMAR	18
77	209Y1A0330	K PRAVEEN KUMAR RAJU	18
78	209Y1A0331	MADATHALA GURIVI REDDY	12
79	209Y1A0332	MADIGA PRAKASH	13
80	209Y1A0334	M SAI DEEKSHITH	17
81	209Y1A0335	MARRIPALLI LOKESHWAR	15
82	209Y1A0338	MULA NAVEEN KUMAR REDDY	12
83	209Y1A0339	MUNAGALA ANIL KUMAR REDDY	13
84	209Y1A0342	P GANESWARA REDDY	16
85	209Y1A0352	SHAIK ABUBAKAR SIDDIQ	15
86	209Y1A0353	SHAIK MASOOD AHAMED	16
87	209Y1A0356	SHAIK RASOOL	12

88	209Y1A0359	SYED MOHAMMED	13
89	209Y1A0360	SYED SOHAIL	17
90	209Y1A0362	V ENKATA SIVA SAI BHAVANI	16
91	209Y1A0363	VASAGIRI NAGA GOKUL	12
92	209Y1A0365	V ADI KESHAVA REDDY	13
93	209Y1A0366	YARRADODDY MAHESH	15
94	219Y5A0314	KUMMARI JAYA SURYA	16
95	219Y5A0318	MADIGA PAVAN KUMAR	12
96	219Y5A0319	MALA GOVARDHAN	13
97	219Y5A0323	MURUSU YELLAREDDY	16
98	219Y5A0324	NAGASANDRAM SIVAKESAVA	18
99	219Y5A0325	NAGELLA NAGABHUSHAN REDDY	11
100	219Y5A0326	P RAMA SAI	12
101	219Y5A0327	PAMIDI ARUNKUMAR REDDY	13
102	219Y5A0328	PANDIBOTI SAI KRISHNA	16
103	219Y5A0330	PETA DINESH KUMAR	17
104	219Y5A0332	R PRAVEEN KUMAR REDDY	12
105	219Y5A0335	SHAIK ASRARUDDIN	15

Coordinator

HoD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

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K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516003
DEPARTMENT OF MECHANICAL ENGINEERING
VALUE ADDED /CERTIFICATE COURSE ON
"ENGINE COMBUSTION"FROM 20/06/22 to 02/07/22

ASSESSMENT TEST

Roll Number: 20941A0312 **Name of the Student:** D. Vamsidhar Reddy

Time: 20 Min **(Objective Questions)** **Max.Marks: 20**

Note: Answer the following Questions and each question carries **one** mark.

1. Volatility of diesel fuel oil is (d) ✓

(a) minimum temperature to which oil is heated in order to give off inflammable vapours in sufficient quantity to ignite momentarily when brought in contact with a flame

(b) temperature at which it solidifies or congeals

(c) it catches fire without external aid

(d) indicated by 90% distillation temperature, i.e., when 90% of sample oil has distilled off

2. Which is more viscous lub oil (a) ✗

(a) SEA 30 (b) SAE 40 (c) SAE 50 (d) SAE 80

3. In the opposed piston diesel engine, the combustion chamber is located (d) ✓

(a) above the piston (b) below the piston (c) between the pistons (d) any when

4. A stoichiometric air-fuel ratio is (a) ✓

(a) chemically correct mixture (b) lean mixture (c) rich mixture for idling (d) rich mixture for over loads

5. In a naturally aspirated diesel engine, the air is supplied by (c) ✓

(a) a supercharger (b) a centrifugal blower (c) a vacuum chamber (d) an injection tube

6. In loop scavenging, the top of the piston is (d) ✓

(a) flat (b) contoured (c) slanted (d) depressed

7. In the crankcase method of scavenging, the air pressure is produced by (d) ✓

(a) Supercharger (b) centrifugal pump (c) natural aspirator (d) movement of engine piston

8. In order to prevent formation of carbon on the injector, the temperature of nozzle tip should be (c) ✓

(a) less than 100°C (b) between 100-250°C (c) between 250 – 300°C (d) between 400 – 500°C

9. The thermal efficiency of a petrol engine of two stroke with crank case scavenging as compared to four stroke petrol engine with same compression ratio will be (c) ✗

(a) higher (b) lower (c) same (d) depends on size of engine

10. Ignition quality of petrol is expressed by (a)

(a) Octane number (b) cetane number (c) calorific value (d) self-ignition temperature

11. Petrol is distilled at a temperature in range of (b)

(a) 30 – 65°C (b) 65 – 220°C (c) 220-350°C (d) 350-450°C

12. Kerosene is distilled at (c)

(a) 30 – 65°C (b) 65 – 220°C (c) 220 – 350°C (d) 350 – 450°C.

13. Self-ignition temperature of petrol is of the order of (b)

(a) 150°C (b) 240°C (c) 370°C (d) 450°C

14. Iso-octane (c)

(a) Has octane number of 0 (b) has octane number of 50 (c) has octane number of 100 (d) is an index of detonation quality

15. Octane number is determined by comparing the performance of the petrol with the following hydrocarbons (a)

(a) iso-octane (b) mixture of normal heptane and iso-oc-tane (c) alpha methyl napthalene (d) mixture of methane and ethane

16. Cetane (b)

(a) has zero cetane number (b) has 100 cetane number (c) helps detonation (d) is a straight chain paraffin

17. Ethyl fluid is used (c) X

(a) to increase the octane rating of the fuel (b) to increase the cetane rating of the fuel (c) as a defrosting agent (d) as a superior type of fluid compared to others

18. Crankcase explosion in I.C. engines occurs as (b) X

(a) first a mild explosion followed by a bi explosion(b) first a big explosion followed by a mil explosion(c) both mild and big explosions occurs simultaneously(d) never occurs

19. Compression loss in I.C engines occurs due to (d)

(a) leaking piston rings(b) use of thick head gasket(c) increase in clearance volume caused b bearing-bushing wear(d) all of the above.

20. The air requirement of a petrol engine during starting compared to theoretical air required for complete combustion is (a)

(a) more (b) loss(c) same(d) may be more or less depending on engine capacity

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K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516003
DEPARTMENT OF MECHANICAL ENGINEERING
VALUE ADDED /CERTIFICATE COURSE ON
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ASSESSMENT TEST

Roll Number: 219Y5A0333 **Name of the Student:** S.Am. Jubair

Time: 20 Min **(Objective Questions)** **Max.Marks: 20**

Note: Answer the following Questions and each question carries **one** mark.

1. Volatility of diesel fuel oil is (d)

(a) minimum temperature to which oil is heated in order to give off inflammable vapours in sufficient quantity to ignite momentarily when brought in contact with a flame

(b) temperature at which it solidifies or congeals

(c) it catches fire without external aid

(d) indicated by 90% distillation temperature, i.e., when 90% of sample oil has distilled off

2. Which is more viscous lub oil (d)

(a) SEA 30 (b) SAE 40 (c) SAE 50 (d) SAE 80

3. In the opposed piston diesel engine, the combustion chamber is located (d)

(a) above the piston (b) below the piston (c) between the pistons (d) any when

4. A stoichiometric air-fuel ratio is (a)

(a) chemically correct mixture (b) lean mixture (c) rich mixture for idling (d) rich mixture for over loads

5. In a naturally aspirated diesel engine, the air is supplied by (c)

(a) a supercharger (b) a centrifugal blower (c) a vacuum chamber (d) an injection tube

6. In loop scavenging, the top of the piston is (b)

(a) flat (b) contoured (c) slanted (d) depressed

7. In the crankcase method of scavenging, the air pressure is produced by (d)

(a) Supercharger (b) centrifugal pump (c) natural aspirator (d) movement of engine piston

8. In order to prevent formation of carbon on the injector, the temperature of nozzle tip should be (c)

(a) less than 100°C (b) between 100-250°C (c) between 250 – 300°C (d) between 400 – 500°C

9. The thermal efficiency of a petrol engine of two stroke with crank case scavenging as compared to four stroke petrol engine with same compression ratio will be (b)

(a) higher (b) lower (c) same (d) depends on size of engine

10. Ignition quality of petrol is expressed by (a)

(a) Octane number (b) cetane number (c) calorific value (d) self-ignition temperature

11. Petrol is distilled at a temperature in range of (b)

(a) 30 – 65°C (b) 65 – 220°C (c) 220-350°C (d) 350-450°C

12. Kerosene is distilled at (c)

(a) 30 – 65°C (b) 65 – 220°C (c) 220 – 350°C (d) 350 – 450°C.

13. Self-ignition temperature of petrol is of the order of (b)

(a) 150°C (b) 240°C (c) 370°C (d) 450°C

14. Iso-octane (c)

(a) Has octane number of 0 (b) has octane number of 50 (c) has octane number of 100 (d) is an index of detonation quality

15. Octane number is determined by comparing the performance of the petrol with the following hydrocarbons (a)

(a) iso-octane (b) mixture of normal heptane and iso-oc-tane (c) alpha methyl napthalene (d) mixture of methane and ethane

16. Cetane (b)

(a) has zero cetane number (b) has 100 cetane number (c) helps detonation (d) is a straight chain paraffin

17. Ethyl fluid is used (a)

(a) to increase the octane rating of the fuel (b) to increase the cetane rating of the fuel (c) as a defrosting agent (d) as a superior type of fluid compared to others

18. Crankcase explosion in I.C. engines occurs as (d) b

(a) first a mild explosion followed by a bi explosion(b) first a big explosion followed by a mil explosion(c) both mild and big explosions occurs simultaneously(d) never occurs

19. Compression loss in I.C engines occurs due to (b)

(a) leaking piston rings(b) use of thick head gasket(c) increase in clearance volume caused b bearing-bushing wear(d) all of the above.

20. The air requirement of a petrol engine during starting compared to theoretical air required for complete combustion is (b) b

(a) more (b) loss(c) same(d) may be more or less depending on engine capacity

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K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516003
DEPARTMENT OF MECHANICAL ENGINEERING
VALUE ADDED /CERTIFICATE COURSE ON
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ASSESSMENT TEST

Roll Number: 209Y5A0302 **Name of the Student:** B. Karthik

Time: 20 Min **(Objective Questions)** **Max.Marks: 20**

Note: Answer the following Questions and each question carries **one** mark.

1. Volatility of diesel fuel oil is (d)
(a) minimum temperature to which oil is heated in order to give off inflammable vapours in sufficient quantity to ignite momentarily when brought in contact with a flame
(b) temperature at which it solidifies or congeals
(c) it catches fire without external aid
(d) indicated by 90% distillation temperature, i.e., when 90% of sample oil has distilled off

2. Which is more viscous lub oil (b)
(a) SEA 30 (b) SAE 40 (c) SAE 50 (d) SAE 80

3. In the opposed piston diesel engine, the combustion chamber is located (a)
(a) above the piston (b) below the piston (c) between the pistons (d) any when

4. A stoichiometric air-fuel ratio is (a)
(a) chemically correct mixture (b) lean mixture (c) rich mixture for idling (d) rich mixture for over loads

5. In a naturally aspirated diesel engine, the air is supplied by (C)
(a) a supercharger (b) a centrifugal blower (c) a vacuum chamber (d) an injection tube

6. In loop scavenging, the top of the piston is (b)
(a) flat (b) contoured (c) slanted (d) depressed

7. In the crankcase method of scavenging, the air pressure is produced by (a)
(a) Supercharger (b) centrifugal pump (c) natural aspirator (d) movement of engine piston

8. In order to prevent formation of carbon on the injector, the temperature of nozzle tip should be (C)
(a) less than 100°C (b) between 100-250°C (c) between 250 – 300°C (d) between 400 – 500°C

9. The thermal efficiency of a petrol engine of two stroke with crank case scavenging as compared to four stroke petrol engine with same compression ratio will be (a)
(a) higher (b) lower (c) same (d) depends on size of engine

10. Ignition quality of petrol is expressed by (a)

(a) Octane number (b) cetane number (c) calorific value (d) self-ignition temperature

11. Petrol is distilled at a temperature in range of (b)

(a) 30 – 65°C (b) 65 – 220°C (c) 220-350°C (d) 350-450°C

12. Kerosene is distilled at (c)

(a) 30 – 65°C (b) 65 – 220°C (c) 220 – 350°C (d) 350 – 450°C.

13. Self-ignition temperature of petrol is of the order of (b)

(a) 150°C (b) 240°C (c) 370°C (d) 450°C

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15. Octane number is determined by comparing the performance of the petrol with the following hydrocarbons (d)

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17. Ethyl fluid is used (a)

(a) to increase the octane rating of the fuel (b) to increase the cetane rating of the fuel (c) as a defrosting agent (d) as a superior type of fluid compared to others

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19. Compression loss in I.C engines occurs due to (b)

(a) leaking piston rings(b) use of thick head gasket(c) increase in clearance volume caused b bearing-bushing wear(d) all of the above.

20. The air requirement of a petrol engine during starting compared to theoretical air required for complete combustion is (C)

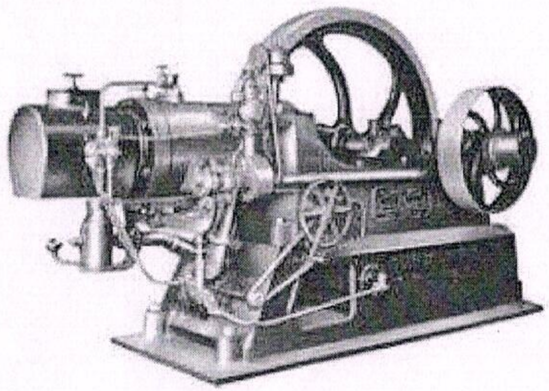
(a) more (b) loss(c) same(d) may be more or less depending on engine capacity

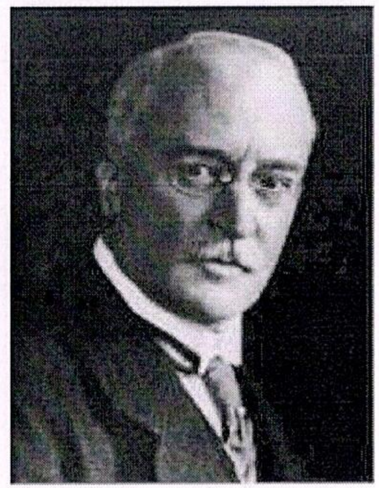
CI Engines

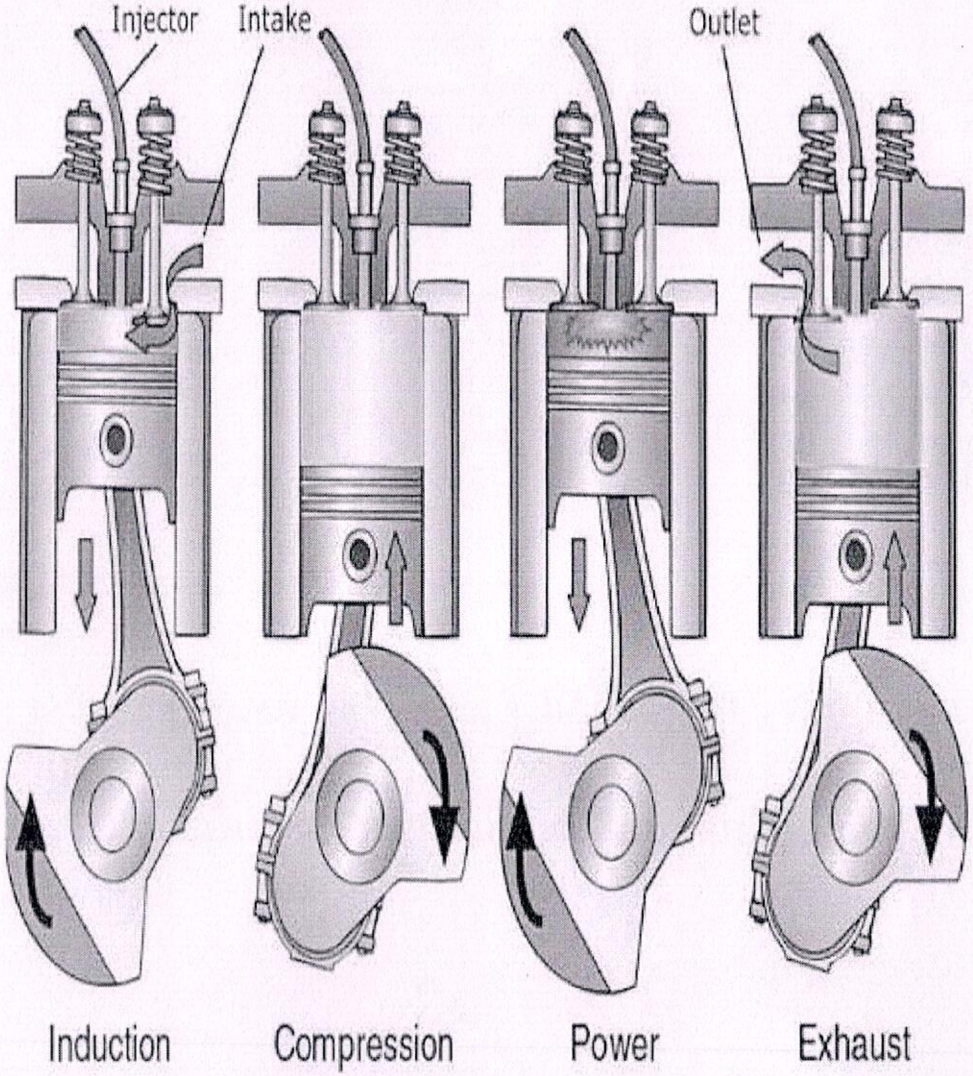
A **CI engine** is an **engine** in which the fuel charge is ignited by the heat of compression.

It is also known as Diesel Engine. On September 29, 1913, **Rudolf Diesel**,

Fuel used :- Diesel







A four-**stroke cycle engine** is an internal combustion **engine** that utilizes four distinct piston **strokes**

1.intake,

2.compression,

3.power,

4.Exhaust

to complete one operating **cycle**. The piston make two complete passes in the cylinder to complete one operating **cycle**.

Combustion in CI Engines

In CI engine A: F mixture is not homogeneous and fuel remains in liquid particles, therefore quantity of air supplied is 50% to 70% more than stiochiometric mixture. The combustion in SI engine starts at one point and generated flame at the point of ignition propagates through the mixture for burning where as in CI engine, the combustion takes place at number of points simultaneously and number of flames generated are also many. To burn the liquid fuel is more difficult as it is to evaporated it is to be elevated to ignition temperature and then burn.

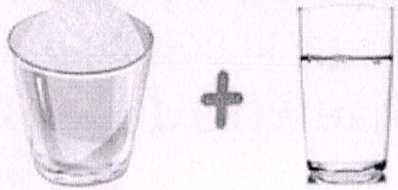
STAGES OF COMBUSTION IN CI ENGINE

The combustion in CI engine is considered to be taking place in four phases:

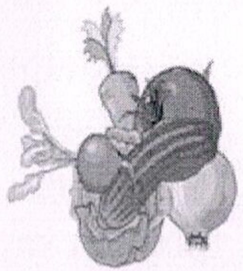
- Ignition Delay period/Pre-flame combustion
- Uncontrolled combustion
- Controlled combustion
- After burning After burning

MIXTURE

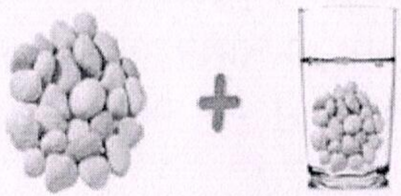
When Two or More Substances Combine together Physically.



→ MIXTURE



→ MIXTURE



→ MIXTURE

MIXTURE

- Homogeneous Mixture
- Heterogeneous Mixture

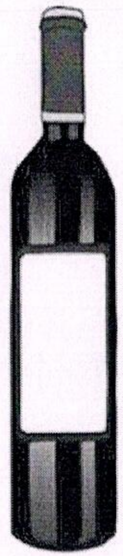
WHAT IS HOMOGENEOUS MIXTURE ?

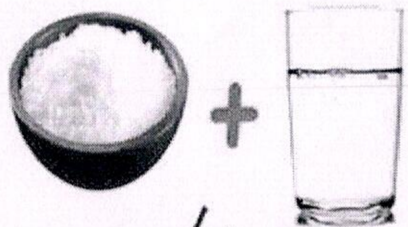
The word HOMO means " SAME".

A mixture which has Uniform Composition throughout its mass.

You can't see the Particles of Homogenous Mixture.

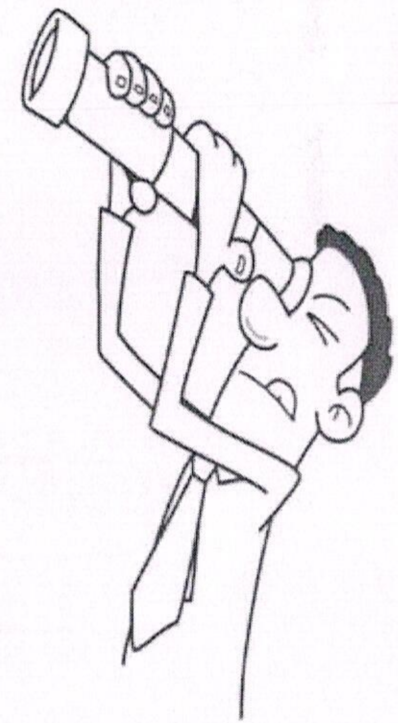
Alcohol



 → Homogeneous Mixture

AIR → Homogeneous Mixture

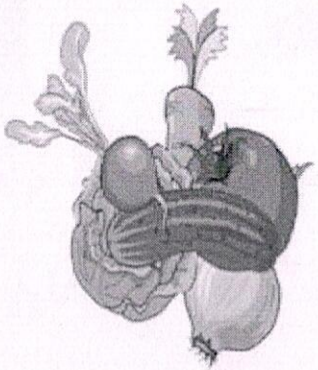
[Oxygen
Nitrogen]



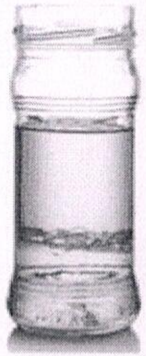
WHAT IS HETEROGENEOUS MIXTURE ?

A mixture which has Non-uniform Composition throughout its mass.

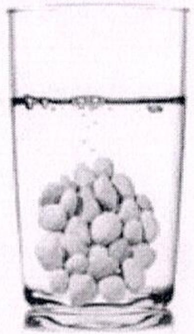
We can see the particles of Heterogeneous Mixture...



SALAD



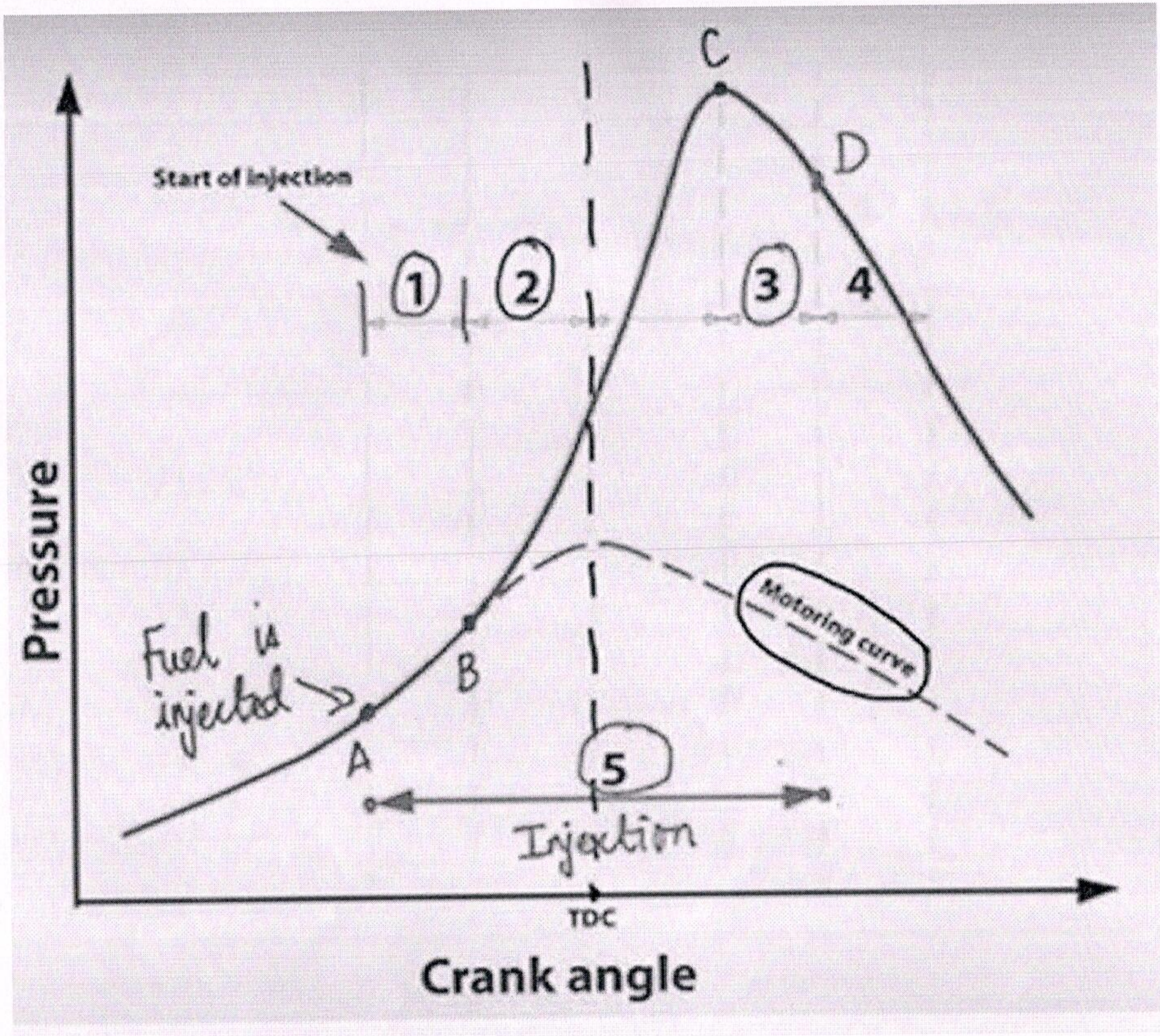
OIL AND WATER



STONES AND WATER

When we observe the Particles of Mixture.

HETEROGENOUS MIXTURE

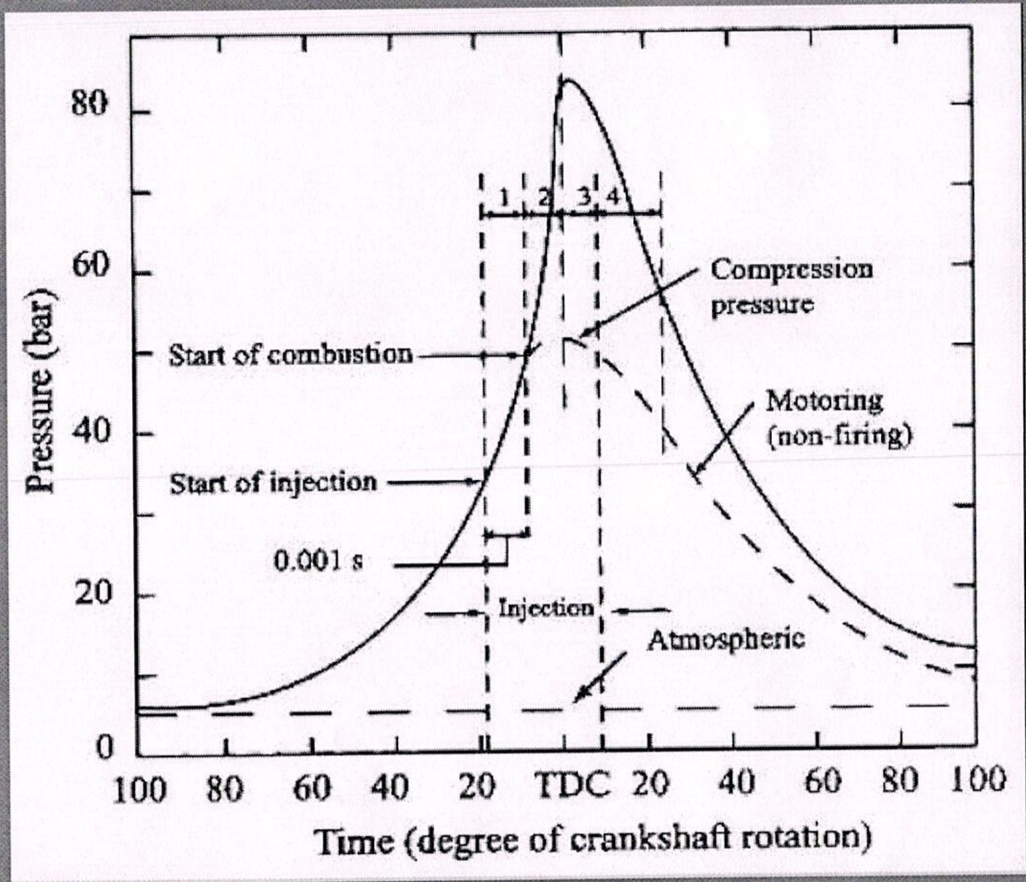


Pressure
Start of injection
1
2
3
4
C
D
Fuel is injected
A
B
Motoring curve
5
Injection
TDC
Crank angle

- ## Combustion in CI Engines

- Combustion in CI engines differ from SI engine due to the basic fact that CI engine combustion is unassisted combustion occurring on its' own.
- In CI engine the fuel is injected into combustion space after the compression of air is completed.
- Due to excessively high temperature and pressure of air the fuel when injected in atomised form gets burnt on its' own and burning of fuel is continued till the fuel is injected.
- Theoretically this injection of fuel and its' burning should occur simultaneously up to the cut-off point, but this does not occur in actual CI engine. Different significant phases of combustion are explained as under.

- Stages of Combustion in CI Engines



1) Ignition Delay Period
   - Physical delay
   - Chemical Delay
2) Uncontrolled Combustion
3) Controlled Combustion
4) After Burning

- Stages of Combustion in CI Engines

(i) Ignition Delay Period

- Injection of fuel in atomized form is initiated into the combustion space containing compressed air.
- Fuel upon injection does not get burnt immediately instead some time is required for preparation before start of combustion.
- Fuel droplet injected into high temperature air first gets transformed into vapour (gaseous form) .
- Subsequently, if temperature inside is greater than self ignition temperature at respective pressure then ignition gets set.
- Thus, the delay in start of ignition may be said to occur due to 'physical delay' i.e. time consumed in transformation from liquid droplet into gaseous form, and'chemical delay' i.e. time consumed in preparation for setting up of chemical reaction (combustion).

- ## Stages of Combustion in CI Engines

(i) Ignition Delay Period

- The duration of ignition delay depends upon fuel characteristic, compression ratio (i.e. pressure and temperature after compression), fuel injection, ambient air temperature, speed of engine, and geometry of combustion chamber etc.
- Ignition delay is inevitable stage and in order to accommodate it, the fuel injection is advanced by about 20º before TDC. Ignition delay is shown by *a – b in Fig., showing* pressure rise during combustion.
- Fuel injection begins at *'a' and ignition begins at 'b'. Theoretically, this* ignition delay should be as small as possible.

- Stages of Combustion in CI Engines

(ii) Uncontrolled Combustion

- During the ignition delay period also the injection of fuel is continued as it has begun at point '*a*' and shall continue upto the point of cut-off.
- For the duration in which preparation for ignition is made, the continuous fuel injection results in accumulation of fuel in combustion space.
- The moment when ignition just begins, if the sustainable flame front is established then this accumulated fuel also gets burnt rapidly.
- This burning of accumulated fuel occurs in such a manner that combustion process becomes uncontrolled resulting into steep pressure rise as shown from '*b*' *to* '*c*'.
- *The uncontrolled burning* continues till the collected fuel gets burnt.
- During this 'uncontrolled combustion' phase if the pressure rise is very abrupt then combustion is termed as 'abnormal combustion' and may even lead to damage of engine parts in extreme conditions.

- ## Stages of Combustion in CI Engines

(ii) Uncontrolled Combustion

- Thus, it is obvious that 'uncontrolled combustion' depends upon the 'ignition delay' period as during ignition delay itself the accumulation of unburnt fuel occurs and its' burning results in steep pressure rise.
- Hence in order to have minimum uncontrolled combustion the ignition delay should be as small as possible.
- During this uncontrolled combustion phase about one-third of total fuel heat is released.

- Stages of Combustion in CI Engines

(iii) Controlled Combustion

- After the 'uncontrolled combustion' is over then the rate of burning matches with rate of fuel injection and the combustion is termed as 'controlled combustion'.
- Controlled combustion is shown between *'c' to 'd' and during this phase maximum of heat gets evolved in controlled manner.*
- *In controlled* combustion phase rate of combustion can be directly regulated by the rate of fuel injection i.e. through fuel injector.
- Controlled combustion phase has smooth pressure variation and maximum temperature is attained during this period.
- It is seen that about two-third of total fuel heat is released during this phase.

- Stages of Combustion in CI Engines

(iv) After Burning

- After controlled combustion, the residual if any gets burnt and the combustion is termed as 'after burning'.
- This after burning may be there due to fuel particles residing in remote position in combustion space where flame front could not reach.
- 'After burning' is spread over 60 - 70º of crank angle rotation and occurs even during expansion stroke.

- Combustion in CI Engines

Abnormal Combustion

- Thus, it is seen that the complete combustion in CI engines may be comprising of four distinct phases i.e. 'ignition delay' followed by 'uncontrolled combustion,' 'controlled combustion' and 'after burning'.
- Combustion generally becomes abnormal combustion in CI engines when the ignition delay is too large resulting into large uncontrolled combustion and zig-zag pressure rise.
- Abnormal combustion in CI engines may also be termed as 'knocking' in engines and can be felt by excessive vibrations, excessive noise, excessive heat release, pitting of cylinder head and piston head etc.
- In order to control the knocking some additives are put in CI engine fuel so as to reduce its' self ignition temperature and accelerate ignition process.
- Also, the combustion chambers are properly designed so as to have reduced physical and chemical delay.

- ## Factors affecting Delay Period in CI Engines
  - Compression Ratio
    Increase in CR increases the temperature of air. Autoignition temperature decreases with increased density. Both these reduce the delay period(DP).
  - Engine Power Output
    With an Increase in engine power, the operating temperature increases. A/F ratio decreases and delay period decreases
  - Engine Speed
    Delay period decreases with increasing engine speed, as the temperature and pressure of compressed air rises at high engine speeds.
  - Injection Timing
    The temperature and pressure of air at the beginning of injection are lower for higher injection advance. The DP increases with increase in injection advance or longer injection timing. The optimum angle of injection is 20° BTDC
  - Atomization of fuel
    Higher fuel injection pressures increase the degree of atomization. The fineness of atomization reduces the DP due to higher A/V ratio of the spray droplets.

- Factors affecting Delay Period in CI Engines
  - Injection Pressure
    Increase injection pressure reduces the auto ignition temperature and hence decreases DP.
  - Intake Temperature
    High intake temperature increase the air temperature after compression , which reduces DP.
  - Engine Size
    Large engines operate at lower speeds, thus increasing the DP in terms of crank angle.
  - Cetane No.
    Fuels with high cetane no. Have lower DP.
  - F/A ratio
    With increasing F/A ratio, operating temperature increases and thus DP decreases.
  - Injection Duration
    Increase in injection duration, results in higher quantity of fuel injected which reduces DP.

- Comparison of Knocking in SI and CI Engines

Parameter	SI Engines	CI Engines
Timing	Occurs at the end of combustion	Occurs at the beginning of combustion
Major Cause	Auto ignition of end charge	Ignition of accumulated fresh charge
Pre-Ignition	Possible as the fuel air mixture is compressed	Not possible as only air is compressed

- Parameters which reduce knocking in SI and CI Engines

S.No.	Parameter	SI Engines	CI Engines
1	Self Ignition Temperature of fuel	High	Low
2	Ignition Delay	Long	Short
3	Inlet Temperature	Low	High
4	Inlet Pressure	Low	High
5	Compression Ratio	Low	High
6	Speed	Low	High
7	Combustion Chamber Wall Temperature	Low	High
8	Cylinder Size	Small	Large

COMBUSTION CHAMBER FOR CI ENGINES

Combustion Chamber Characteristics

- The proper design of a combustion chamber is very important.
- In a Cl engine the fuel is injected during a period of some 20 to 35 degrees of crank angle.
- In this short period of time an efficient preparation of the fuel-air charge is required, which means:
  - An even distribution of the injected fuel throughout the combustion space, for which it requires a directed flow or swirl of the air.
  - A thorough mixing of the fuel with the air to ensure complete combustion with the minimum excess air, for which it requires an air swirl or squish of high intensity.

COMBUSTION CHAMBER FOR CI ENGINES

Combustion Chamber Characteristics

An efficient smooth combustion depends upon:

- A sufficiently high temperature to initiate ignition; it is controlled by the selection of the proper compression ratio.
- A small delay period or ignition lag.
- A moderate rate of pressure rise during the second stage of combustion.
- A controlled, even burning during the third stage; it is governed by the rate of injection.
- A minimum of afterburning.
- Minimum heat losses to the walls. These losses can be controlled by reducing the surface- to-volume ratio.

The main characteristics of an injection system that link it with a given combustion chamber are atomization, penetration, fuel distribution, and the shape of the fuel spray.

Classification of CI Engine Combustion Chambers

(a) direct-injection (DI) engines, which have a single open combustion chamber into which fuel is injected directly;

(b) (b) indirect-injection (IDI) engines, where the chamber is divided into two regions and the fuel is injected into the pre-chamber which is situated above the piston crown and is connected to the main chamber via a nozzle or one or more orifices.

DIRECT INJECTION (DI) ENGINES OR OPEN COMBUSTION CHAMBER ENGINES

An open chamber has the entire compression volume in which the combustion takes place in one chamber formed between the piston and the cylinder head.

The shape of the combustion chamber may create swirl or turbulence to assist fuel and air.

- Swirl denotes a rotary motion of the gases in the chamber more or less about the chamber axis.
- Turbulence denotes a haphazard motion of the gases.

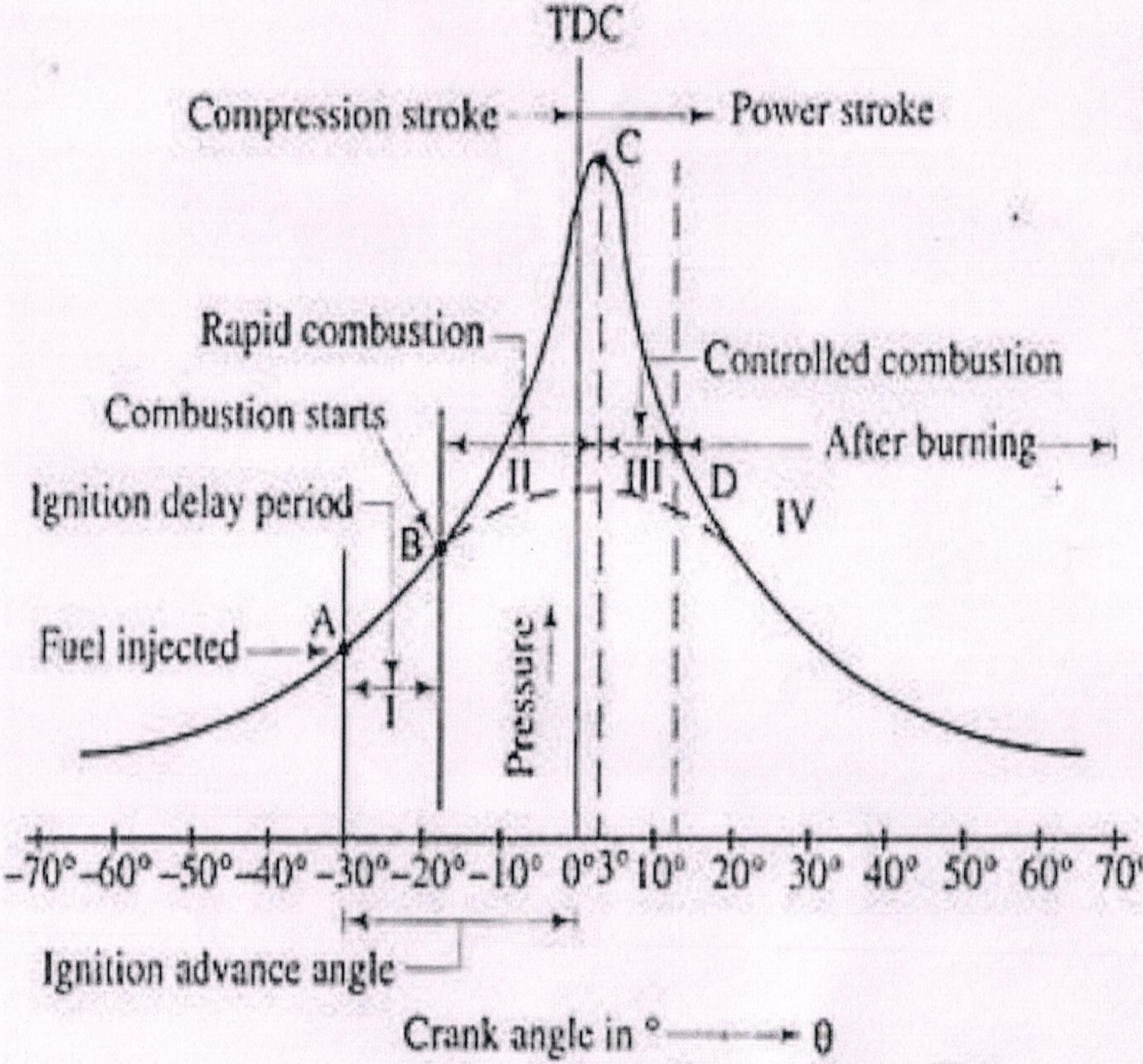
In this combustion chamber, the mixing of fuel and air depends entirely on the spray characteristics and on air motion, and it is not essentially affected by the combustion process. In this type of engine, the spray characteristics must be carefully arranged to obtain rapid mixing.

Fuel is injected at high injection pressure and mixing is usually assissted by a swirl, induced by directing the inlet air tangentially, or by a squish which is the air motion caused by a small clearance space over part of the piston.

Swirl is defined as the organized rotation of charge about the cylinder axis. Swirl is created by bringing an intake flow into the cylinder with an initial angular momentum. Swirl is used in CI engine concepts to promote more rapid mixing between the inducted air charge and the injected fuel.

Squish is **an effect in internal combustion engines which creates sudden turbulence of the air-fuel mixture as the piston approaches top dead centre (TDC)**

Tumble in IC engines is **the rotational motion of the incoming air/fuel charge in a plane approximately normal to the crankshaft on a four-valve head**.



Phases of combustion

I – Ignition delay period

II – Rapid combustion

III – Controlled combustion

IV – After burning

Normal combustion in C.I. engine

Delay period in CI Engine

The ignition **delay** in a **diesel engine** is defined as the time interval between the start of injection and the start of combustion.

This **delay period** consists of

(a) Physical **delay**, wherein atomization, vaporization and mixing of air fuel occur Chemical **delay** attributed to pre-combustion reactions. However, it depends on the temperature of the surroundings and high temperatures, the chemical reactions are faster and the physical delay.

$$\text{Total delay period} = \text{Physical delay} + \text{Chemical delay}$$

$$T_t = tp + tc,$$

In CI engine $tp >> tc$,

In SI engine In SI engine $tp \approx 0$

EFFECT OF VARIOUS FACTORS ON DELAY PERIOD IN CI ENGINE

Many design and operating factors affect the delay period. The important ones are:

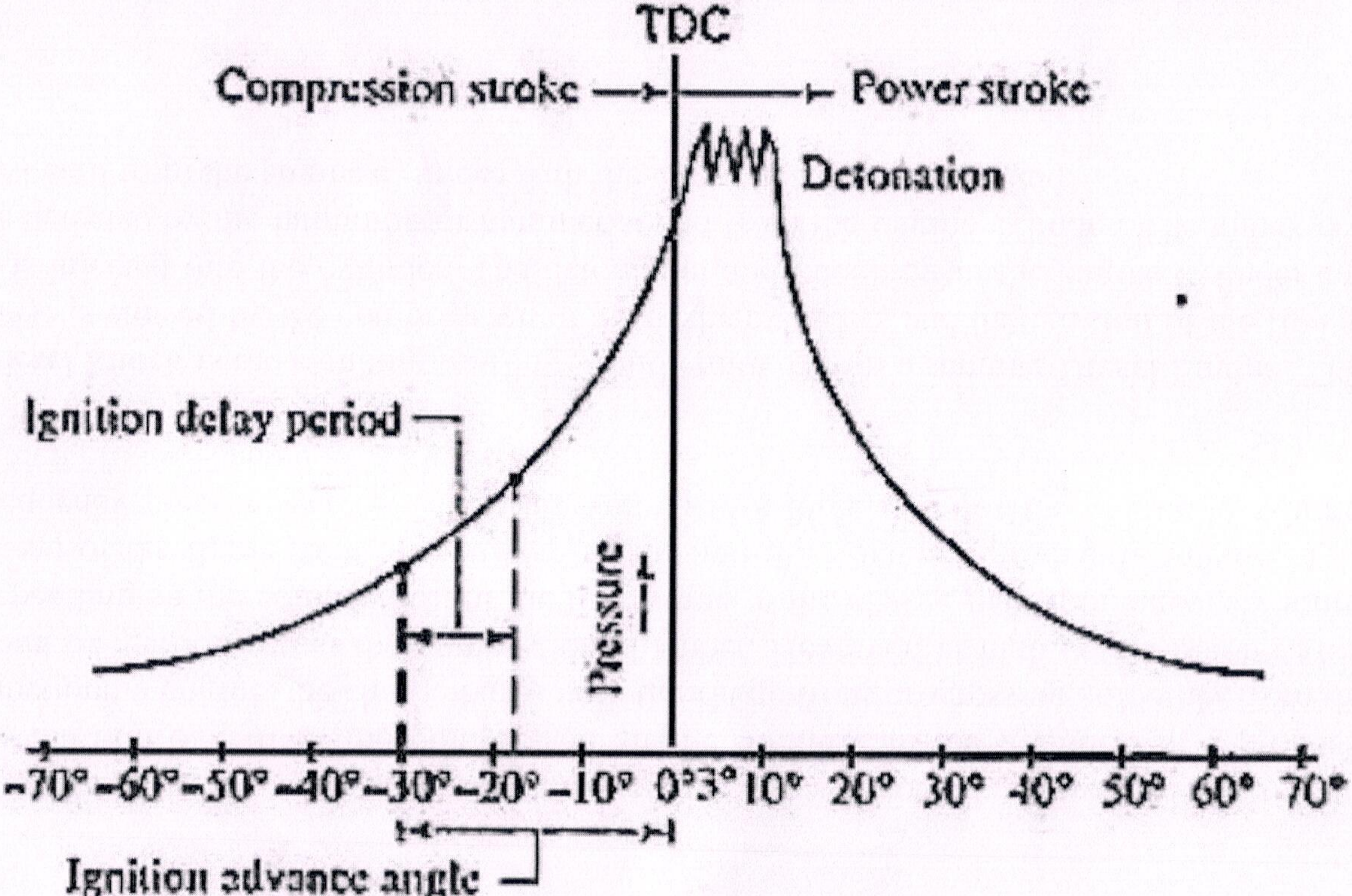
1. Compression ratio
2. Engine speed
3. Output
4. Injection timing
5. Quality of the fuel
6. Intake temperature and pressure

SN	Variable	Effect on delay period	Reason
1.	Cetane number of fuel	Reduces	Reduces self-ignition temperature
2.	Injection pressure	Reduces	Greater surface volume ratio, less physical delay
3.	Injection advance angle	Increases	Pressures and temperatures lower when injection begins
4.	Compression ratio	Reduces	Increases air temperature and pressure and reduces auto-ignition temperatures.
5.	Intake temperature	Reduces	Increases air temperature
6.	Intake Pressure	Reduces	Increase in density reduces auto-ignition temperature
7.	Speed of engine	Reduces in milli-seconds but increases in crank angle	Less loss of heat more crank angle in a given time
8.	Load(fuel-air-ratio)	Decreases	Operating temperature increases

Diesel knock

Knocking, in an internal-combustion engine, sharp sounds caused by premature combustion of part of the compressed air-fuel mixture in the cylinder. In a properly functioning engine, the charge burns with the flame front progressing smoothly from the point of ignition across the combustion chamber. However, at high compression ratios, depending on the composition of the fuel, some of the charge may spontaneously ignite ahead of the flame front and burn in an uncontrolled manner, producing intense high-frequency pressure waves. These pressure waves force parts of the engine to vibrate, which produces an audible knock.

Diesel knock is the clanking, rattling sound emitted from a running **Diesel** Engine. This noise is **caused** by the compression of air in the cylinders and the ignition of the fuel as it is injected into the cylinder. The detonation and knocking in the engine cylinder can be detected by the humming or hammer sound from the engine cylinder. The knock can be heard from the engine cylinder with the continuous metallic sound.



Detonation or knocking in C.I. engine

FACTORS AFFECTING DETONATION OR KNOCKING

(i) Compression Ratio:

The compression ratio of the engine is the main factor affecting the detonation or knocking in the .I.C engine. Since the combustion in the C.I. engine is mainly because of self-ignition of fuel. The minimum compression ratio is required in the C.I. is 12 for diesel fuel. The compression ratio is mainly dependent on the clearance volume and total volume of the engine cylinder. The high compression ratio is desirable in the engine because the possibility of self-ignition of fuel increases with increase in compression ratio. But due to mechanical constraint CR is limited to 22.

(ii) Speed of the Engine:

The speed of the engine affects the possibility of detonation or knocking in C.I. engine. Increase in the speed of the engine reduces the time for transfer heat to cooling system and gas temperature is higher which reduces the possibility of detonation in C.I. engine.

(iii) Quality of Fuel:

The quality of fuel is a very important factor. If the fuel quality is poor then the combustion of fuel occurs by delayed self-ignition of fuel which will be responsible for detonation or knocking in C.I. engine.

METHODS OF CONTROLING DIESEL KNOCK

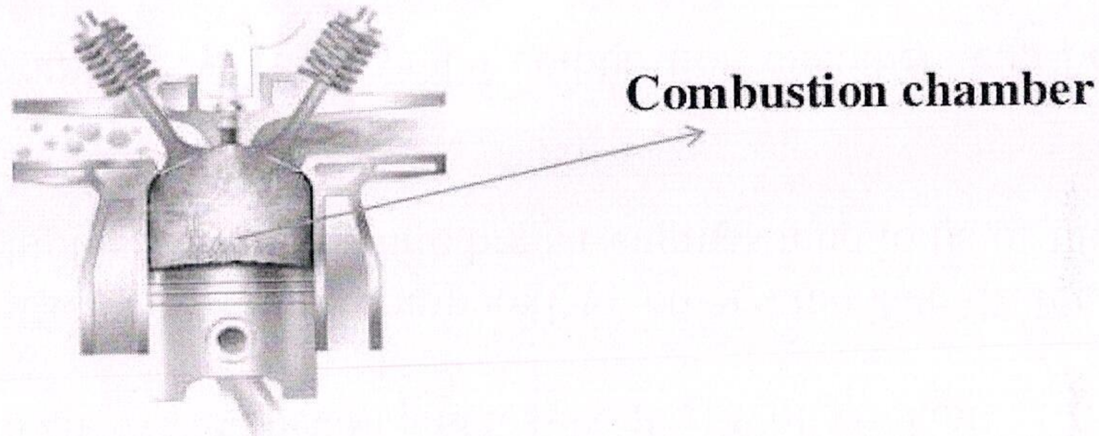
1. Using a better fuel.
2. Controlling the Rate of Fuel Supply
3. Knock reducing fuel injector
4. By using Ignition accelerators
5. Increasing Swirl

COMPARISON OF KNOCK IN SI AND CI ENGINES

S. No.	*Factors Affecting Knock*	*S.I. Engines*	*C.I. Engines*
1.	Self ignition temperature	High	Low
2.	Delay period of fuel	Long	Short
3.	Compression Ratio	Low	High
4.	Inlet Temperature	Low	High
5.	Inlet Pressure	Low	High
6.	Speed	High	Low
7.	Cylinder Size	Small	Large
8.	Combustion chamber wall Temperature	Low	High

Various types of combustion chambers

COMBUSTION CHAMBER -An enclosed space in which combustion takes place, especially in an engine or furnace.



CI engine combustion chambers are classified into two categories

- Direct-Injection (DI)
- Indirect-Injection (IDI)

Direct-Injection (DI)

✓This type of combustion chamber is also called an open combustion chamber.

✓In this type the entire volume of the combustion chamber is located in the main cylinder and the fuel is injected into this volume.

✓ Its use is increasing due to their more economical fuel consumption (up to 20% savings)

FEATURES OF DIRECT INJECTION COMBUSTION CHAMBERS-

➢For DI engine, ω piston crown recess is most widely used. In this design, the fuel is injected directly into the cylinder chamber.

➢Lower combustion surface wall area compared to combustion volume in comparison with IDI.

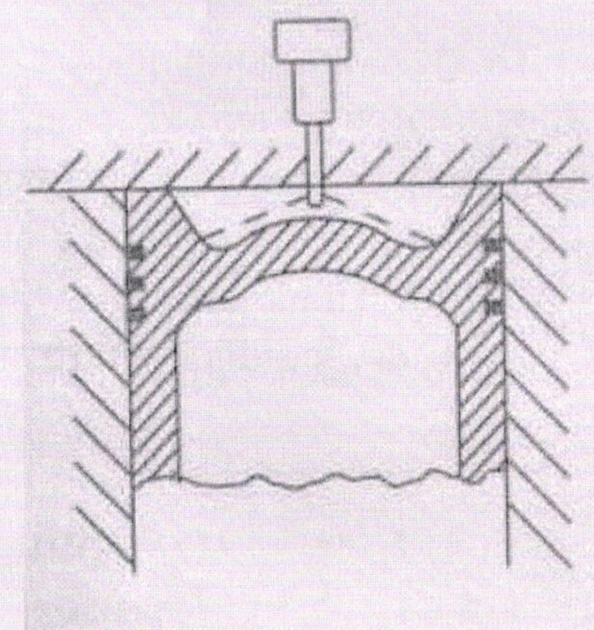
➢More combustion taking place in and on the piston and less contact with coolant.

➢DI chamber has highest fuel efficiency rating compared to other chamber design. Smaller engines tend to be of the high-swirl type, while bigger engines tend to be of the quiescent type.

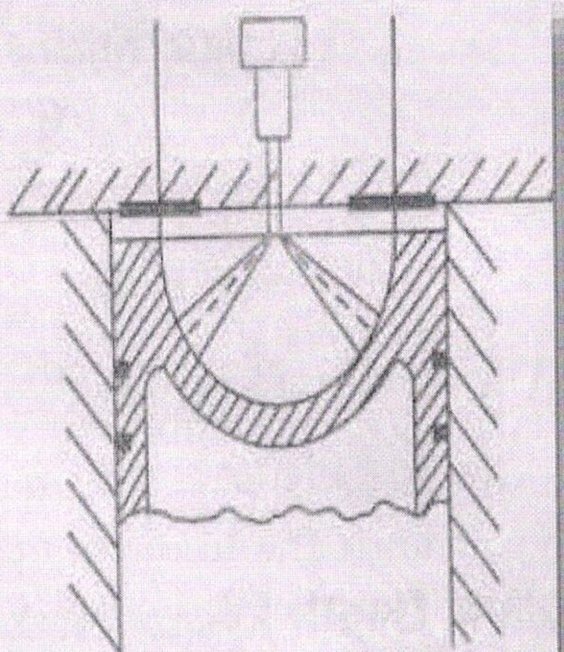
Classification of direct injection combustion chamber DI combustion chambers can be classified as

(a) Shallow depth chamber,
(b) Hemispherical chamber,
(c) Cylindrical chamber,
(d) Toroidal chamber

SHALLOW DEPTH CHAMBER :-The shallow depth combustion chamber has large diameter cavity in the piston. The depth of the cavity is moderately small. This chamber is normally used for large engines running at low speeds, since the squish is negligible.



(a) Shallow depth chamber

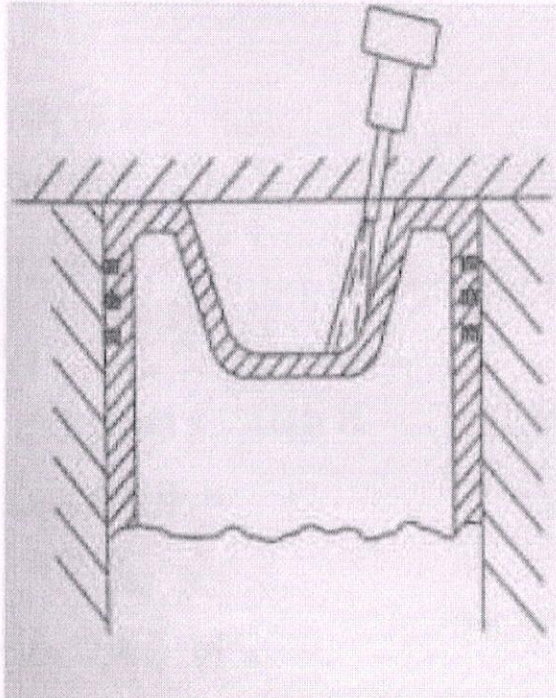


(b) Hemispherical chamber

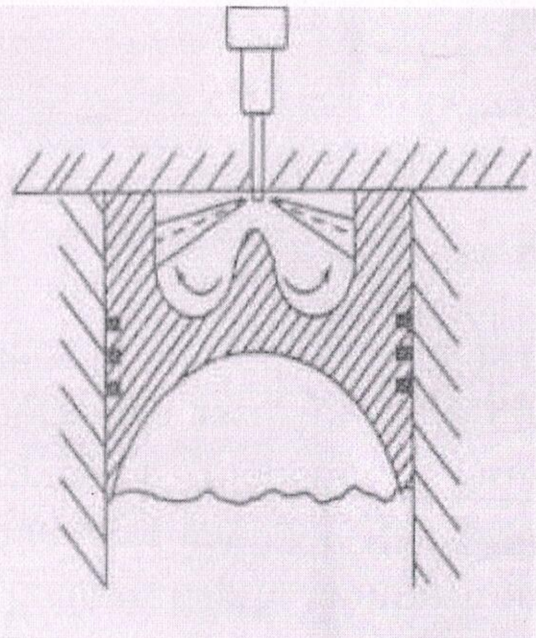
HEMISPHERICAL CHAMBER The hemispherical combustion chamber provides small squish and swirl. However, in this chamber, the depth to diameter ratio can be varied to give any desired squish for engine better performance

CYLINDRICAL CHAMBER :-

Cylindrical combustion chamber is a modified version of the hemispherical chamber. It has cavity in the form of a truncated cone with a base angle of 30 degree. The swirl was produced by masking the valve for nearly 180 degree to the circumference. Squish can also be varied by varying the depth.



(c) Cylindrical chamber



(d) Toroidal chamber

TOROIDAL CHAMBER:-

The toroidal combustion chamber provides a powerful squish along with the swirl in form of smoke ring within the chamber. Due to powerful squish the mask needed on inlet valve is small and there is better utilization of oxygen. The cone angle of spray for this type of chamber is 150 to 160 degree.

INDIRECT-INJECTION (IDI) TYPE :-

In this type of combustion chambers, the combustion space is divided into two parts, one part in the main cylinder and the other part in the cylinder head.

The fuel-injection is effected usually into that part of the chamber located in the cylinder head.

These chambers are classified further into:-

- **Pre combustion chamber** -in which combustion swirl is induced.
- **Swirl chamber** -in which compression swirl is generated.
- **Air cell chamber** -in which both compression and combustion swirl are induced

THE MAIN ADVANTAGES OF THE INDIRECT-INJECTION COMBUSTION CHAMBERS ARE:

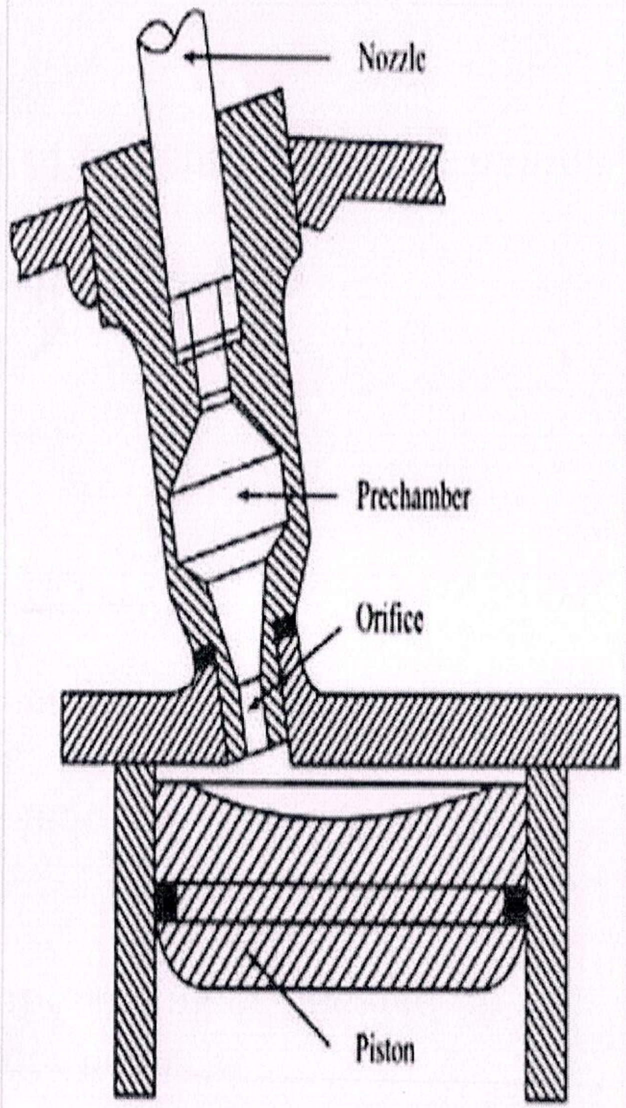
- ✓ injection pressure required is low .
- ✓ direction of spraying is not very important.

These chambers have the following serious drawbacks which have -

- ✓ Poor cold starting performance requiring heater plugs.
- ✓ Specific fuel consumption is high because there is a loss of pressure due to air motion through the duct and heat loss due to large heat transfer area.

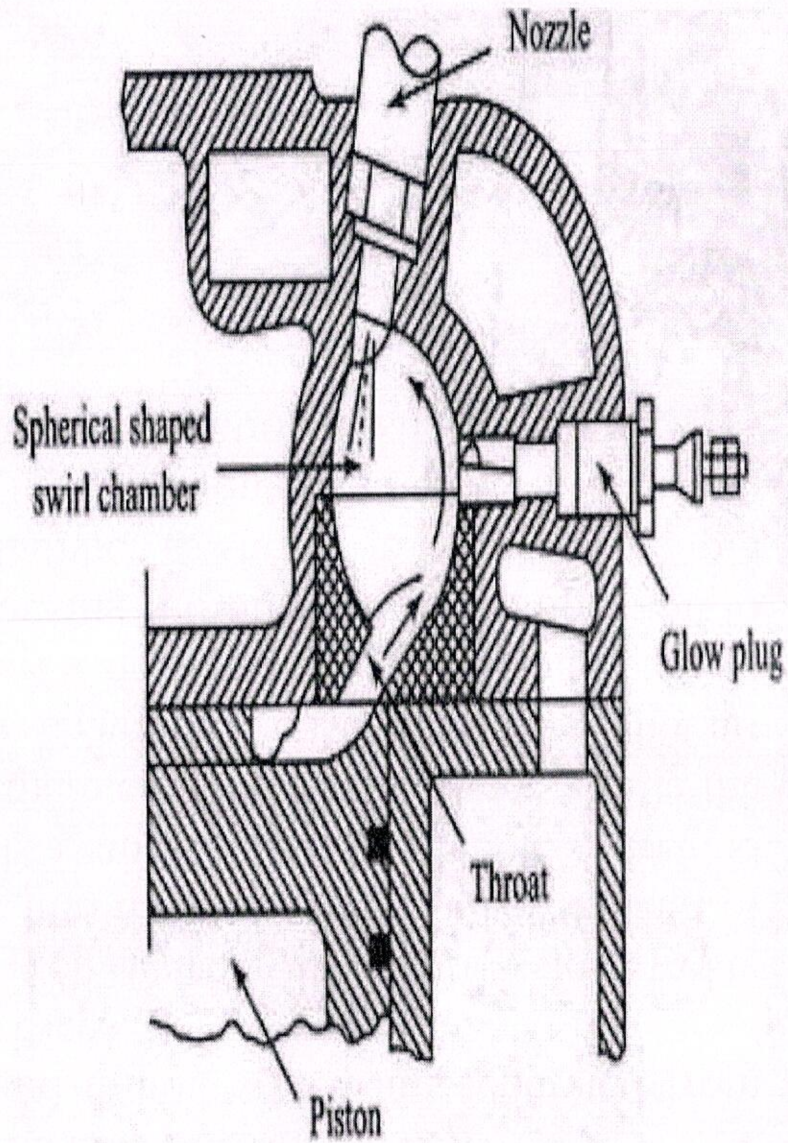
PRE-COMBUSTION CHAMBER :-

The combustion space is divided into pre-chamber and a spherical combustion space. The pre-combustion chamber is mounted in a heat resisting alloy in the cylinder head slightly to one side of the single inlet and exhaust valve seats. During the compression stroke, as piston approaches TDC, 40% to 50% of compressed air is forced through the nozzle holes and parallel throat passage where it is exited into a vigorous and highly turbulent mass. The fuel is injected through a pintle nozzle. It has a specially shaped baffle in the centre of the chamber diffuses the jet of fuel that strikes it and mixes it thoroughly with the air. The resulting pressure from burning charge forces burnt and unburnt charge through the throat into the piston crown. The thrust of combustion a gases project the directional jet of flame-fronts towards the cylinder walls and, in doing so, sweeps the burnt gases and soot to one side while exposing the remaining fuel vapor to fresh oxygen.



SWIRL CHAMBER SYSTEM :-

The swirl indirect injection combustion chamber is divided in two chambers. The upper half is a sphere swirl chamber, cast directly in the cylinder head, and the lower half is a separate a twin disc shaped recesses in the piston crown as shown in Fig.4. The combustion is initiated in the swirl chamber that has approximately 60% of the compression volume. As soon as combustion starts in swirl chamber, the air-fuel mixture is forced under pressure through the throat into the cylinder chamber, where it is turbulently mixed with the remaining compressed air as shown in Fig:-

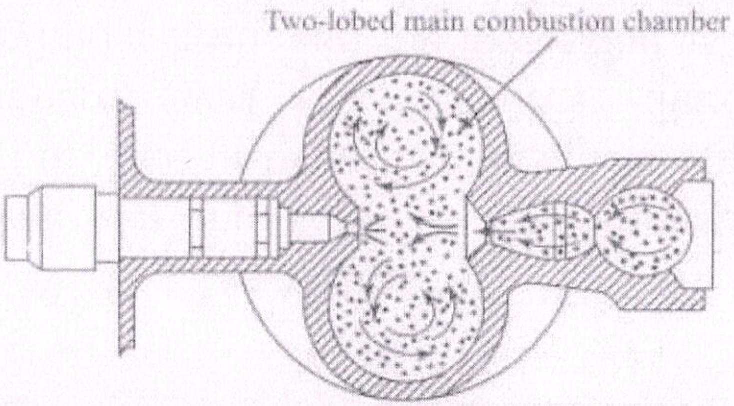


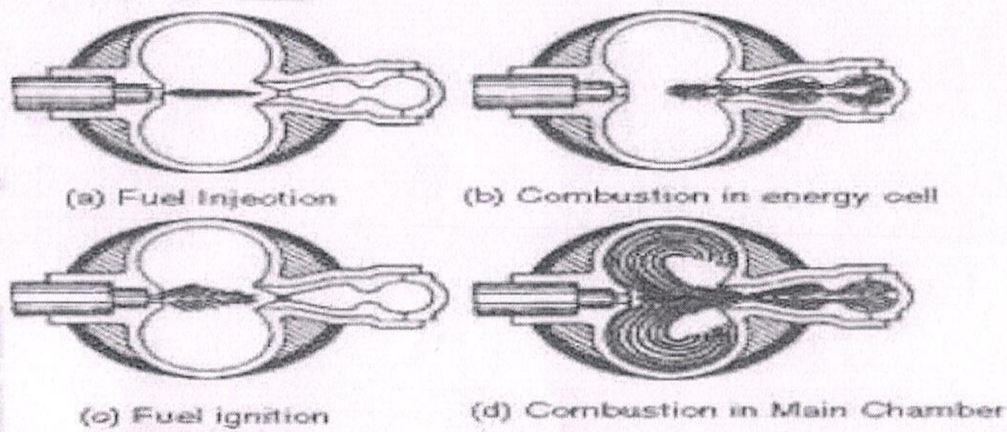
AIR-CELL CHAMBER :-

This chamber is divided into the main combustion chamber and energy cell.

The energy cell is divided into two parts, major and minor, which are separated from each other and from the main chamber by narrow orifices.

The high degree turbulence is created by an energy cell. During the compression stroke, the piston forces a small amount of compressed air into the energy cell. Near the end of compression stroke, a pintle nozzle injects the fuel, a small quantity of fuel is directed into the cell and remaining amount is injected into main combustion chamber. While the fuel charge is travelling across the centre of the main chamber, the fuel mixes with hot air and instantaneously burns. The remainder of the fuel enters the energy cell and start to burn. At this moment cell pressure rises sharply, causing the products of combustion to flow at high velocity back into main combustion chamber as shown in Fig. This setup a rapid swirling movement of burning charge in each lobe of main chamber promoting fuel air mixing within remaining charge to ensure complete combustion as shown in Fig.





EMISSION CONTROL TECHNOLOGIES IN I C ENGINES

Need for Emission control

- Global warming
- Toxic gases harmful to all living beings
- Stringent emission norms

Major pollutants

- Carbon monoxide
- Unburnt hydrocarbons
- Oxides of nitrogen
- Carbon dioxide
- Particulates/ Smoke

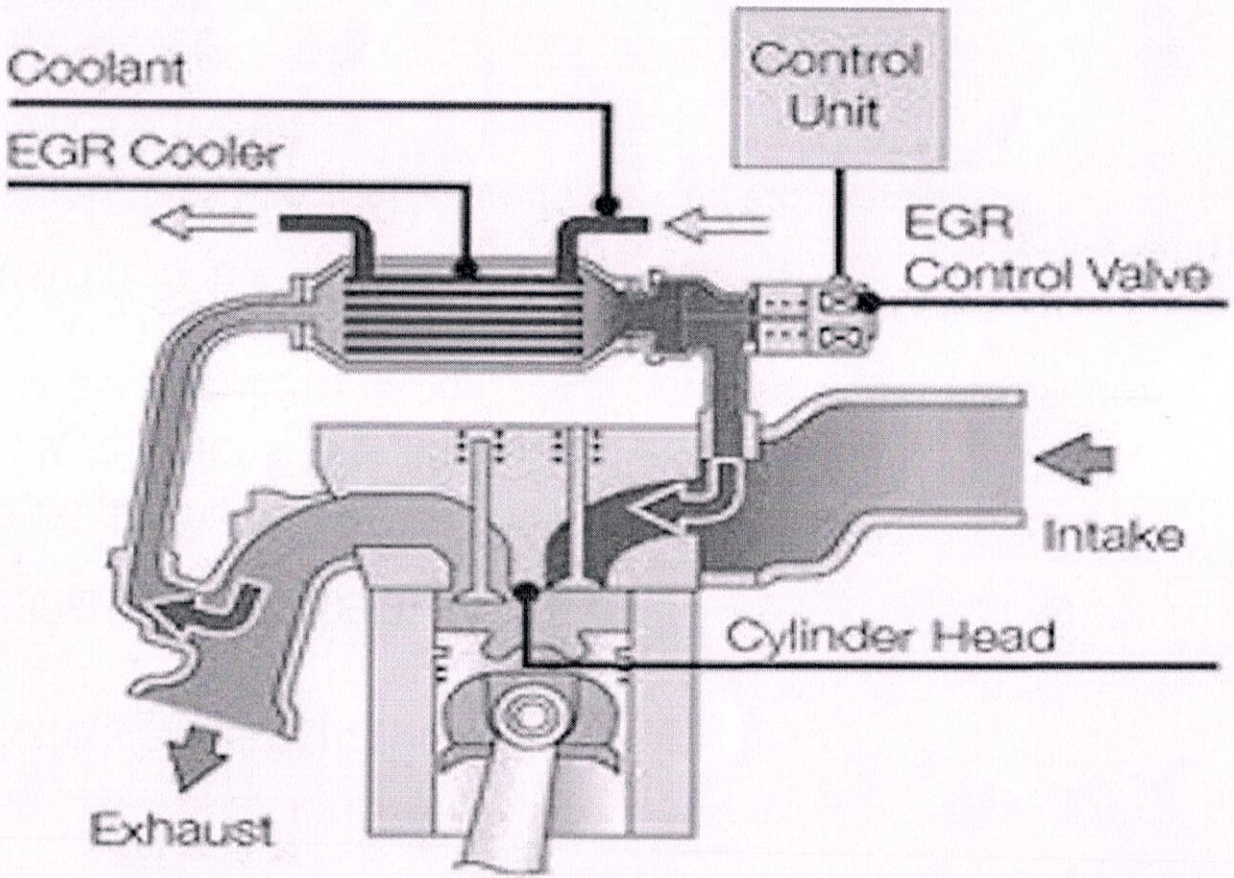
Phenomenon of formation of pollutants

- Incomplete combustion
  - Improper Air/Fuel ratio
  - Poor spray pattern or poor atomization
  - Improper mixing of air and fuel
  - Overcooling of engine
- Higher peak temperature in cylinder

Emission control technologies

- Cranckcase ventilation
- In cylinder treatment
  - Exhaust gas re-circulation
  - Multiple injections (Common rail diesel injection)
  - Proper spray pattern, atomization and use of high pressure
- Exhaust gas treatment
  - Oxidation near exhaust valve (Thermal Converter)
  - Catalytic convertor
  - Particulate filter
  - Urea injection

Exhaust gas recirculation



- Reduction in oxides of nitrogen
- Increase in UBHC and Carbon monoxide

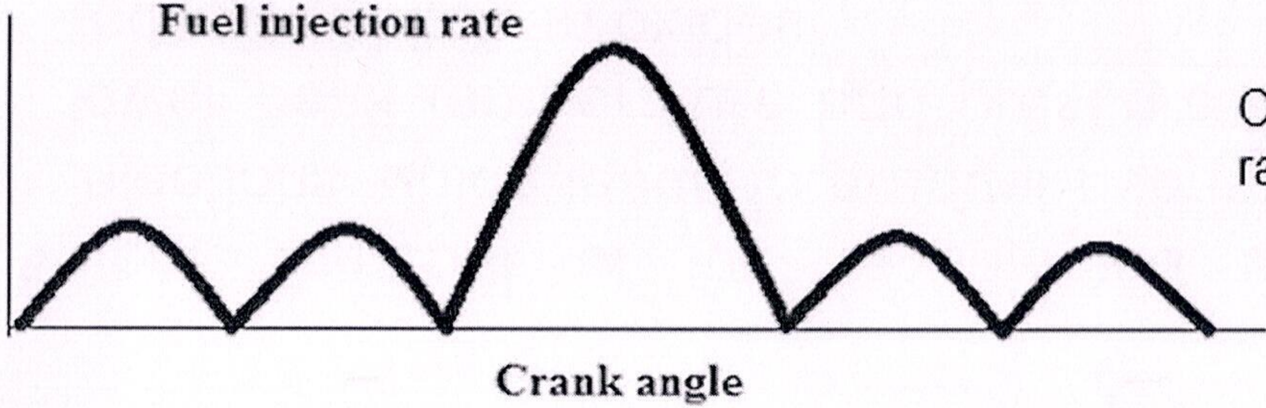
Multiple injections

- Reduces oxides of nitrogen and CO and unburnt hydrocarbon simultaneously

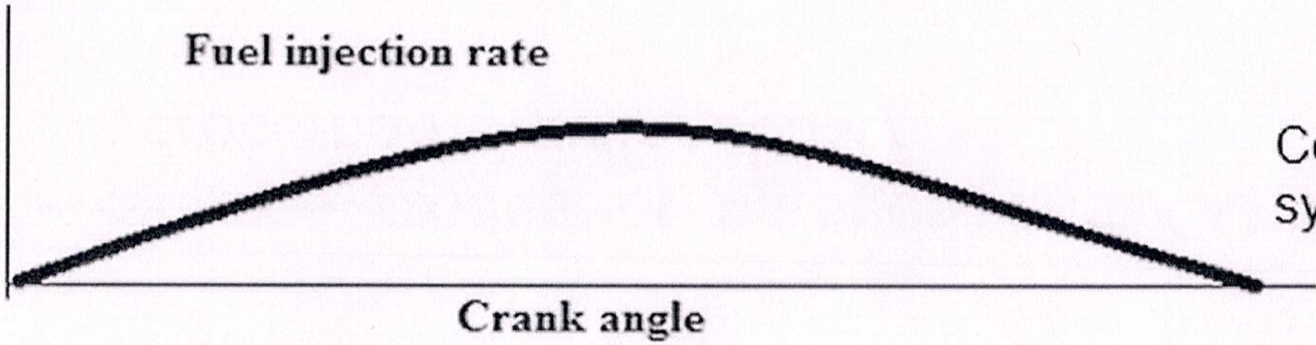
- Injecting fuel in single injection leads to higher peak temperature and pressure

- Same amount of fuel is injected using multiple injections which leads to gradual rise in temperature / lower peak temperature and pressure . This helps in reducing Nitrogen oxides

Multiple injection strategy

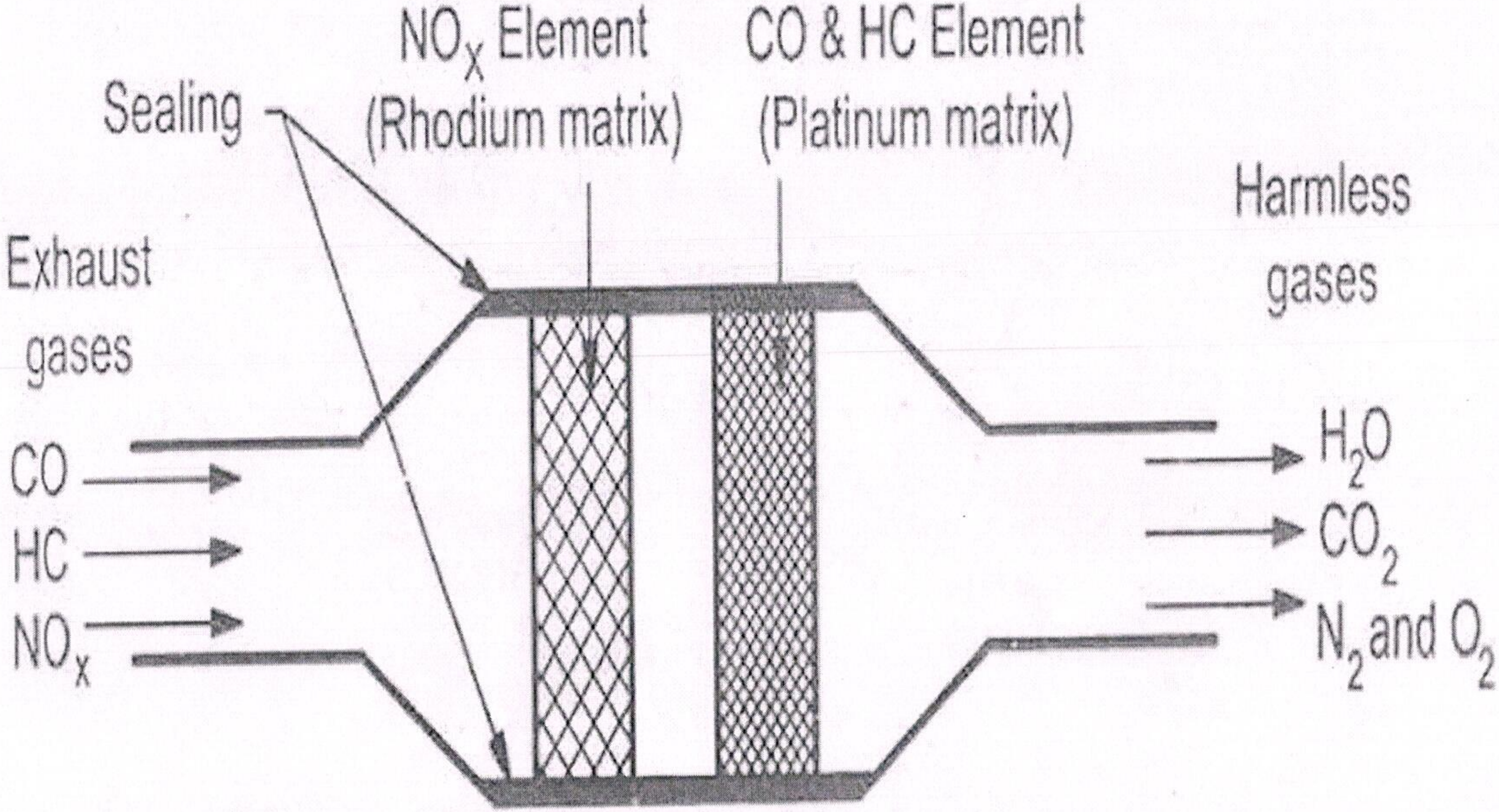


Common rail system

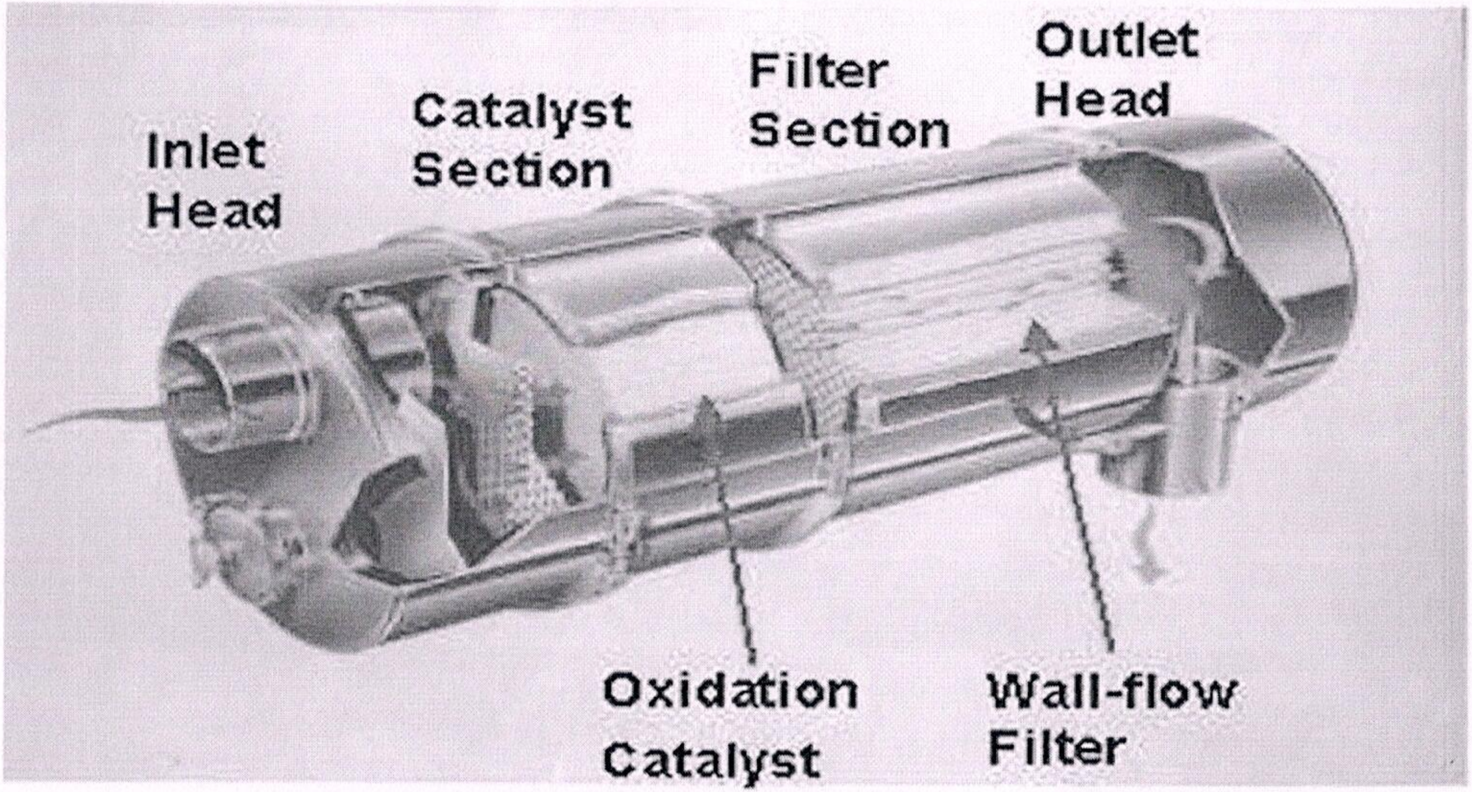


Conventional FI system

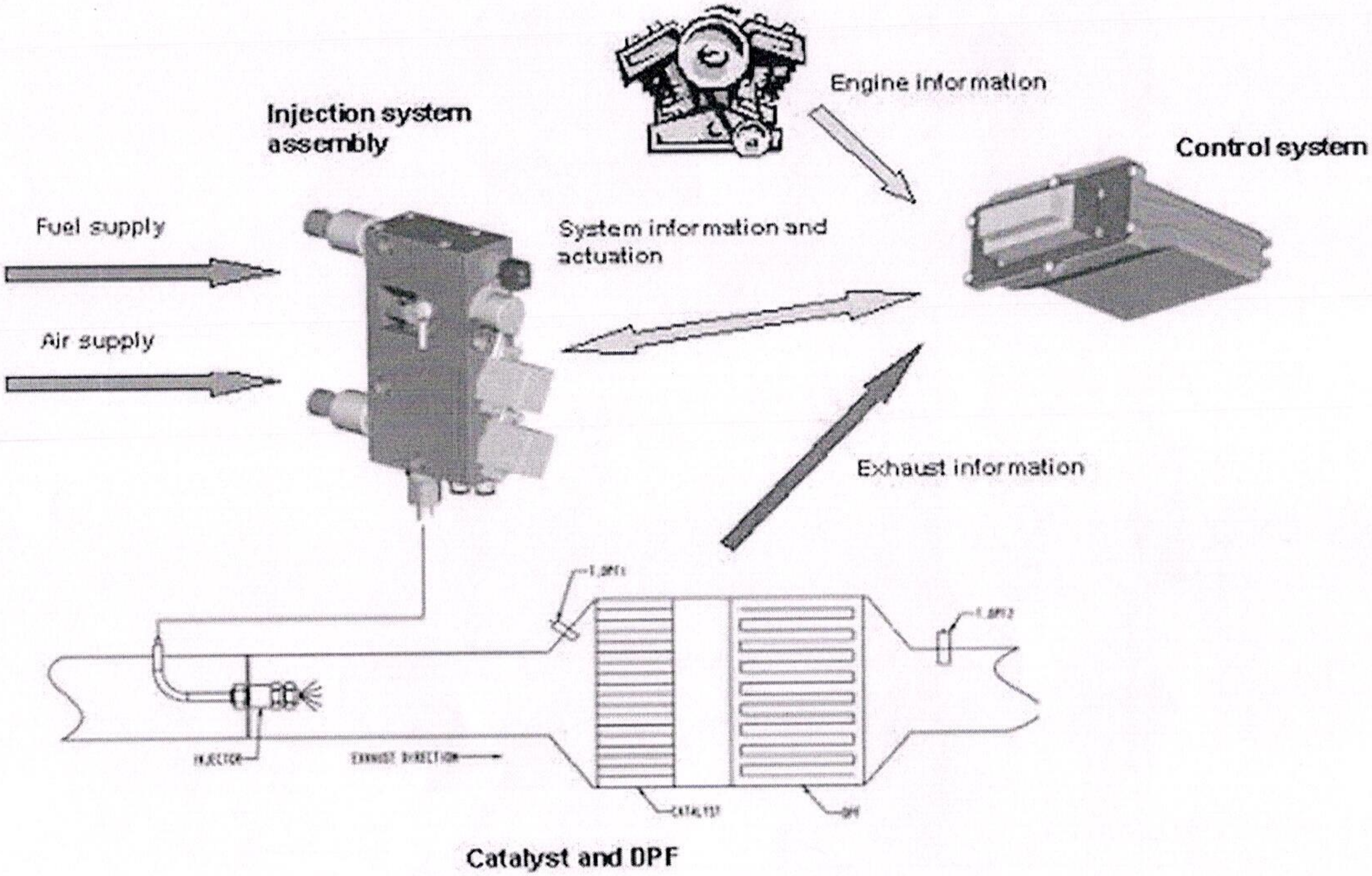
Catalytic convertor

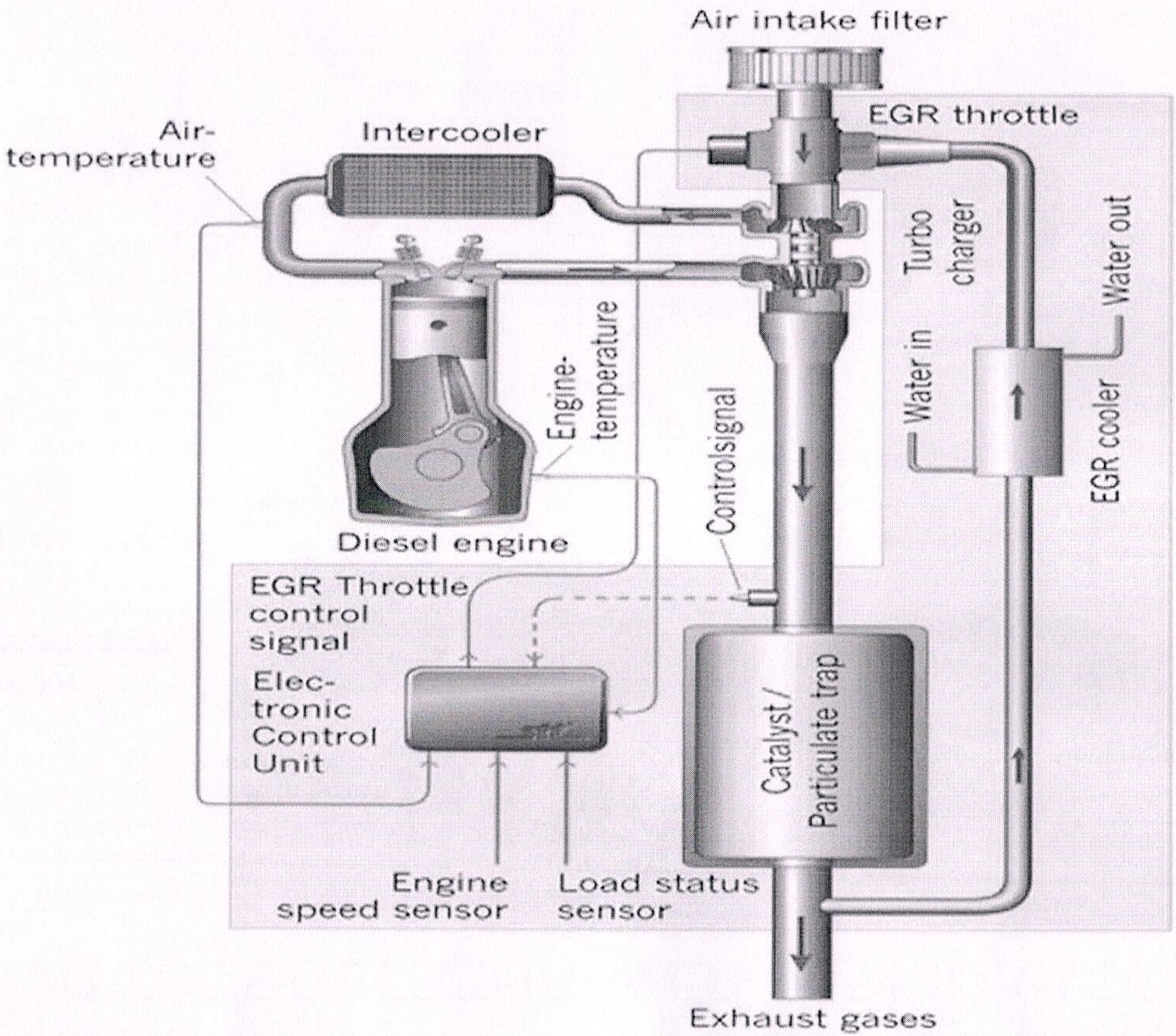


Particulate filter/Trap



Active regeneration with fuel injection





Air intake filter
EGR throttle
Air-
temperature
Intercooler
Turbo
charger
Water out
Water in
EGR cooler
Engine-
temperature
Controlsignal
Diesel engine
EGR Throttle
control
signal
Elec-
tronic
Control
Unit
Catalyst /
Particulate trap
Engine
speed sensor
Load status
sensor
Exhaust gases

Some more methods

- Urea injection
- Downsizing engine using turbocharger
- Use of additives
- Use of Alternate fuels/ Biofuels

Alternate fuels/ Biofuels

- LPG/ CNG
  - Better combustion due to proper mixing
  - Reduced emissions
- Biofuels
  - Oxygen present in fuel leads to better combustion and high flame speed
  - Net CO_2 is zero
  - Biodiesel , Ethanol / Methanol, Biogas