Shri Gajanan Shikshan Sanstha's
SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING
SHEGAON – 444203, DIST. BULDHANA (MAHARASHTRA STATE), INDIA
"Recognized by A.I.C.T.E., New Delhi" Affiliated to Sant Gadge Baba Amravati University, Amravati
"Approved by the D.T.E., M.S. Mumbai"

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Website- www.ssgmce.ac.in
Email. principal@ssgmce.ac.in, registrar@ssgmce.ac.in

CRITERION I - CURRICULAR ASPECTS

Key Indicator: 1.1 Curriculum Planning and Implementation

Metric No	Assessment Indicators	Evidences
1.1.1	The institution ensures effectivecurriculum delivery throughplanned a well- and documented process	Institutional Academic Calendar and Planner
		Department wise Load Distribution
		Master Time Table
		Department Time Table
		Course File

Shri Sant Gajanan Maharaj College of Engineering SHEGAON 444 203

PRINCIPAL
Shri Sant Gajanan Maharaj
College of Engineering,Shegaon.

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

ACADEMIC PLANNER: 2023-2024 (TENTATIVE) [AUTUMN SEMESTER]

Date	July – 23	Aug. – 23	Sept. – 23	Oct. – 23	Nov.– 23	Dec. – 23
1				SUNDAY		
2	SUNDAY			Mahatma Gandhi Jayanti*		National Pollution Control Day
3	AUTUMN SEM COMMENCE		SUNDAY			SUNDAY
4			NSS/NCC Registration			
5					SUNDAY	
6		SUNDAY				
7		B.E. First Yr. Commencement B.E. First Yr. Orientation		Project Screening Phase-II		
8		--"--		SUNDAY	University Exams Begins (Sem. –III,V,VII) (WV) Begins	
9	SUNDAY	--"--		CT-I : B.E. First Yr.		
10	B.E. Final Yr. Registrations	--"--	SUNDAY	--"--		SUNDAY
11	B.E. Final Yr. Classes	--"--	CT-I : III,V, VII (Sem.)		National Education Day	
12		--"--	--"--		SUNDAY Dipawali	
13		SUNDAY	--"--			
14		--"--	Pola**			National Energy Conservation Day(India)
15	.	Independence Day		SUNDAY National Innovation Day		
16	SUNDAY	Parsi New Year*		CT-II : III,V, VII (Sem.)		
17	B.E. II, III Yr. Registrations	--"— MBA/M.E. First Yr. Commencement	SUNDAY	--"--		SUNDAY
18	B.E. II, III Yr. Classes	--"--	.	--"--		University Exam. Sem-I
19		--"--	Ganesh Chaturthi*		SUNDAY	
20		SUNDAY	Rishi Panchami**			
21		.				
22			Gauri Poojan*	SUNDAY		
23	SUNDAY	SSGMCE Convocation				
24			SUNDAY	Dasara*		SUNDAY
25						Christmas*
26		Project Screening Phase-I			SUNDAY	
27		SUNDAY			(WV) Ends	
28			Anant Chaturdashi*/ Id-E-Milad		SPRING SEM COMMENCE CT-II : B.E. First Yr.	
29	Moharum*		Final Year Seminar	SUNDAY	--"--	
30	SUNDAY	Raksha Bandhan*	--"--		GOI Scholarship Due Date	University Exams Ends (Odd Sem)
31						SUNDAY

* Holiday as per University Gazette
PPM: Project Progress Monitoring

** Morning College
Sunday / Holiday

WV: Winter Vacation
CT: Class Test

Date : 01.07.2023

(Dr. S. B. Somani)
Principal

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

ACADEMIC PLANNER: 2023-2024 (TENTATIVE) [SPRING SEMESTER]

Date	Jan. – 24	Feb. – 24	Mar. – 24	Apr. – 24	May – 24	June – 24
1	TEACHING BEGINS— Sem. (VI, VIII)	Soft-Skill B.E.-3rd Yr.			CT-II (Sem. IV)	
2		--"--			--"--	SUNDAY
3			SHRI Pragat Din SUNDAY	CT-II (Sem. VI, VIII)	--"--	
4		SUNDAY	Soft-Skill B.E.-2nd Yr.	--"--		
5			--"--	--"--	SUNDAY	World Environment Day University Exams Begins (Sem. II)
6			Soft-Skill B.E.-2nd Yr	--"--	CT-II (Sem. II)	
7	SUNDAY		Soft-Skill B.E.2U1U2	SUNDAY	--"--	
8		Sports Meet	Soft-Skill B.E.-2nd Yr Mahashivratri* International Women's Day	CT-II (Sem. VI, VIII)	--"--	
9		--"--	Soft-Skill B.E.-2nd Yr	Gudhi Padwa*	--"--	SUNDAY
10		--"-- Project Screening Phase-III	SUNDAY			
11		SUNDAY	CT-I (Sem. IV)	Ramzan Id*	National Technology Day	Commencement of 2024-25 Academic Session
12	National Youth Day	Soft-Skill B.E.-3rd Yr.	--"--	SSGMCE Convocation CULFEST	SUNDAY	
13	Alumni Meet-2024	--"--	--"--	CULFEST		
14	SUNDAY	--"--		SUNDAY		
15		--"--	PURSUIT / PARISHKRITI 2024		University Exams Begins (Sem. IV)	
16	National Startup Day		--"--	Project Screening Phase-IV		SUNDAY
17			SUNDAY	--"-- Shriram Navmi**		.
18		SUNDAY	CT-I (Sem. II) Soft-Skill B.E.-2nd Yr.	Final Yr. Project Exhibition		
19	ISO Certification	Chhatrapati Shivaji Maharaj Jayanti*	--"— --"--		SUNDAY	
20	--"--	CT-I (Sem. VI, VIII)	Soft-Skill B.E.-2nd Yr.		.	
21	SUNDAY	--"--	Soft-Skill B.E.-3rd Yr. (Only U1U2)	SUNDAY World Creativity and Innovation Day		International Yoga Day
22	TEACHING BEGINS Sem.-IV NSS Camp	--"--				
23	--"--					SUNDAY
24	--"--	University Convocation	SUNDAY			.
25	--"--	SUNDAY	Holi (Second Day)*			
26	Republic Day --"--	Soft-Skill B.E.-3rd Yr. (Excluding U1U2)		World Intellectual Property Day	SUNDAY	
27	--"--	--"--				
28	SUNDAY	National Science Day		SUNDAY		
29	TEACHING BEGINS—Sem-II Sports Meet		Good Friday*	University Exams Begins (Sem. VI,VIII) CT-II (Sem. IV)		
30	--"--			--"--		SUNDAY
31	--"-- Soft-Skill B.E.-3rd Yr.		SUNDAY			

* Holiday as per University Gazette
** Morning College
SV: Summer Vacation
PPM: Project Progress Monitoring
Sunday / Holiday
CT: Class Test

Date : 01.07.2023

(Dr. S. B. Somani)
Principal

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

ACADEMIC CALENDAR (B.E.)

Academic Year 2023-24

AUTUMN SEMESTER (Semester – I, III, V, VII)

10 July 2023	Students Reporting (VII Semester)
11 July 2023	Teaching Begins for (VII Semester)
13 July 2023	Library Book Issue (VII Semester)
17 July 2023	Students Reporting (III & V Semester)
18 July 2023	Teaching Begins for (III & V Semester)
11, 12,13 Sep. 2023	Class Test – I **(Semester –III, V, VII)**
26 Aug. 2023	Project Screening Phase – I
21 Sep. 2023	Feedback on Class Test – I **(Semester –III, V, VII)**
29, 30 Sep. 2023	Final Year Seminar
09, 10 Oct. 2023	Class Test – I **(Semester –I)**
16 Oct. 2023	Feedback on Class Test – I **(Semester –I)**
16, 17, 18 Oct. 2023	Class Test – II **(Semester –III, V, VII)**
07 Oct. 2023	Project Screening Phase – II
25 Oct. 2023	Feedback on Class Test – II **(Semester –III, V, VII)**
01 – 07 Nov. 2023	Conduction of missed experiments / Lab & Lab Test/ Submission of TEC/Pr. Marks **(Semester** III, V, VII**)**
08 Nov. 2023	University Exams **(Semester –III, V, VII)** Tentative
28, 29 Nov. 2023	Class Test – II **(Semester –I)**
04 Dec. 2023	Feedback on Class Test – II **(Semester –I)**
18 Dec. 2023	University Examination **(Semester –I)**

SPRING SEMESTER (Semester – II, IV, VI, VIII)

26 Dec. 2023	Submission of Lesson Plan, Academic Action Plan & TEC Detail
30 Dec. 2023	Review Meeting of Lesson Plan, Academic Action Plan & TEC Detail
01 Jan.2024	Teaching Begins for (VI, VIII) Semester
04 Jan.2024	Library Book Issue
22 Jan.2024	Teaching Begins for (IV) Semester
27 Jan.2024	Mentee-Mentor Meeting
29 Jan.2024	Teaching Begins for (II) Semester
10 Feb. 2024	Project Screening Phase – III
24 Feb. 2024	Mentee-Mentor Meeting
20, 21, 22 Feb. 2024	Class Test - I **(Semester –**VI, VIII**)**
27 Feb. 2024	Feedback on Class Test – I **(Semester –** VI, VIII**)**
11, 12, 13 March 2024	Class Test - I **(Semester –** IV**)**
15 March 2024	Project Screening Phase – IV
18 March 2024	Feedback on Class Test - I **(Semester –** IV**)**
18, 19 March 2024	Class Test - I **(Semester –** II**)**
25 March 2024	Feedback on Class Test – I **(Semester –** II**)**
30 March 2024	Mentee-Mentor Meeting
01, 02, 03 April 2024	Class Test - II **(Semester –** VI, VIII**)**
08 April 2024	Feedback on Class Test – II **(Semester –** VI, VIII**)**
15, 16, 17 April 2024	Class Test - II **(Semester –** IV**)**
15 - 20 April 2024	Conduction of missed experiments / Lab & Lab Test/ Submission of TEC/Pr. Marks **(Semester** IV, VI, VIII**)**
22 April 2024	Feedback on Class Test - II **(Semester –** IV**)**
22, 23 April 2024	Class Test - II **(Semester –** II**)**
27 April 2024	Mentee-Mentor Meeting
27 April 2024	Feedback on Class Test – II **(Semester –** II**)**
29 April 2024	University Exams **(Semester –** VI, VIII**)**
05 June 2024	University Exams **(Semester –** II, IV**)**

June-23

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

July-23

S	M	T	W	T	F	S
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

August-23

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

September-23

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

October-23

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November-23

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December-23

S	M	T	W	T	F	S
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

January-24

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

February-24

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29		

March-24

S	M	T	W	T	F	S
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

April-24

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

May-24

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Prof. D. L. Bhombe
Dean (Academics)

Dr. S. B. Somani
Principal

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

ACADEMIC CALENDAR (B.E.)

DEPARTMENT OF MECHANICAL ENGINEERING

AUTUMN SEMESTER

(Semester – I, III, V, VII) Academic Year 2023-24

10 July 2023	Students Reporting (VII Semester)
11 July 2023	Teaching Begins for (VII Semester)
13 July 2023	Library Book Issue (VII Semester)
17 July 2023	Students Reporting (III & V Semester)
18 July 2023	Teaching Begins for (III & V Semester)
11, 12,13 Sep. 2023	Class Test – I **(Semester –III, V, VII)**
26 Aug. 2023	Project Screening Phase – I
21 Sep. 2023	Feedback on Class Test – I **(Semester –III, V, VII)**
29, 30 Sep. 2023	Final Year Seminar
09, 10 Oct. 2023	Class Test – I **(Semester –I)**
16 Oct. 2023	Feedback on Class Test – I **(Semester –I)**
16, 17, 18 Oct. 2023	Class Test – II **(Semester –III, V, VII)**
07 Oct. 2023	Project Screening Phase – II
25 Oct. 2023	Feedback on Class Test – II **(Semester –III, V, VII)**
01 – 07 Nov. 2023	Conduction of missed experiments / Lab & Lab Test/ Submission of TEC/Pr. Marks **(Semester** III, V, VII)
08 Nov. 2023	University Examination **(Semester –III, V, VII)** Tentative
28, 29 Nov. 2023	Class Test – II **(Semester –I)**
04 Dec. 2023	Feedback on Class Test – II **(Semester –I)**
18 Dec. 2023	University Examination **(Semester –I)**

SPRING SEMESTER

(Semester – II, IV, VI, VIII)

05 Jan.2024	Teaching Begins for (IV, VI, VIII) Semester
07 Jan.2024	Library Book Issue
10 Feb. 2024	Project Screening Phase – III
19, 20, 21 Feb. 2024	Class Test - I **(Semester** – IV, VI, VIII)
27 Feb. 2024	Feedback on Class Test – I **(Semester** – IV, VI, VIII)
04, 05 March 2024	Class Test - I **(Semester** – II)
11 March 2024	Feedback on Class Test – I **(Semester** – II)
15 March 2024	Project Screening Phase – IV
01, 02, 03 April 2024	Class Test - II **(Semester** – IV, VI, VIII)
09 April 2024	Feedback on Class Test – II **(Semester** – IV, VI, VIII)
08, 09 April 2024	Class Test - II **(Semester** – II)
15 April 2024	Feedback on Class Test – II **(Semester** – II)
15 - 20 April 2024	Conduction of missed experiments / Lab & Lab Test/ Submission of TEC/Pr. Marks **(Semester** IV, VI, VIII)
29 April 2024	University Examination (Tentative) **(Semester** – IV, VI, VIII)

Coordinator **HOD, Mech. Dept.**

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SHRI SANT GAJANAN MAHARAJ ENGINEERING COLLEGE, SHEGAON
DEPARTMENT OF MECHANICAL ENGINEERING
Session 2023-24 (Autumn Sem)

LOAD DISTRIBUTION

SN	Name of Faculty	Sem	Subject Allotted		Teaching Load		
			Code	Abbr.	Theory	Practical	Total Load
1	Dr. S. P. Trikal	III	3ME02	MP	4	4	08
2	Dr. V. K. Thute	VII	7ME01	MECHX	4	8	12
3	Prof. M. B. Bhambere	V VII	5ME02 7ME05	HT CFD	4 2	6 2	14
4	Prof. C. V. Patil	I V ME-I	1A3 5ME05 1MMD2	EM OE-IRA CADE	5 3 3	8 - 2	19
5	Dr. J. G. Khan	VII III ME-I	7ME05 3ME10 1MMD1	AE MD AMP	4 - 3	8 2 2	19
6	Prof. A. S. Bharule	III V ME-I	3ME03 5ME03 1MMD3	MOM MS AMD	4 - 3	8 2 -	18
7	Prof. N. B. Borkar	I VII	1A4 7ME04	EG IMC	5 4	6 -	15
8	Dr. N. H. Khandare	V VII ME-I	5ME01 7ME02 1MMD4	MQC PT LM	4 4 3	8 - 3	19
9	Prof. S. Q. Syed	VII V	7ME02 5ME02	EC-II HT	4 -	8 2	14
10	Prof. P. T. Patokar	I	1A5	WP	-	24	24
11	Prof. K. D. Gadgil	VII V	7ME05 5ME04	CFD KOM	2 4	- 8	14
12	Prof. K V Chandan	III III	3ME03 1A3	FM EM	4 -	8 4	16
13	Prof. K.R.Dudhe	I III	1A4 3ME09	EG MP	5 -	6 4	15
14	Prof.S.P.Joshi	I V	1A4 5ME03	EG MS	5 4	6 -	15
15	Prof. P.A. Dalke	I	1A5	WP	-	12	12
16	Prof. V. T. Mhaske	III V III	3ME04 5ME03 3ME10	ET MS MD	4 - -	- 6 6	16
17	Prof. G. S. Wahile	I V	1A3 5ME05	EM OE-IRA	5 3	6 -	14

(Prof. A. S. Bharule)
Time-Table Coordinator

(Dr. S. P. Trikal)
Head of Department

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING,
DEPARTMENT OF MECHANICAL ENGINEERING
ACADEMIC SESSION 2023-24

All faculty members are requested to give preferences of subject for Spring Semester 2023-24 Autumn

Total Theory load 87 Practical - 168 faculty - 14

Date : 02/06/23

HOD, Mech. Dept.

S.N.	NAME OF FACULTY	THEORY			PRACTICAL			SING
1	Dr. S. P. Trikal	MP			MP			
2	Dr. V. K. Thute	Mechatronics VII Sem ME01			Mechatronics VII Sem.			
3	Prof. M.B.Bhambere	HT	CFD		HT	CFD	FM	
4	Prof. C. V. Patil	EM	IPA		LP			
5	Dr. J. G. Khan	AE VIII sem	CIM	L.M M.E	A.E	M.D	E.G	
6	Prof. A. S. Bharule	DTS VII Sem	MOM 3rd Sem	DMD (ME)	DTS	MOM	EM	
7	Prof. P. T. Patokar				WS-I	WS-II		
8	Dr. N. H. Khandare P.T.	MQC	M IMMDS	A.E Mech. Elc.	MQC	A.E Mech. Elc.		
9	Prof. N. B. Borkar	EG	IMC	MP	EG	MP	—	
10	Prof. S. Q. Syed	ET	ECII	HT	ECII	HT	—	
11	Prof. K. D. Gadgil	KOM	CFD	FM	KOM	FM	—	
12	Prof. K. V. Chandan	FM	ET		FM	MD	DM	
13	Prof. P. A. Dalke							
14	Prof. S. P. Joshi	EG	MS		EG	MS		
15	Prof. K. R. Dudhe	EG	FM	MQC	EG	MQC		
16	XYZ							

FM

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SHRI SANT GAJANAN MAHARAJ ENGINEERING COLLEGE, SHEGAON
DEPARTMENT OF MECHANICAL ENGINEERING
(Session 2023-24, Spring Sem)

LOAD DISTRIBUTION

SN	Name of Faculty	Sem	Subject Allotted		Teaching Load		
			Code	Abbr.	Theory	Practical	Total Load
1	Dr. S. P. Trikal	IV	4ME04	MT	4	6	10
2	Dr. V. K. Thute	VI ME-II	6ME02 2MMD1	DOM MSD	4 3	8 2	17
3	Prof. M. B. Bhambere	IV VI	4ME05 6ME09	HM RS LAB	4 -	8 2	14
4	Prof. C. V. Patil	II VIII	1A3 8ME03	EM AI	5 4	6 -	15
5	Dr. J. G. Khan	VI VI VIII ME-II	6ME09 6ME04 8ME03 2MMD4	CADS LM PPC RPT	- 4 4 3	4 - - -	15
6	Prof. A. S. Bharule	VI ME-II	6ME01 2MMD2	DME ESA	4 3	8 2	17
7	Prof. N. B. Borkar	II IV	1B4 4ME04	EG MT	5 -	6 2	13
8	Dr. N. H. Khandare	VIII ME-II	8ME02 2MMD3	RIA AMT	4 3	8 -	15
9	Prof. S. Q. Syed	IV VIII VI	4ME03 8ME02 6ME09	EC-I ICE RS LAB	4 - -	- 4 6	14
10	Prof. P. T. Patokar	II	1A5	WP	-	24	24
11	Prof. K. V. Chandan	VIII II	8ME02 1A3	ICE EM	4 -	4 6	14
12	Prof. K.R.Dudhe	II VIII	1B4 8ME01	EG ORT	5 4	6 -	15
13	Prof.S.P.Joshi	II VI	1B4 6ME09	EG CADS	5 -	6 4	15
14	Prof. V. T. Mhaske	VI IV VII	6ME05 4ME01 8ME02	AEEV MS RAC	3 4 4	- 8 2	21
15	Prof. G. S. Wahile	II VI	1A3 6ME04	EM NES	5 4	6 -	15
16	Prof. P. A. Dalke	II	1A5	WP	-	12	12

(Prof. A. S. Bharule)
Time-Table Coordinator

(Dr. S. P. Trikal)
Head of Department

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING,
DEPARTMENT OF MECHANICAL ENGINEERING
ACADEMIC SESSION 2023-24

All faculty members are requested to give preferences of subject for Spring Semester 2023-24

S.N.	NAME OF FACULTY	THEORY			PRACTICAL			SIGN
1	Dr. S. P. Trikal	MT			MT			
2	Dr. V. K. Thute	DOM 6ME02				DOM 6ME02		
3	Prof. M.B.Bhambere	HM 4ME05			HM	RS (Research Skills) 6ME09		
4	Prof. C. V. Patil	EM	AJ		EM			
5	Dr. J. G. Khan	Lean mfg	PPC	RPT	MT	EG	CADS Lab	
6	Prof. A. S. Bharule	DME	POD	ESA	DME	ESA	EM	
7	Prof. P. T. Patokar				WS-I	WS-II		
8	Dr. N. H. Khandare	RIA 8ME04	M.S 4ME01	AMT 2MMD3	RIA 8ME04	M.S 4ME01		
9	Prof. N. B. Borkar	EG	MT	AMT	EG	MT		
10	Prof. S. Q. Syed	ECI			ICE	HM	RS	
11	Prof. K. V. Chandan	ICE	RAC		ICE	EM	RAC	
12	Prof. P. A. Dalke							
13	Prof. S. P. Joshi	EG	ECI		EG	HM		
14	Prof. K. R. Dudhe	EG	ORT		EG	RAC		
15	Prof. V. T. Mhaske	ICE	RAC	MS/NEEV	ICE	RAC		
16	Prof. G. S. Wahile	EM	MS	NES	EM	MS		

28/11/2023

Shri Gajanan Shikshan Sanstha's
SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING
SHEGAON – 444203, DIST. BULDANA (MAHARASHTRA STATE), INDIA
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Fax : 091-7265-252346 Website- www.ssgmce.ac.in

Shri Sant Gajanan Maharaj College of Engineering, Shegaon
Department of Mechanical Engineering
Session-2023-24 (Autumn Semester)

Time-Table

Class: 2M (Classroom E1) Semester-Third w.e.f.:18/07/2023

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	FM (KVC)	MOM (ASB)	Short Break	M-III (KPD)	MP (SPT)	Short Break	ET (VTM)	ET (VTM)
Tue	FM (KVC)	MOM (ASB)		M-III (KPD)	MP (SPT)		MP / MOM / FM / MD (D / A / B / C) SPT / ASB / KVC / VTM	
Wed	FM (KVC)	MOM (ASB)		M-III (KPD)	MP (SPT)		MP / MOM / FM / MD (A / B / C / D) SPT / ASB KVC / VTM	
Thu	ET (VTM)	MOM (ASB)		M-III (KPD)	MP (SPT)		MP / MOM / FM / MD (B / C / D / A) KRD / ASB / KVC / VTM	
Fri	ET (VTM)	MOM (ASB)		FM (KVC)	EVS (RMK)		MP / MOM / FM / MD (C / D / A / B) KRD / ASB / KVC / JGK	
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat	Skill Development/ Professional Training/ Tech Talk/Webinar		Short Break	Skill Development/ Professional Training/ Tech Talk/Webinar			Batch-A_01 to 20 Batch-B_21 to 40 Batch-C_41 to 62 Batch-D_63 to onwards	

Class: 3M (Classroom E3) Semester-Fifth w.e.f.:18/07/2023

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	HT (MBB)	MQC (NHK)	Short Break	MS (SPJ)	KOM (KDG)	Short Break	HT / MS / MQC / KOM (D / A / B / C) MBB / ASB / NHK / KDG	
Tue	HT (MBB)	MQC (NHK)		MS (SPJ)	KOM (KDG)		OPEN ELECTIVE-I	MS (SPJ)
Wed	HT (MBB)	MQC (NHK)		HT / MS / MQC / KOM (A / B / C / D) MBB / VTM /NHK /KDG				KOM (KDG)
Thu	MS (SPJ)	KOM (KDG)		HT / MS / MQC / KOM (B / C / D / A) MBB / VTM /NHK /KDG				HT (MBB)
Fri	MS (SPJ)	MQC (NHK)		HT (MBB)	KOM (KDG)		HT / MS / MQC / KOM (C / D / A / B) SQS / VTM /NHK /KDG	
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat	Skill Development/ Professional Training/ Tech Talk/Webinar		Short Break	Skill Development/ Professional Training/ Tech Talk/Webinar			Batch-A_01 to 19 Batch-B_20 to 38 Batch-C_39 to 57 Batch-D_58 to 76	

Class: 4M (Classroom E4/Seminar Hall) Semester-Seventh w.e.f.:11/07/2023

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	AE/CFD (JGK/KDG)	IMC (NBB)	Short Break	EC-II (SQS)	PT (NHK)	Short Break	EC-II / MECHX/AE (A/ B / C) SQS / VKT / JGK	
Tue	EC-II (SQS)	IMC (NBB)		MECHX (VKT)	PT (NHK)		EC-II / MECHX/AE (D / A / B) SQS / VKT / JGK	
Wed	AE/CFD (JGK/KDG)	IMC (NBB)		MECHX (VKT)	EC-II (SQS)		EC-II / MECHX/AE (B / C / D) SQS / VKT / JGK	
Thu	AE/CFD (JGK/MBB)	PT (NHK)		MECHX (VKT)	EC-II (SQS)		EC-II / MECHX/AE (C / D/ A) SQS / VKT / JGK	
Fri	AE/CFD (JGK/MBB)	IMC (NBB)		MECHX (VKT)	PT (NHK)		CFD (MBB)	
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat	PROJECT & SEMINAR		Short Break	PROJECT & SEMINAR			Batch-A_01 to 19, Batch-B_20 to 38, Batch-C_39 to 57, Batch-D_58 to 76	

Prof. A. S. Bharule
Time Table Coordinator

Dr. S. P. Trikal
Head of Department

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Shri Sant Gajanan Maharaj College of Engineering, Shegaon
Department of Mechanical Engineering
Session-2023-24 (Autumn)

Time-Table

Class: ME (Classroom E2) **Semester-FIRST** **w.e.f.: 01 /09 /2023**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	AMP (JGK)	AMD (ASB)	Short Break	AMP LAB (JGK)		Short Break		
Tue	AMP (JGK)	AMD (ASB)		CADE LAB (CVP)				
Wed	LM (NHK)	CADE (CVP)		LM (NHK)	CADE (CVP)			
Thu	LM (NHK)	CADE (CVP)		AMD (ASB)	AMP (JGK)			
Fri	AMP (JGK)	CADE (CVP)		LM (NHK)	AMD (ASB)			
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat			Short Break					

Class: ME (SEMINAR HALL) **Semester-THIRD** **w.e.f.:01/08/2023**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon			Short Break			Short Break		
Tue	SEMINAR & DISSERTATION							
Wed								
Thu	SEMINAR & DISSERTATION							
Fri								
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat			Short Break	SEMINAR & DISSERTATION				

Prof. A. S. Bharule
Time Table Coordinator

Dr. S P Trikal
Head of Department

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Shri Sant Gajanan Maharaj College of Engineering, Shegaon
Department of Mechanical Engineering
Session-2023-24 (Spring Semester)

Time-Table

Class: 2M (Classroom E2) **Semester-Fourth** **w.e.f.:22/01/2024**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	EC-I (SQS)	HPS (MBB)	Short Break	BEDC (BSR)	MT (SPT)	Short Break	MS (VTM)	EVS (RMK)
Tue	MT/ MS / HPS / BEDC (A / B / C / D) SPT / VTM / MBB / BSR			BEDC (BSR)	MT (SPT)		HPS (MBB)	MS (VTM)
Wed	MT/ MS / HPS / BEDC (B / C / D / A) SPT / VTM / MBB / BSR			BEDC (BSR)	MT (SPT)		EC-I (SQS)	EVS (RMK)
Thu	MT/ MS / HPS / BEDC (C / D / A / B) SPT / VTM / MBB / BSR			EC-I (SQS)	MT (SPT)		HPS (MBB)	MS (VTM)
Fri	MT/ MS / HPS / BEDC (D / A / B / C) NBB / VTM / MBB / BSR			BEDC (BSR)	EC-I (SQS)		HPS (MBB)	MS (VTM)
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat	Skill Development/ Professional Training/ Tech Talk/Webinar		Short Break	Skill Development/ Professional Training/ Tech Talk/Webinar				

Class: 3M (Classroom E3) **Semester-Sixth** **w.e.f.:01/01/2024**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	DOM (VKT)	DME (ASB)	Short Break	CSE (RZF)	NES/LM (GSW/JGK)	Short Break	DME / DOM / CADS / RSL (A / B / C / D) ASB / VKT / SPJ / SQS	
Tue	DOM (VKT)	DME (ASB)		CSE (RZF)	OPEN ELECTIVE-II		DME / DOM / CADS / RSL (C / D / A / B) ASB / VKT / JGK / SQS	
Wed	DME (ASB)	NES/LM (GSW/JGK)		CSE (RZF)	OPEN ELECTIVE-II		DME / DOM / CADS / RSL (B / C / D / A) ASB / VKT / SPJ / MBB	
Thu	DOM (VKT)	DME (ASB)		NES/LM (GSW/JGK)	OPEN ELECTIVE-II		DME / DOM / CADS / RSL (D / A / B / C) ASB / VKT / JGK / SQS	
Fri	DOM (VKT)	DME (ASB)		CSE (RZF)	NES/LM (GSW/JGK)		COUNSELLING / MENTORING	
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat	Skill Development/ Professional Training/ Tech Talk/Webinar		Short Break	Skill Development/ Professional Training/ Tech Talk/Webinar				

Class: 4M Classroom E4) **Semester-Eight** **w.e.f.:01/01/2024**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	ICE (KVC)	AI / PPC (CVP/JGK)	Short Break	RIA / ICE (B / C) (NHK / SQS)		Short Break	PROJECT (GUIDE)	
Tue	ICE (KVC)	AI / PPC (CVP/JGK)		RIA / ICE (C / D) (NHK / SQS)			PROJECT (GUIDE)	
Wed	ICE (KVC)	ORT (KRD)		RIA / RAC (NHK/ VTM)	AI / PPC (CVP/JGK)		PROJECT (GUIDE)	
Thu	ORT (KRD)	RIA / RAC (NHK/ VTM)		RIA / ICE (D / A) (NHK / KVC)			PROJECT (GUIDE)	
Fri	ORT (KRD)	RIA / RAC (NHK/ VTM)		RIA / ICE (A / B) (NHK / KVC)			PROJECT (GUIDE)	
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat	ICE (KVC)	AI / PPC (CVP/JGK)	Short Break	RIA / RAC (NHK/ VTM)	ORT (KRD)			

Prof. A. S. Bharule
Time Table Coordinator

Dr. S P Trikal
Head of Department

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Shri Sant Gajanan Maharaj College of Engineering, Shegaon
Department of Mechanical Engineering
Session-2023-24 (Spring Semester)

Time-Table

Class: ME (Classroom E2) **Semester-SECOND** **w.e.f.: 29/01/2024**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon	AMT (NHK)	RPT (JGK)	Short Break	MSD LAB (VKT)		Short Break		
Tue	MSD (VKT)	ESA (ASB)		ESA LAB (ASB)				
Wed	AMT (NHK)	ESA (ASB)		MSD (VKT)	RPT (JGK)			
Thu	RPT (JGK)	ESA (ASB)		MSD (VKT)	AMT (NHK)			
Fri	RPT (JGK)	MSD (VKT)		ESA (ASB)	AMT (NHK)			
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat			Short Break					

Class: ME (SEMINAR HALL) **Semester-FOURTH** **w.e.f.: 01/01/2024**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon			Short Break	SEMINAR & DISSERTATION		Short Break		
Tue	SEMINAR & DISSERTATION							
Wed				SEMINAR & DISSERTATION				
Thu	SEMINAR & DISSERTATION							
Fri				SEMINAR & DISSERTATION				
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat			Short Break	SEMINAR & DISSERTATION				

Prof. A. S. Bharule
Time Table Coordinator

Dr. S P Trikal
Head of Department

COURSE NAME

"Material Science"

4ME01

By

Prof. V.T. Mhaske

Mechanical Engg. Dept.
Shri Sant Gajanan Maharaj College of Engineering, Shegaon

Material Science (4ME01)

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Teaching Faculty Course File contents

1	Vision of the department
2	Mission of the department
3	Time table
4	Teaching scheme
5	Syllabus
6	Students' list
7	Academic Planner/ calendar
8	Course Outcome-statement
9	Program Outcomes & Program Specific outcomes-statement
10	CO-PO mapping & CO-PSO mapping
11	Lesson plan
12	TEC action plan
13	Course Material (Notes, Hand outs, PPTs, audio, video, case studies, etc),
14	Best Practices in teaching and learning*
15	Topics beyond Syllabus*
16	Class test /University question papers, Model answer sheet
17	Sample answer scripts (highest marks/ average marks/ lowest marks)
18	Test feedback report
19	Attendance report
20	Continuous evaluation practical record*
21	Test mark report
22	TEC marks report/ TEC conduction details
23	Result analysis(university exams)
24	Academic Audit report
25	Course exit survey report
26	Final Co attainment report
27	PO & PSO attainment from Cos
28	Any other

Miss
Visi

Shri Sant Gajanan Maharaj College of Engineering, Shegaon

Department of Mechanical Engineering

Vision Statements:-

To develop quality mechanical engineers, researchers and entrepreneurs with commitment for excellence, learning enthusiasm, ethical behavior and serving the society.

Mission Statements:-

1) To impart fundamental knowledge of Mechanical Engineering to the students through the excellent learning experience and provide a platform for Higher Education.
2) To offer Industry Institute Interface, interdisciplinary knowledge, and value-based education for the overall development of students.
3) To enhance research, next-gen skills, and entrepreneurship abilities of the students to solve social problems.

Program Educational Objectives (PEOs) Statements:-

1) Engage in creating, designing, manufacturing, analyzing, testing, and maintaining the systems of Mechanical Engineering and allied branches of engineering.
2) Solve the problems of societal importance by applying fundamentals of mechanical engineering & pursuing higher education, research in the domain of mechanical Engineering.
3) Imbibe ethical values & skills for lifelong learning to work effectively as a part of a team member, leading a team in a multidisciplinary setup.

Program Specific Outcomes (PSOs) Statements:-

PSO1: **Manufacturing Engineering:** An ability to apply the principles of manufacturing engineering and technology to develop techno commercial skills.

PSO2: **Thermal Engineering:** An ability to apply fundamentals to design and analyze the thermo-hydraulic systems.

PSO3: **Design Engineering:** An ability to design and analyze mechanical components and processes to predict the behavior of engine-erring systems.

3

Shri Sant Gajanan Maharaj College of Engineering, Shegaon
Department of Mechanical Engineering
Session:2023-2024 (Spring)

Time-Table

Class Room: E1 **Class: 2M** **Semester – IV** **w.e.f.: 22/01/2024**

Day	11.00AM 12.00PM	12.00PM 01.00PM	01.00PM 01.15PM	01.15PM 02.15 PM	02.15 PM 03.15 PM	03.15 PM 03.45 PM	03.45 PM 04.45 PM	04.45 PM 05.45 PM
Mon	EC-I (SQS)	HPS (MBB)	BREAK	BEDC (BSR)	MT (SPT)	RECESS	MS (VTM)	EVS (RMK)
Tue	MT/ MS / HPS / BEDC (A / B / C / D) SPT / VTM / MBB / BSR			BEDC (BSR)	MT (SPT)		HPS (MBB)	MS (VTM)
Wed	MT/ MS / HPS / BEDC (B / C / D / A) SPT / VTM / MBB / BSR			BEDC (BSR)	MT (SPT)		EC-I (SQS)	EVS (RMK)
Thu	MT/ MS / HPS / BEDC (C / D / A / B) SPT / VTM / MBB / BSR			EC-I (SQS)	MT (SPT)		HPS (MBB)	MS (VTM)
Fri	MT/ MS / HPS / BEDC (D / A / B / C) NBB/ VTM / MBB / BSR			BEDC (BSR)	EC-I (SQS)		HPS (MBB)	MS (VTM)
Day	08.30 AM 09.30 AM	09.30 AM 10.30 AM	10.30AM 10.45AM	10.45 AM 11.45 AM	11.45AM 12.45 AM			
Sat	Skill Development/ Professional Training/ Tech Talk/Webinar		BREAK	Skill Development/ Professional Training/ Tech Talk/Webinar				

Subject & Code:

Code	Name of Subject (Full Name)	Name of Faulty (Theory/Practical)
4ME01	Material Science	Prof. V. T. Mhaske
4ME02	Energy Conversion – I	Prof. S. Q. Syed
4ME03	Manufacturing Technology	Dr. S. P. Trikal
4ME04	Basic Electrical Drives & Control	Prof. B. S. Rakhonde
4ME05	Hydraulic & Pneumatic Systems	Prof. M. B. Bhambere
4ES06	Environmental Studies	Dr. R. M. Kharate

Practical:

Code	Name of Subject	Name of Lab
4ME07	Material Science Lab.	Metallurgy Lab
4ME08	Manufacturing Technology Lab.	Workshop (Machine Shop)
4ME09	Basic Electrical Drives & Control Lab.	Machine Lab (ELPO DEPT)
4ME10	Hydraulic & Pneumatic Systems Lab	Fluid Power Lab

Practical Batches

Batch	A	B	C	D
Roll No.	01-18	19-36	37-54	55-74

Date: 16/ 01 / 2024

Time Table Coordinator Head of Department Dean (Academics) Principal

SHRI SAI GAJANAN MAHARAJ COLLEGE OF ENGG, SHEGAON
DEPARTMENT OF MECHANICAL ENGINEERING
INDIVIDUAL TIME TABLE

Session 2023-24(Spring Semester)

Prof. V. T. Mhaske **w. e. f.:01/01/2024**

Day	11.00am 12.00pm	12.00pm 01.00pm	01.00pm 01.15pm	01.15pm 02.15pm	02.15pm 03.15pm	03.15pm 03.45pm	03.45pm 04.45pm	04.45pm 05.45pm
Mon			Short Break			Short Break	MS	
Tue	MS (B)							MS
Wed	MS (C)			RAC			RAC-X	
Thu	MS (D)	RAC						MS
Fri	MS (A)	RAC						MS
	8.30am 9.30am	9.30am 10.30am	10.30am 10.45am	10.45am 11.45am	11.45am 12.45am			
Sat			Short Break	RAC				

Prof A. S. Bharule
Time-Table Coordinator

Dr S P Trikal
Head of the Dept.

SEMESTER : FOURTH																	
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks	
THEORY																	
01	4ME01	Material Science	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
02	4ME02	Energy Conversion - I	3	1	--	4	4	3	80	20	100	40	--	--	--	--	
03	4ME03	Manufacturing Technology	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
04	4ME04	Basic Electrical Drives & Control	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
05	4ME05	Hydraulic & Pneumatic Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--	
06	4ES06	**Environmental Studies	2	--	--	2	2	3	80	20	100	40	-	-	-	-	
PRACTICALS / DRAWING / DESIGN																	
07	4ME07	Material Science-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
08	4ME08	Manufacturing Technology-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
09	4ME09	Basic Electrical Drives & Control -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
10	4ME10	Hydraulic & Pneumatic Systems-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25	
		Total	17	1	8	26	22	--	--	--	500	--	--	--	200	--	
														Total	700		

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

3ME10 Machine Drawing - Lab

Course Learning Objectives :

1. To study the techniques of sectioning and visualizing the objects
2. To imagine and develop the missing views of objects
3. To seek the knowledge of development of surfaces
4. To seek the knowledge of intersection of solid objects
5. To know the conventions for materials and parts used in industries
6. To prepare the drawings for machine assembly

Course Outcomes.:

Student will be able to -

1. Demonstrate the techniques of sectioning and visualizing the objects
2. Imagine, understand and sketch the missing views
3. Develop surfaces of objects and apply knowledge during their fabrication
4. Understand the concept of intersection of solid objects
5. Understand and apply the conventions for materials and parts used in industries
6. Prepare detail machine assembly drawings

List of Practicals :

1. Conversion of pictorial view into Sectional Orthographic Projection
2. Missing Views
3. Development of surfaces of Cubes / Prisms / Cylinders / Pyramids / Cones & their cut sections
4. Intersections of Solids – Prism & Prism /Cylinder & Cylinder /Cylinder & Prism / Cone & Prism
5. Conventions for various materials & parts
6. Preparation of detail drawings of simple machine assembly
7. Preparation of assembly drawing of simple machines

Books recommended:

Text Books:

1. Engineering drawing by N.D. Bhatt; Charactor Publications.
2. Machine Drawing by A. M. Bisen; New Edge International publication.
3. Machine Drawing by R. K. Dhawan, S. Chand
4. Machine Drawing by Basant Agrawal, McGraw Hill.
5.

****

B.E. (MECHANICAL) SEMESTER FOURTH

4ME01 MATERIAL SCIENCE

Course Learning Objectives:

1. To study the basic concepts of metallurgy and classification of materials
2. To study the process of formation of microstructures of metal materials and composites
3. To study the alloying elements, their effects and applications
4. To study the ferrous and non-ferrous metals and respective alloys
5. To study the various heat treatment processes and their industrial applications
6. To study the mechanical working of metals and process of powder metallurgy

Course Outcomes:

Students will understand the -

1. Basic concepts of metallurgy and types of materials.
2. Iron-Carbon Equilibrium Diagram, critical temperatures, formation of microstructures and they will get the knowledge of alloys.
3. Uses and practical applications of ferrous & non ferrous materials
4. Various heat treatment processes, powder metallurgy and industrial applications.

SECTION - A

UNIT-I: Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation, lever rule for phase mixtures. Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification. (8 Hrs)

UNIT II: Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Microstructure of slowly cooled steel, Estimation of carbon from microstructure, structure property relation, Introduction to composite materials, advantages and applications. (8 Hrs)

UNIT III: **Alloy Steels:** Purpose of alloying, Classification of alloy steels, classification of alloying elements, Effect of alloying elements on eutectoid composition, Eutectoid temperature, and on the S curve, , alloying elements and their effect on properties of steels,. OHNS steels, Hadfield'S Manganese steels, High speed steels, their heat treatments and applications, Ferritic, Austenitic and Martensitic stainless steels, their properties and applications, weld decay in stainless steel. (8 Hrs)

SECTION - B

UNIT IV: Cast irons : Factors governing condition of carbon in cast iron, Maurer's diagram, Solidification of grey and white cast iron, Malleabalizing, Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.
Non Ferrous Metals and Alloys : Types, Properties and uses of Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (8 Hrs)

UNIT V: Principles of Heat Treatment: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on 's' Curve, pearlite, bainite and martenste transformation, Quenching media, severity of quench, Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability. (8 Hrs)

UNIT VI: Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening. Mechanical working of Metals: - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve, Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth. Metallurgical factors affecting various Mechanical working processes, preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.
Powder Metallurgy: Concept, Methods of Manufacture of metal powders, compaction Process- Single die and double die, sintering, stages of sintering, Manufacture of porous bearings & cemented carbide tip tools by P.M.T. Advantages, limitations and applications of powder metallurgy. (8 Hrs)

BOOK RECOMMENDED :-

Text Books :-

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Grawhill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material nScience & Mettalurgy, by V.D. Kodgire. Everest Publication House.

Reference Books:

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn.,1987.
3. Power metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication.

4ME07 MATERIAL SCIENCE - LAB

List of Practicals: - (At least eight (8) practicals out of the following list.)

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalized plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of non ferrous metals.(brasses, bronzes)
8. Study of micro structures of hardened and tempered steels.
9. Study of Iron carbon Equilibrium diagram & Allotropic forms of iron.

6

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Student Roll List

Class Name : 2M Session : 2023-24 Semester : Spring

Total Students : 74

Roll No.	Admission No.	Student Name
1	307926	Ku. Ashwini Sunil Harsule
2	308575	Ku. Dhanshri Govardhan Tayade
3	307740	Ku. Divya Sunil Chandle
4	307841	Ku. Gayatri Vijay Bhore
5	307962	Ku. Kshitija Prashant Deshmukh
6	308490	Ku. Mansi Pramod Talekar
7	308503	Ku. Prachi Ashok Itnare
8	307977	Ku. Prachi Mahendra Gawali
9	307547	Ku. Pragati Kamlakar Sonone
10	308555	Ku. Punam Ashok Khandare
11	308513	Ku. Ruchika Shrikrushna Nikole
12	308491	Ku. Rutuja Sanjay Deshmukh
13	307545	Ku. Sakshi Vishnudas Bhosle
14	308018	Ku. Samiksha Anil Chendalane
15	307910	Ku. Samiksha Mahesh Dhoke
16	307667	Ku. Sanika Vivek Deshmukh
17	307882	Ku. Sejal Dipankar Pahurkar
18	307956	Ku. Shravani Anant Joshi
19	307989	Ku. Shweta Prabhakar Nalkande
20	307556	Ku. Sneha Rajesh Gite
21	307741	Ku. Sonal Dhanraj Dongre
22	307693	Ku. Sonu Pandurang Rekhate
23	307947	Ku. Unnati Anil Deshmukh
24	307939	Ku. Vaishnavi Arvindrao Deshmukh
25	307831	Ku. Vaishnavi Rajendra Umak
26	307886	Ku. Vaishnvi Shivhari Mirge
27	307618	Abhijeet Dinesh Nanotkar
28	308563	Abhijit Sanjay Nage
29	307818	Abhishek Gopalrao Khodre
30	307743	Abhishek Murlidhar Nimbalkar
31	307539	Abhishek Rajesh Shelke
32	307995	Adinath Girish Udgirikar
33	307540	Adinath Mangesh Gogate
34	307824	Akash Gopal Suralkar
35	307626	Amit Govinda Wankhade
36	307771	Atharv Atul Nage

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Student Roll List

Class Name : 2M Session : 2023-24 Semester : Spring

Roll No.	Admission No.	Student Name
37	307530	Atharva Ajay Joshi
38	308547	Avinash Shrikrushna Honale
39	308515	Chetan Baliram Nimbolkar
40	308583	Chetan Kamlakar Banait
41	307668	Devashish Mahendra Sadavarte
42	307543	Devendra Anand Sawdekar
43	308579	Dhawal Jagdishrao Lokhande
44	308545	Gaurav Tukaram Pande
45	308502	Gazal Prabhakar Barai
46	307933	Gunjan Mahendra Dhage
47	307656	Harshal Mahendra Malik
48	308506	Himanshu Sanjay Zadokar
49	307670	Hrutik Santram Kushwaha
50	308492	Jay Pravin Zope
51	308508	Kaushal Dilippant Ghulaxe
52	308518	Mandar Tanaji Pawar
53	308504	Mohit Mahendra Waghmare
54	307548	Prashant Pandurang Dhamode
55	307655	Pratik Kailas Kalskar
56	308567	Rohit Chandu Kurhade
57	307757	Rohit Satishrao Dautpure
58	308546	Sagar Anil Pande
59	307633	Samarth Suresh Paraskar
60	307837	Shivam Najukrao Mehenge
61	308535	Shivkumar Govind Ingle
62	307807	Shivshankar Ishwar Jadhav
63	308576	Shubhajit Siddharth Mohod
64	308571	Sujal Sanjay Giri
65	307608	Suyash Subhash Pimple
66	307922	Swayamchandra Khadse
67	308497	Tejas Vishwasrao Raut
68	308522	Tushar Madhukar Raut
69	307776	Vansh Krushnakumar Hedau
70	307966	Vedant Manoj Mate
71	307805	Vijay Gajanan Sonune
72	307974	Vishal Dilip Sarkate

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Student Roll List

Class Name : 2M Session : 2023-24 Semester : Spring

Roll No.	Admission No.	Student Name
73	308578	Vivek Bharat Ingle
74	307772	Vivek Rajesh Sawant

SGM/FRM/OFF-52-A

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

ACADEMIC CALENDAR (B.E.)

Academic Year 2023-24

AUTUMN SEMESTER

(Semester – I, III, V, VII)

10 July 2023	Students Reporting (VII Semester)
11 July 2023	Teaching Begins for (VII Semester)
13 July 2023	Library Book Issue (VII Semester)
17 July 2023	Students Reporting (III & V Semester)
18 July 2023	Teaching Begins for (III & V Semester)
11, 12,13 Sep. 2023	Class Test – I **(Semester –III, V, VII)**
26 Aug. 2023	Project Screening Phase – I
21 Sep. 2023	Feedback on Class Test – I **(Semester –III, V, VII)**
29, 30 Sep. 2023	Final Year Seminar
09, 10 Oct. 2023	Class Test – I **(Semester –I)**
16 Oct. 2023	Feedback on Class Test – I **(Semester –I)**
16, 17, 18 Oct. 2023	Class Test – II **(Semester –III, V, VII)**
07 Oct. 2023	Project Screening Phase – II
25 Oct. 2023	Feedback on Class Test – II **(Semester –III, V, VII)**
01 – 07 Nov. 2023	Conduction of missed experiments / Lab & Lab Test/ Submission of TEC/Pr. Marks **(Semester** III, V, VII)
08 Nov. 2023	University Examination **(Semester –III, V, VII)** Tentative
28, 29 Nov. 2023	Class Test – II **(Semester –I)**
04 Dec. 2023	Feedback on Class Test – II **(Semester –I)**
20 Dec. 2023	University Examination **(Semester –I)** Tentative

SPRING SEMESTER

(Semester – II, IV, VI, VIII)

05 Jan.2024	Teaching Begins for (IV, VI, VIII) Semester
07 Jan.2024	Library Book Issue
10 Feb. 2024	Project Screening Phase – III
19, 20, 21 Feb. 2024	Class Test - I **(Semester** – IV, VI, VIII)
27.Feb. 2024	Feedback on Class Test – I **(Semester** – IV, VI, VIII)
04, 05 March 2024	Class Test - I **(Semester** – II)
11 March 2024	Feedback on Class Test – I **(Semester** – II)
15 March 2024	Project Screening Phase – IV
01, 02, 03 April 2024	Class Test - II **(Semester** – IV, VI, VIII)
09 April 2024	Feedback on Class Test – II **(Semester** – IV, VI, VIII)
08, 09 April 2024	Class Test - II **(Semester** – II)
15 April 2024	Feedback on Class Test – II **(Semester** – II)
15 - 20 April 2024	Conduction of missed experiments / Lab & Lab Test/ Submission of TEC/Pr. Marks **(Semester** IV, VI, VIII)
29 April 2024	University Examination (Tentative) **(Semester** – IV, VI, VIII)

Prof. D. L. Bhombe
Dean (Academics)

Dr. S. B. Somani
Principal

June-23

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

July-23

S	M	T	W	T	F	S
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

August-23

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

September-23

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

October-23

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November-23

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December-23

S	M	T	W	T	F	S
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

January-24

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

February-24

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29		

March-24

S	M	T	W	T	F	S
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

April-24

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

May-24

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Course outcome

1. **CO1:** Student will be able to understand the basic concepts of metallurgy and materials classification, different crystal structure and process of solidification of solid solutions.

2. **CO2:** Student will be able to understand the Iron-Carbon Equilibrium Diagram, process of formation of microstructure of metal materials and composites.

3. **CO3:** Student will be able to understand different alloying elements and their effects on properties of steels and different types of alloys and their application.

4. **CO4:** Student will be able to understand different types of cast iron, non ferrous metal and alloys and their use, properties and applications.

5. **CO5:** Student will be able to understand various principles of heat treatment used in metallurgy.

6. **CO6:** Student will be able to understand various heat treatment processes, powder metallurgy and industrial applications.

SSGMCE Shegaon, MS, India	COURSE OUTCOME ASSESSMENT MAP			NO. OF COs
				6
UG - Mechanical Engg.	CLASS	2M	COURSE CODE	4ME01
	COURSE	Material Science		
ACADEMIC YEAR	2023-24	FACULTY	Prof. V. T. Mhaske	
SEMESTER	IV			

SL. NO.	CO	ASSESSMENT TOOLS	INTERNAL (THEORY)				INT. (LAB)		UNIV (THEORY)	UNIV. (LAB)	TOTAL
			30	30	30				80		170
			CT1	CT2	A1	A2	CA	LT	ES	EX.P	
1	CO1	CT1, A1,ES,	Q1,Q2		Q1, Q2				Q1, Q2		
2	CO2	CT1, CT2,A1,ES,	Q1,Q2	Q1,Q2	Q3, Q4				Q3, Q4,Q5,Q6		
3	CO3	CT1,CT2,A1,ES,		Q1,Q2	Q5, Q6				Q7, Q8,Q9,Q1		
4	CO4	A1,ES,			Q7, Q8				Q11, Q12		
5	CO5										
6	CO6										
1	CO1	CT1, A1,ES,	15		12				14		41
2	CO2	CT1, CT2,A1,ES,	15	15	4				26		60
3	CO3	CT1,CT2,A1,ES,		15	7				26		48
4	CO4	A1,ES,			7				14		21
5	CO5										0
6	CO6										0
TOTAL			30	30	30				80		170

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

MECHANICAL ENGINEERNG DEPARTMENT

LESSON PLAN

CLASS: Second Year **Spring Semester:** IV
Subject: Material Science
Subject Code: 4ME01
Session: 2023 – 2024
Subject Teacher: Prof. V. T. Mhaske

1. **Total number of lectures** : **48 (Min. 44 and Max. 48)**

2. **Introduction of Subject** :

The development of mankind is defined in terms of advances in materials: the Stone Age, the Bronze Age, and the Iron Age. The dramatic advances in architecture and building introduced by the Roman Empire were possible only because of the invention of a new material - concrete. The Industrial Revolution was to a large extend made possible by advances in the sue of materials in industrial equipment, as was the rapid development of the railroads in the late nineteenth century, and the skyscrapers that began to define the skylines of American cities in the early twentieth century.

In the last half century, the growth of materials technology has been explosive, and its impact on our daily lives, pervasive. Beginning with the invention of the transistor in the 50's, the electronics revolution, enabled by advances in materials, has dramatically and irreversibly changed our lives. Some of us remember the sage career advice given to Dustin Hoffman in the 1960's film *The Graduate* - "Plastics". The use of plastics is now so widespread that it is difficult to imagine life without them the double edged sword inherent in the use of new technologies is apparent in today's concern with the disposal of non-biodegradable plastics.

Today's fundamental research activities in the Universities and Research Laboratories give us confidence that we have not seen the end, but rather only the beginning, of advances in Materials Science and Technology that will profoundly effect the way we live our lives. We can expect to see biodegradable plastics produced by genetically engineered microbes, structural materials that are analogs of naturally occurring materials such as shell or bone, improved bioengineered materials to replace joints, bone tendons and skin, super hard materials with hardness greater than that of diamond, aircraft skins that can detect and respond to changes in ambient conditions or to structural damage, bridges made of strong, light weight fiber reinforced plastic composites, and road surfaces that will last for a human lifetime. We have just begun to see the impact of The Materials Revolution. We have chosen Materials Science as the subject of this teaching module

both because of its importance and pervasiveness in our lives, and because it brings together all of the major physical science disciplines and applies them to practical problems with which the student can identify. We have tried to bring in elements of chemistry, physics, mathematics, engineering and the use of computers. We have incorporated materials that represent all of the major classes of materials: metals, ceramics and plastics.

The core of the module is the laboratory work. Here we have tried to keep things as "hands on" as possible. The intent is for the students to get an acquaintance with the scientific method, with laboratory practice, with physical observation and data taking and analysis, and to get a feeling for the fundamental differences between the various classes of materials.

Materials science involves the preparation and characterization of materials to ensure that they have the properties required for a particular application. Classes of materials include plastics, glass, ceramics, metals, and semiconductors. Key properties of materials include their mechanical behavior, electrical, magnetic optical and thermal characteristics, chemical stability and other physical properties such as density and grain structure. The philosophy therefore is to develop the material base of the nation, by making available locally relevant manpower for such development, and basically in the following very broad areas;

-Physical and Mechanical Metallurgy
- Extractive Metallurgy.
- Mineral Processing
- Corrosion Engineering.
- Heat treatment of metals &
- Powder metallurgy.

3.

a] **Course Objectives:**

The objectives of the course are to:

i. Expose the students to sound foundational sciences of Engineering and Engineering technology.
ii. Encourage close association of the course with industries a relevant research establishment in the country and outside the country.
iii. Impart to the students the ability to investigate, analyze and provide solutions to problems arising from metallurgical and materials engineering processes.
iv. Develop in the students an overall sound knowledge of metallurgical and materials

b] **Course Outcomes:**

1. Student will be able to understand the basic concepts of metallurgy and materials classification, different crystal structure and process of solidification of solid solutions
2. Student will be able to understand the Iron-Carbon Equilibrium Diagram, process of formation of microstructure of metal materials and composites.

3. Student will be able to understand different alloying elements and their effects on properties of steels and different types of alloys and their application.
4. Student will be able to understand different types of cast iron, non ferrous metal and alloys and their use, properties and applications.
5. Student will be able to understand various principles of heat treatment used in metallurgy.
6. Student will be able to understand various heat treatment processes, powder metallurgy and industrial applications.

4. Syllabus:

Material Science

Section - A

Unit I: - Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys,
Solid solutions, types and their formation, lever rule for phase mixtures. Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification (8)

Unit II: Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Microstructure of slowly cooled steel, Estimation of carbon from microstructure, structure property relation, Introduction to composite materials, advantages and applications. (8)

Unit III: Alloy Steels: Purpose of alloying, Classification of alloy steels, classification of alloying elements, Effect of alloying elements on eutectoid composition, Eutectoid temperature, and on the S curve, , alloying elements and their effect on properties of steels, OHNS steels, Hadfield'S Manganese steels, High speed steels, their heat treatments and applications, Ferritic, Austenitic and Martensitic stainless steels, their properties and applications, weld decay in stainless steel. (8)

Section-B

Unit IV: Cast irons: Factors governing condition of carbon in cast iron, Maurer's diagram, Solidification of grey and white cast iron, Malleabalizing, Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.
Non Ferrous Metals and Alloys : Types, Properties and uses of Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (8)

Unit V: Principles of Heat Treatment: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on 's' Curve, pearlite, bainite and martenste transformation, Quenching media, severity of quench,

Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability.

(8)

Unit VI : Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening.

Mechanical working of Metals: - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve, Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth. Metallurgical factors affecting various Mechanical working processes, preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.

Powder Metallurgy: Concept, Methods of Manufacture of metal powders, compaction Process-Single die and double die, sintering, stages of sintering, Manufacture of porous bearings & cemented carbide tip tools by P.M.T. Advantages, limitations and applications of powder metallurgy.

(8)

5. Book Recommended: -

1. **Test Book**

Sr. No.	Title of the book	Author(s)	Units covered
T-1	Engineering Metallurgy	Dr. Avener	5,6
T-2	Engineering materials & metallurgy	R. K. Rajput	1,2,4,5.
T-3	Material Science and Metallurgy	Dr. O. P. Khanna	1,2,3,4,5,6

2. Reference Books

Sr No.	Title	Author	Publication
R-1	Mechanical Metallurgy	G. E. Dieter	Mc- Graw Hill International, London 3rd Edition. 1999
R-2	Physical metallurgy for engineers	Clarke and Varney	second Edn.,1987
R-3	Power metallurgy	A.K Sinha	First Edition. 1991.
R-4	Material Science and Metallurgy	V.D. Kodgire	Everest Publishing House
R-5	Engineering physical Metallurgy	Y Lakhtin	Mir Publications. Second Ed. 1999

R-6	Material Science and Metallurgy-	C Daniel Yesudian,	SciTech Publication

6. **Magazine**

Sr No.	Title	Periodicity
1.	ASME, Jr. of material science	Monthly
2.	ASME, Jr. of national science for metallurgy	Monthly

7. **Lecture Plan**

B. E. (Mechanical Engineering)
Semester: Four Semester Lecture Scheme

Subject: Material Science **Subject Teacher:** Vishnu T. Mhaske

Lecture No.	Topics	References
1	Vision Mission PEO's CO's of subject Reference book MS present in library Unit wise syllabus description	
2	**Introduction to metallurgy:** Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy.	T-2,T-3, R-4
3	Classification of materials & their application,	
4	Structure of metals and alloys, formation of Alloys,	
5	Solid solutions, types and their formation	
6	Lever rule for phase mixtures. Solidification of pure metals	
7	nucleation and growth, ingot structure, dendritic solidification	
8	Study of binary equilibrium diagram and invariant reactions.	
9	Construction phase diagram and types	
10	study of Iron-carbon Equilibrium Diagram	
11	Critical temperatures	T-2,T-3, R-4
12	Microstructure of slowly cooled steel	
13	Estimation of carbon from microstructure ,	
14	structure property relation	T-2,T-3,

15	Introduction to composite materials, advantages and applications.	R-4
16	**Alloy Steels:** Purpose of alloying, Classification of alloy steels, classification of alloying elements.	T-2,T4,T-3,R-2
17	Effect of alloying elements on eutectoid composition.	
18	Eutectoid temperature, and on the S curve.	
19	Alloying elements and their effect on properties of steels.	
20	OHNS steels, Hadfield'S Manganese steels.	
21	High speed steels, their heat treatments and applications,	
22	Ferrites, Austenitic and Martensitic stainless steels, their properties applications	
23	Weld decay in stainless steel.	
24	**Cast irons :** Factors governing condition of carbon in cast iron	T-2,T-3, R-4
25	Maurer's diagram	
26	Solidification of grey and white cast iron, Malleabalizing	
27	Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications	
28	Alloy cast irons	
29	Non Ferrous Metals and Alloys: Types, Properties and uses of Brasses and Bronzes.	
30	Important alloys of Aluminum, Lead, Tin and Zinc, their applications.	
31	Bearing materials, Season cracking, precipitation hardening.	
32	**Principles of Heat Treatment:** - Annealing, Normalizing	
33	Tempering Iso-thermal transformation diagrams(S-curve)	
34	super imposition of continuous cooling curves on 's' Curve	R-2
35	pearlite, bainite and martenste transformation	
36	Continued -pearlite, bainite and martenste transformation	
37	Quenching media, severity of quench, Austempering, Martempering and patenting	
38	Retained austenite and sub-zero treatment. Harden ability	
39	**Methods of surface hardening:** Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening.	
40	**Mechanical working of Metals:** - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve,	T-5, T-1,T-2,R-3, T-3
41	Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth.	
42	Metallurgical factors affecting various Mechanical working processes,	
43	Preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.	

44	**Powder Metallurgy:** Concept, Methods of Manufacture of metal powders	R-2
45	compaction Process- Single die and double die, sintering, stages of sintering,	
46	Manufacture of porous bearings & cemented carbide tip tools by P.M.T.	
47	Advantages, limitations and applications of powder metallurgy	R-2
48	Practical Application of material science (topic beyond syllabus) Title: different engine components and its material composition"	

Related Links -

- **http://nptel.iitm.ac.in**

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COURSE NAME

"Material Science"

4ME01

By

Prof. V. T. Mhaske

Mechanical Engg. Dept.
Shri Sant Gajanan Maharaj College of Engineering, Shegaon

Course Outcomes

- 1. To study the basic concepts of metallurgy and classification of materials
- 2. To study the process of formation of microstructures of metal materials and composites
- 3. To study the alloying elements, their effects and applications
- 4. To study the ferrous and non-ferrous metals and respective alloys
- 5. To study the various heat treatment processes and their industrial applications
- 6. To study the mechanical working of metals and process of powder metallurgy

Reference Book

- **Text Books :-**

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Graw hill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material and Science & Mettalurgy, by V.D. Kodgire. Everest Publication House.

- **Reference Books:**

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn., 1987.
3. Power metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication.

Unit 01

Introduction to material Science and metallurgy

Classification of Metallurgy

- **Mechanical Metallurgy:**
  - Mechanical Metallurgy deals with mechanical working, the testing of mechanical properties, the relation between these properties and engineering design and selection of materials.
  - Mechanical metallurgy mainly consist of two main parts:
    - To study basic mechanical properties
    - Behavior of metals in mechanical working operations.
- **Physical Metallurgy:**
  - Study of all the effects that deals with structure of metals and alloys includes in Physical Metallurgy.
  - Physical Metallurgy includes processes like annealing, tempering, work hardening, quenching and alloying of different materials.
  - Also includes study of dislocation and automic structures in metals.

Classification of Metallurgy

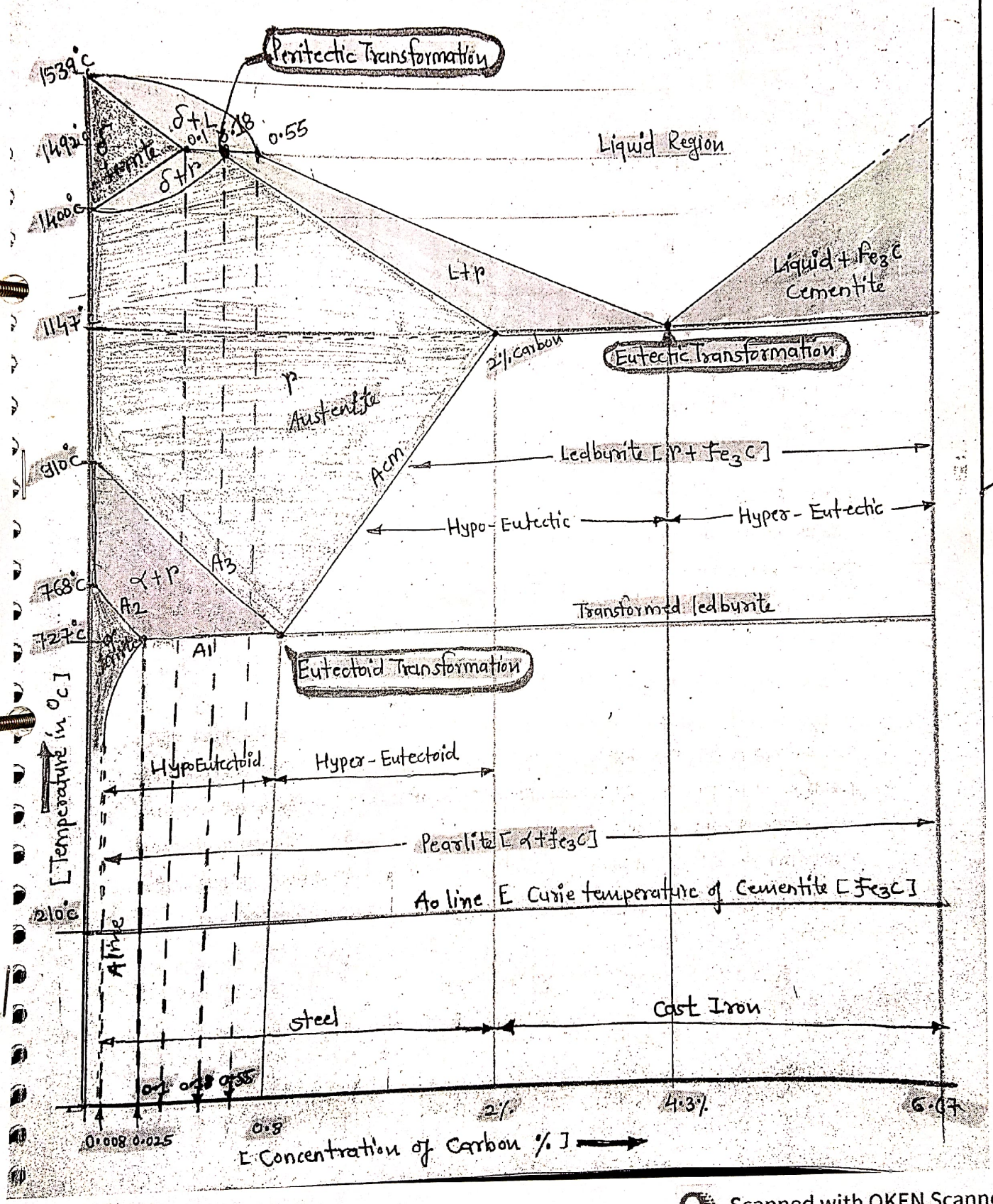
- Metallurgical field divided into three types
1. Extractive Metallurgy or Chemical Metallurgy.
2. Mechanical Metallurgy
3. Physical Metallurgy
- **Extractive Metallurgy or Chemical Metallurgy:**
  - "this metallurgy deals with the liberation of metals by various chemical processes from the ores in which they are found".
  - It also includes refining the metals to a purity.
  - Extractive metallurgy includes mining, concentration, extraction and refining of metals and alloys.
  - Extractive metallurgy sub-divided into ferrous and Non-ferrous categories
  - Ferrous metallurgy is concerned with iron and steel and alloys of iron and steel
  - Non-ferrous metallurgy encompasses all metals and alloys with exception of steel and iron and their alloys.

Materials and its Classification

- **Material:** A material is a substance or mixture of substances that constitutes an object.
- **Materials Classification:**
  - 1. Metals : metals plays major role in industrial and everyday life of human beings.
  - Metals are composed of elements which readily give up electrons to provides metallic bonds and electrical conductivity.
  - Metals are of two types:
    - A. Ferrous Materials
    - B. Non-Ferrous Materials
  - Properties of metals:
    - Luster
    - Hardness
    - Good thermal and electrical conductivity
    - Malleability
    - Formability
    - Dimensional Stability
  - Examples:
    - Iron
    - Aluminium
    - Copper
    - Zinc etc

Phase change Diagram.

1. General phase change Diagram [fe-c] / [fe-fe_3c] diagram



↳ steel with other elements in small amounts having different structure and properties can be discussed with the help of equilibrium diagram named as Fe-C or Fe-Fe_3C diagram as shown in figure.

↳ The various phases existing in the diagram are as below:-

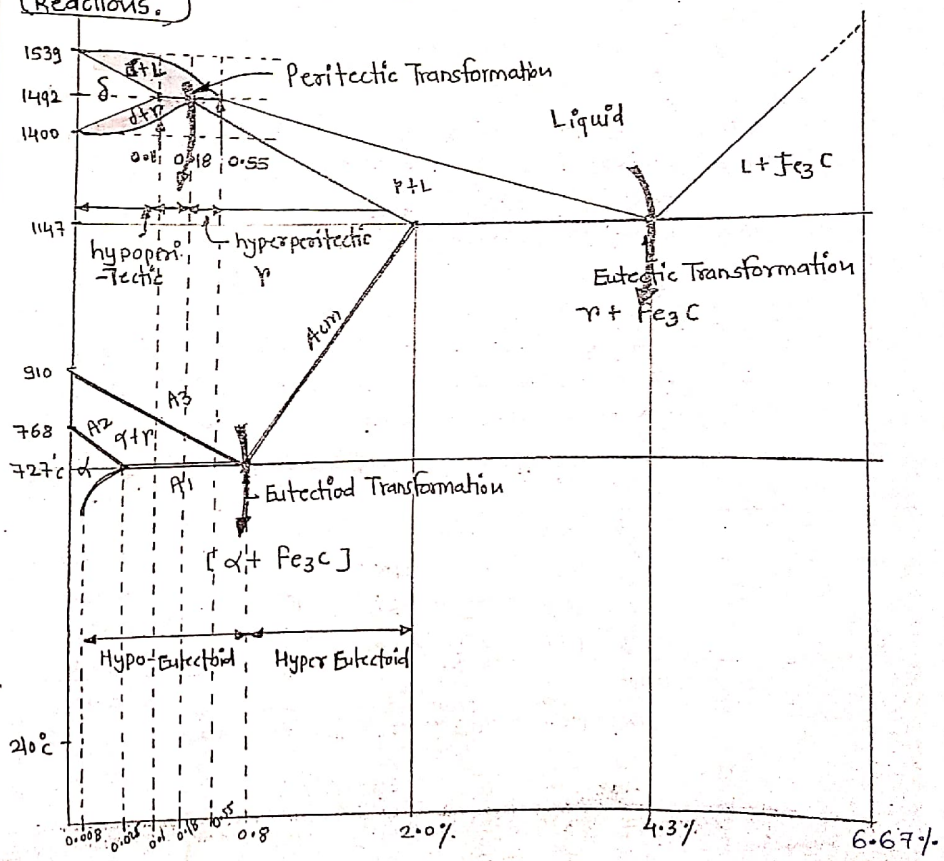
1. **α- Ferrite** :-
   - Ferrite is generally an interstitial solid solution of carbon in low temperature.
   - It is in B.C.C.
   - Solubility of carbon in α-iron [α-Ferrite] is 0.008 to 0.025% at 727°c.
   - Soft, ductile, can be cold worked.
   - Hardness: 80 BHN
   - Strongly Ferromagnetic upto 768°c
   - Curie temperature of α-Ferrite :- 768°c [α-Ferrite changes from Ferromagnetic to paramagnetic
   - upper critical temperature of α-Ferrite :- 910°c

2. **γ (Austenite)** :-
   - Austenite is an interstitial solid solution of carbon in F.C.C.
   - Name Austenite came from Metallographer "Sir Austin."
   - Solubility of carbon in γ [Austenite] is 0.8% of carbon at 727°c upto 2.0% of carbon at 1147°c.
   - Soft, ductile, Malleable
   - Paramagnetic [non-Magnetic]
   - γ (Austenite) phase is stable above 727°c

3. **δ- Ferrite** :-
   - It is interstitial solid solution of carbon at high temperature
   - It is in B.C.C
   - Solubility of carbon in δ-Ferrite is 0.1 to 0.55% at 1492°c
   - Soft ductile
   - upper critical temperature of δ-Ferrite is 1539°c

3. **Cementite [Fe_3C]** :
   - It is intermetallic compound of iron & carbon
   - fixed carbon percentage of 6.67%.
   - Complex orthorhombic structure.
   - Extremely hard & Brittle
   - Hardness 900 VPN.
   - Curie temperature of Cementite :- 210°c
   - Below 210°c, it is feromagnetic.
   - Above 210°c it is paramagnetic or non-magnetic.

Iron- Iron Carbide Diagram with Different transformation points & Reactions.



UNIT 03

Alloying elements and different alloy steels

Prof. V. T. Mhaske

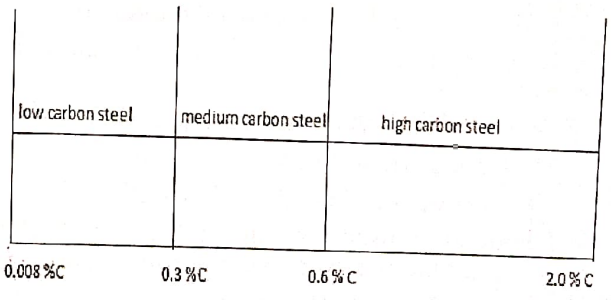
CLASSIFICATION PLAIN CARBON STEEL

- Steels are classified on the various basis as follows:
  - Amount of carbon
  - Amount of alloying element and carbon
  - Amount of deoxidation
  - Grain coursing characteristics
  - Depth of hardening
  - Method of manufacturing.

ACCORDING TO THE TYPE OF CARBON

- Low carbon steel
- Medium carbon steel
- High carbon steel

1. **Low carbon steel:**
   - Carbon % varied from 0.008 to 0.30 %
   - They are soft, ductile, malleable, tough, machinable, weldable,
   - They are good for cold working such as rolling into thin sheets required for galvanizing, tinning or press work.
   - Good for fabrication work.
   - They cannot be hardened by heat treatment.



Application:

wires, nails, rivets, screws, panels, welding rods, ship plates, boiler plates, fan blades, crank shaft, connecting rods, tube for bicycles and automobile.

- Steels with 0.15 to 0.30 % carbon are widely used as structural steel and find application as building bars, grills, beams, angle channels
- Well known example of this type of steel is Mild steel.
- In mild steel as per Indian Standard Specification:
  - Carbon < 0.23
  - Y.S. = 26 kg/mm^2
  - Sulphur < 0.055 %
  - Phosphorous < 0.055 %

Complete

Unit 04

Cast Iron and Non-Ferrous Metals

by

Prof. V. T. Mhaske

Classification of Cast Iron

1. **On the basis of furnace used:**
   1. Cupola furnace: cupola cast iron
   2. Air furnace cast iron
   3. Electric furnace cast iron
   4. Duplex cast iron (Melted in one furnace and refined in another)
2. **On the basis of composition and purity:**
   1. Low carbon low silicon cast iron
   2. High carbon low sulpher cast iron
   3. Nickel alloy cast iron
3. **On the basis of microstructure and appearance of fracture:**
   1. White cast iron
   2. Malleable cast iron
   3. Grey cast iron
   4. Nodular cast iron
   5. Mottled cast iron
   6. Chilled cast iron

UNIT 05

"PRINCIPLES OF HEAT TREATMENT"

BY

PROF. V. T. MHASKE

CONTINUOUS COOLING TRANSFORMATION (CCT) CURVE AND SUPERIMPOSITION ON TTT DIAGRAM

- TTT diagram valid only for isothermal transformation of austenite.
- They are not valid exact sense to the usual heat treatment processes like full annealing, normalising and hardening because in these processes steel is not cooled isothermally but cooled continuously.
- When steel is cooled continuously from high temperature to low temperature, TTT curve shift towards right side and also downwards, i.e. pearlite and bainite transformation occurs at lower temperature and required longer time for their completion.
- As shown in figure, superimposed curve i.e. CCT curve on TTT diagram is as shown in figure.

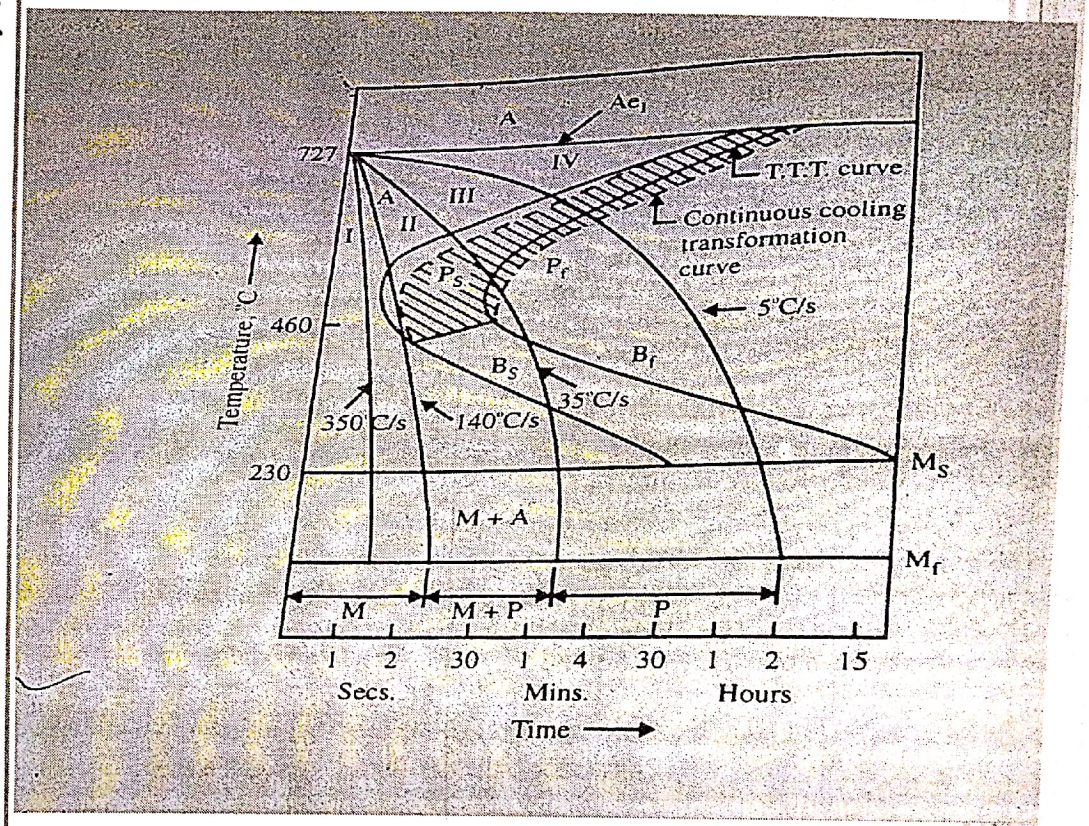


Figure: Continuous cooling transformation (CCT) curve and superimposition on TTT diagram

Unit 06

"Hardening techniques and Powder Metallurgy"

Prof. V. T. Mhaske

Surface hardening or case hardening

- In many applications such as crankshaft, camshaft, gears etc. hard and wear resistance surface is necessary with tough core to withstand impact loads.
- It is difficult to achieve by using steel of uniform composition.
- This is achieved by using:
  - Increasing the carbon on the surface of low carbon or low carbon low alloy steel and subsequently heat treating the components in specific manner.
  - Introducing nitrogen in the surface of tough steel so as to produced hard nitrided case with no subsequent heat treatment.
  - Introducing carbon and nitrogen in the surface of tough steel and subsequently heat treating so as to produced hard and wear resistance case.
  - Hardening the surface without change of composition of surface.
- **Different surface hardening methods are:**
  - Carburizing
  - Nitriding
  - Carbonitriding
  - Flame hardening
  - Induction hardening

Carburizing

- **Definition:**
  - The method of increasing the carbon on the surface of steel is called carburizing.
- **Process:**
  - Consists of heating the steel in austenitic region in contact with carburizing medium
  - Holding at this temperature for sufficient time period
  - Cooling to room temperature.
  - In austenitic region solubility of carbon is more and hence carbon from media diffuses into the steel.
  - After carburizing, hardening treatment is necessary to bring carbon in martensitic form.
  - Carburization is also known as cementation, case carburizing or case hardening
- **Types of carburizing:**
  - Solid carburizing:
    - Components to be carburized are packed with carbonaceous materials in steel or cast iron boxes and sealed with clay.
    - Usual carbonaceous material consists of wood charcoal, 30 to 32 % coke and remaining carbonates of Ba, Ca, and Na.
  - Roll carburizing:
    - For obtaining very thin cases, roll carburizing may be used
    - Roll carburizing consists of heating the steel components to above 900 degree celcius.
    - Rolling it in carburizing media.
    - Reheating to the same temperature and holding for some time
    - Quenching in water.
    - Non toxic Kashenite components is used in this process.

3. Gas carburizing:
   - Here components is heated in the austenitic region in the presence of carbonaceous gas such as methane, ethane, propane.
   - These gases decomposes and carbon diffuses into steel to maintained uniform distribution of carbon, gases should be properly controlled.
   - Process is carried out at 900 to 925 °C.
   - It is commonly used to obtained relatively thin cases of high uniformity
   - Particularly suited to large volume production and provides accurate control of case depth.
4. Liquid carburizing:
   - In this method the carburizing is done by immersing the steel components in carbonaceous fused salt bath medium in austenitic region.
   - Bath is composed of sodium cyanide, sodium carbonate and sodium chloride.
   - Used of salt bath offers uniform heat transfer, low distortion and rapid absorption of carbon.

Heat treatments after carburization:

Direct quench

Double quenching

Powder metallurgy

- What is powder metallurgy? Explain different steps and methods of powder metallurgy with neat sketch. Also gives application of powder metallurgy.
- **Powder metallurgy:**
  - Powder metallurgy is the branch of metallurgy which deals with the production of metals and non-metals powder and subsequently manufacturing of components by using these product.
- **Steps in production of powder metallurgy:**
  - Production of sintered structural components using powder metallurgy has following steps:
  - 1. powder production
  - 2. blending or mixing
  - 3. compacting that is pressing
  - 4. sintering
  - 5. sizing or impregnation
  - 6. testing and inspection.

1. **Power production:**
   - Powders are manufactured by various methods and the powder from each method has typical properties
   - Right type of powder should be used or obtaining the specific properties in the components.
2. **Blending or mixing:**
   - Powder of metals or nonmetals are carefully blended to obtained uniform and homogeneous mixture.
   - This is essential for obtaining the desired properties in the components after sintering.
   - During blending or mixing, lubricants are usually added to reduced the friction between the die wall and punches to obtain better uniformity of density distribution in the cold compact.

3.Compacting:

- Compaction in metal dies is one of the most important method for shaping of metal powder.
- Powder mix is feed into the die cavity as shown in figure through the hopper and feed show is oscillated to assist the powder flow
- The volume of powder is controlled by adjusting the position of bottom punch in die cavity.
- When the die has been evenly filled with powder, the upper surface is leveled by the swip of the feed show and the top punch is pushed in to the die cavity.
- The pressure is then applied on any one punch or simultaneously on both the punches to compact the powder.
- After maximum compression, upper punch is removed and the compact is injected by raising the lower punch, leaving it free for the next similar operation.

4. Sintering:

- Sintering is carrying out to increase the strength and hardness of green compact.
- It consist of heating the compact to same temperature under controlled condition with or without pressure for a definite time .sintering process is concern with
  - Diffusion
  - Densification
  - Recrystalluzation
  - Grain growth.

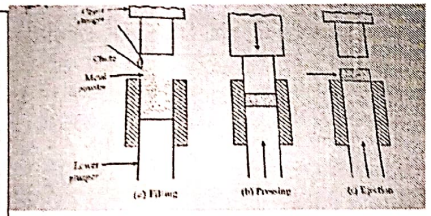


Figure: Steps in cold Compaction

5. **Sizing or impregnation:**
   - The sintered compact may have slightly different size from the desired one due to distortion occurring during sintering process.
   - Size rectification is done by placing the components in master die and applying the pressure as shown in figure called sizing.
6. **Testing and inspection:**
   - The components should be tested for various properties.
   - Various test conducted are compressive strength, tensile strength, porosity, density etc.

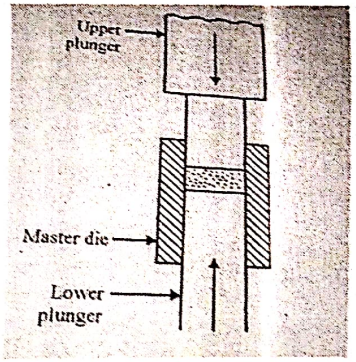


Figure: Sizing or impregnation

Different Processes for powder metallurgy

- Various processes in manufacturing the powder are classified into four methods:
  Mechanical process 2. Physical process 3. Chemical process. 3. Electrochemical process.

1. Mechanical process:

mechanical processes are classified as

1. machining:
   - this method is used to produced filing, turning, chips etc which are subsequently pulverized by crushing and milling.
   - relatively coarsed powder is obtained by this method.
   - Only suitable for Mg powder, silver solder, dental alloys etc.
2. crushing:
   - Solid materials are crushed by hammer, jaw crushers etc.
   - The powder particles of brittle materials are angular in shape
   - Suitable for brittle materials.
3. milling:
   - Most important and widely used methods for production of powder of required grades and fineness
   - Milling is done by using equipments like ball mills, rod mills, disc mills, eddy mills.
   - In ball milling methods the materials to be powdered is tumbled or rotated in container with large number of hard balls.
   - Milling may be done either dry or wet method.
   - In wet method, liquid medium such as distilled water, alcohol, acetone is used in drum.
   - Drum of ball is made of stainless steel lined with hard alloy steel plates.
   - Any type of materials can be powder by milling methods.
   - Widely used for carbide metal mixture.

Different engine components and its material compositions

Prof. V. T. Mhaske

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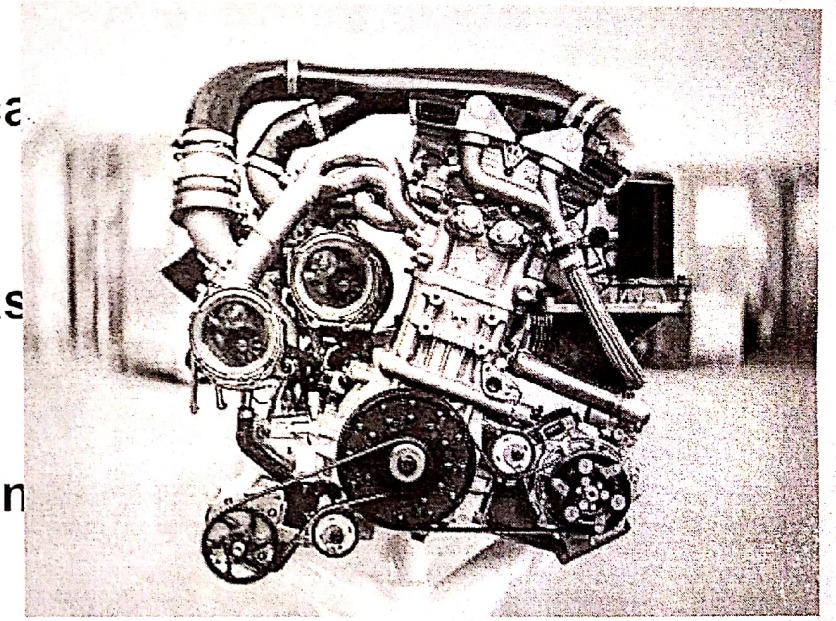
INTRODUCTION

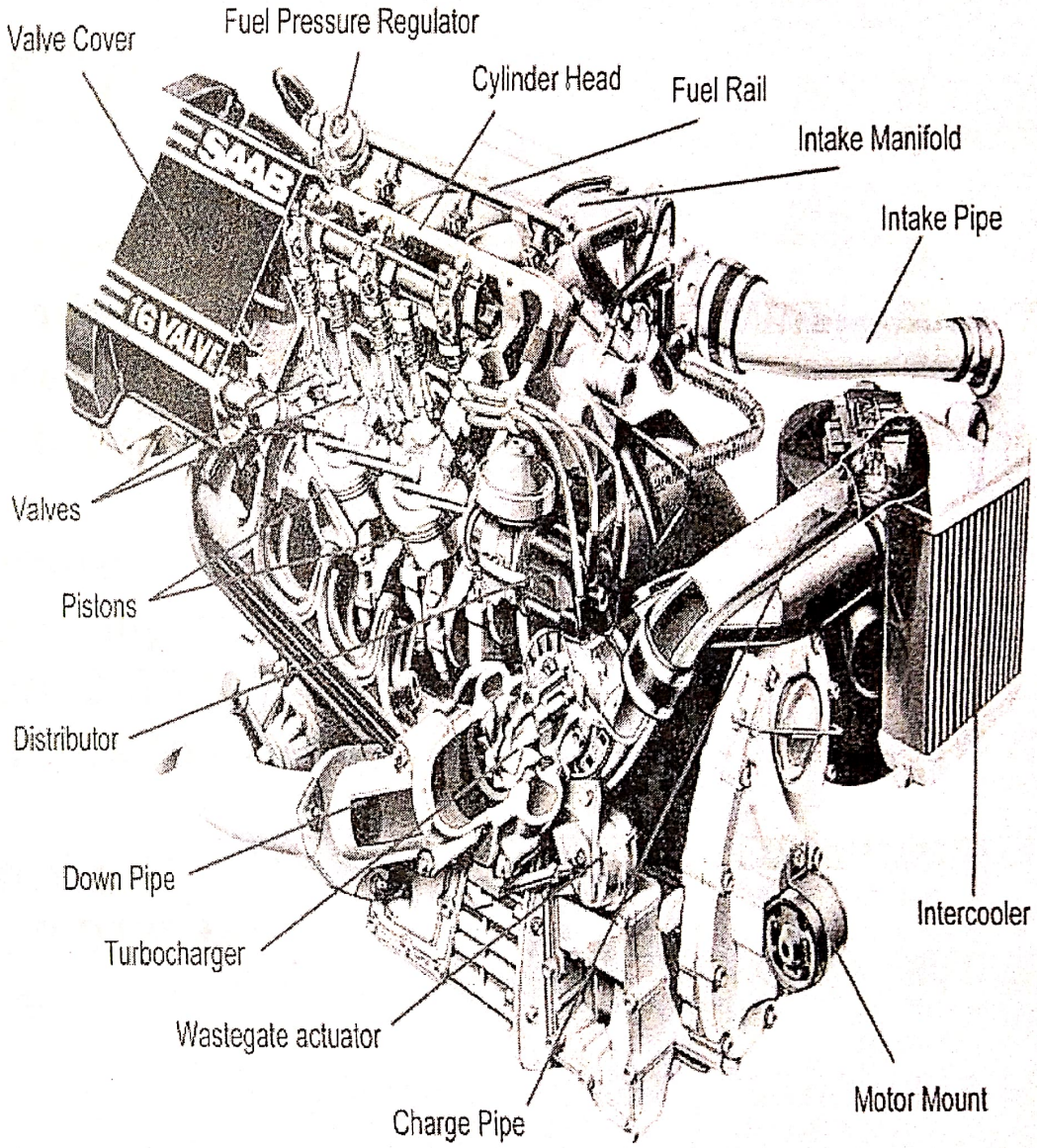
- An engine is a machine that converts energy from another form into mechanica energy, which creates motion. Engines can run on a variety of fuels, including gasoline, diesel, biofuels, and natural gas

- This presentation provides a comprehensive overview of vehicle engin components and their material compositions.



PARTS OF ENGINE

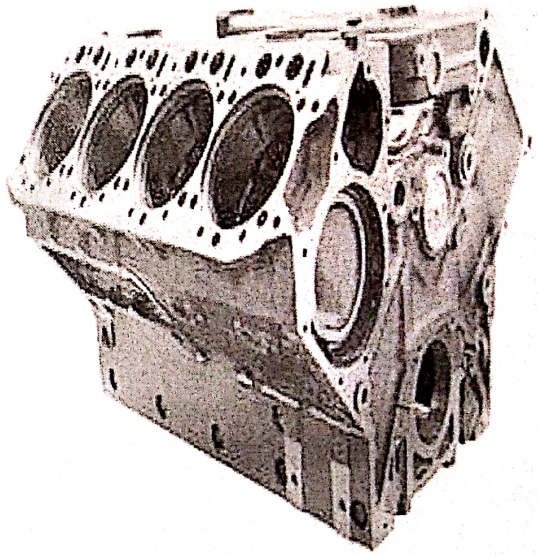
1. Cylinder block
2. Pistons
3. Crankshaft
4. Camshaft
5. Valves
6. Spark plugs
8. Fuel injectors
9. Gasket
10. Belt Drives
11. Engine exhaust manifold
12. Oil Pump



CYLINDER BLOCK

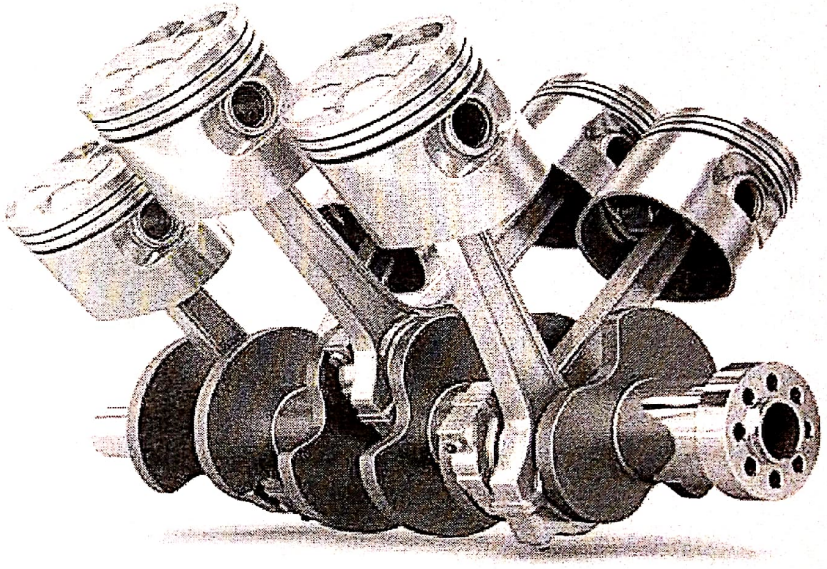
Engine blocks are normally cast from either cast iron or an aluminium alloy. Aluminium blocks are much lighter in weight and transfer heat more effectively to coolant.

An aluminum alloy for a cast engine block, said alloy consisting essentially of by weight, 11.25 to 11.75% silicon, 0.35 to 0.65% iron, 1.75 to 2.75% copper, 0.4 to 1.2% manganese, 0.15 to 0.3% magnesium, 0.5% max zinc, a trace of nickel, 0.2% maximum titanium, 0.01% to 0.03% strontium and the balance aluminum.



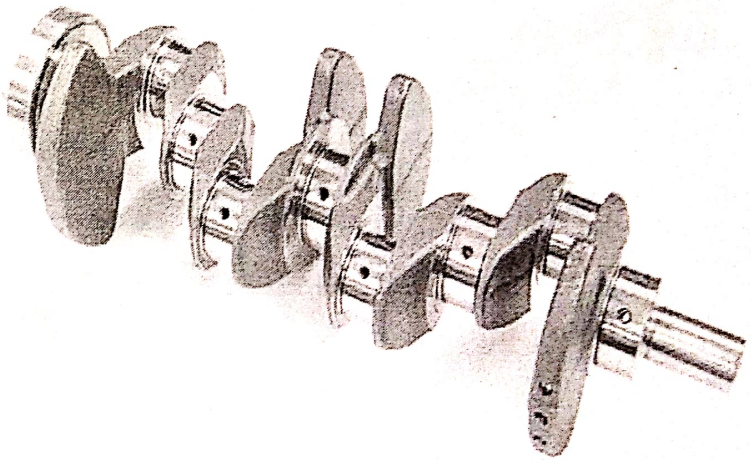
PISTONS

Pistons are produced from cast or forged, high-temperature resistant aluminum silicon alloys. There are three basic types of aluminium piston alloys. The standard piston alloy is a eutectic Al-12%Si alloy containing in addition approx. 1% each of Cu, Ni and Mg.



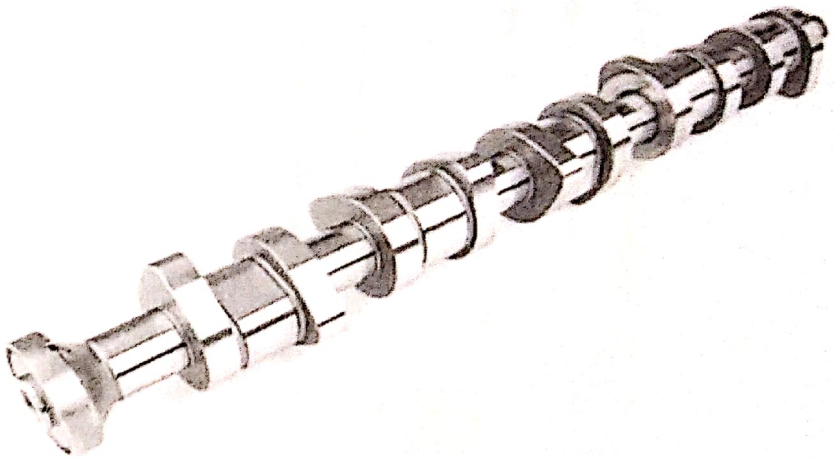
CRANKSHAFT

Crankshafts are typically made of forged steel or cast iron because these materials are durable enough to withstand high stress and pressure. The crankshaft is usually made of medium-carbon steel alloys, which contain iron and a small percentage of carbon (0.25% to 0.45%), along with combinations of several alloying elements



CAMSHAFT

Camshafts are made from a variety of materials, including cast iron, steel, ductile iron, and medium carbon steel. The material used affects the camshaft's toughness and hardness. For example, steel camshafts can handle more mechanical loads than cast iron camshafts. The shape of the cams also has a big impact on the engine's characteristics.



VALVES

Engine valves are made of various materials, including chrome, nickel, tungsten steel, silicon-chromium, cobalt-chromium alloys, stainless steel, titanium, and Tribaloy® alloys. The main elements in exhaust valves are chromium, nickel, and silicon. For example, exhaust valves can be made of a martensitic steel with chromium and silicon alloys, or a two-piece valve with a stainless steel head and martensitic steel stem. Intake valves are mainly made of chrome, nickel, or tungsten steel.

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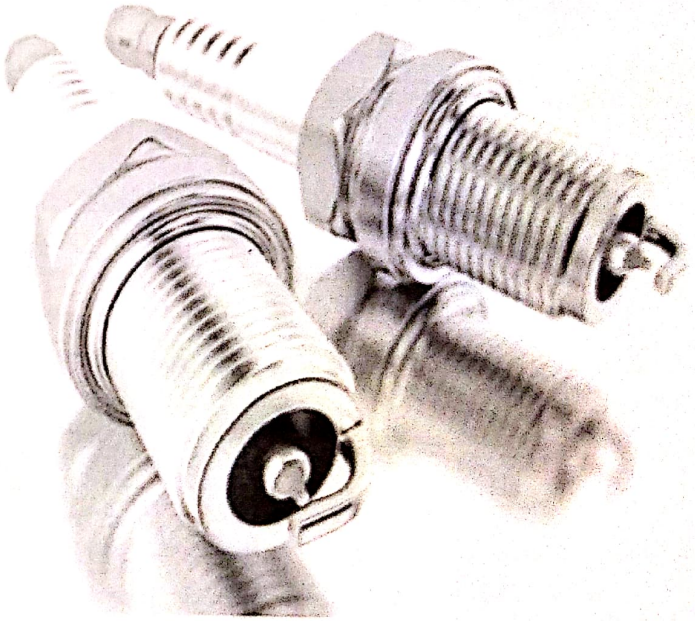
SPARK PLUGS

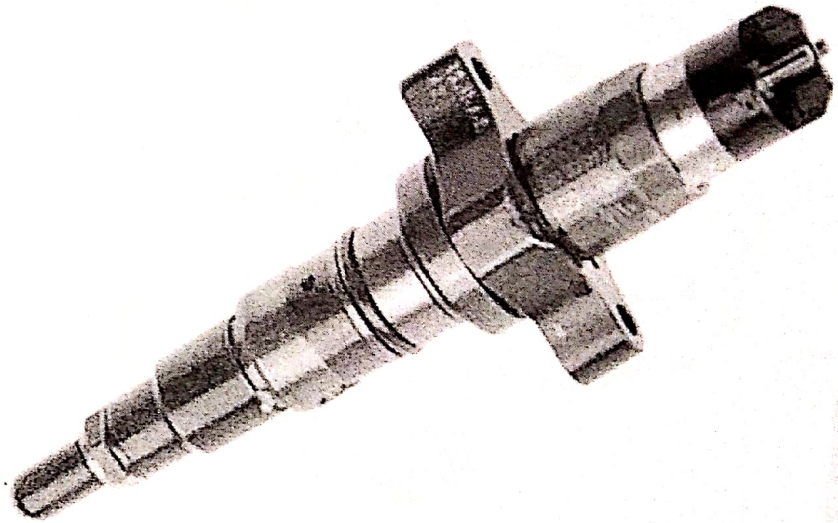
Most spark plugs used today feature a single-ceramic insulator made from aluminium oxide, with other types of ceramic materials like porcelain used in the past. This provides many benefits, including thermal conductivity and superior insulation.



FUEL INJECTOR

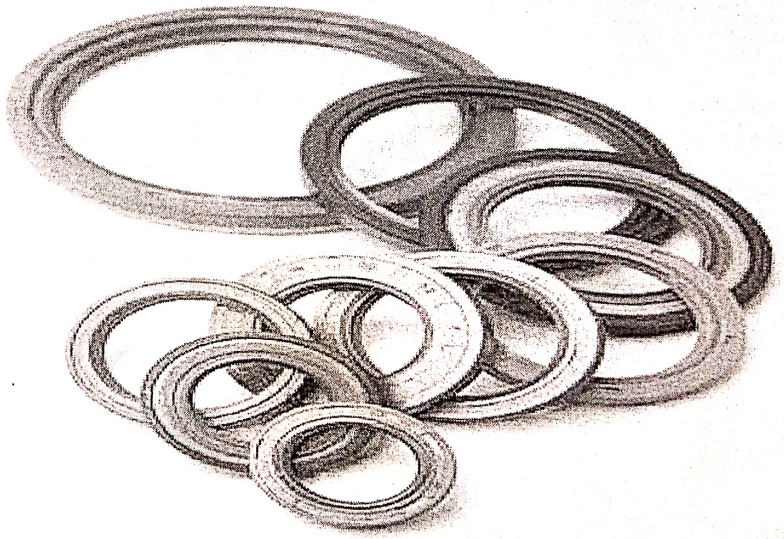
Fuel injectors are usually made of stainless steel.

- Carburized or maraging steel: Can withstand high temperatures and pressures
- Copper: Has good corrosion resistance and thermal conductivity, and can dissipate engine heat
- Aluminum killed steel: Can prevent problems like tembrittlement and cracks.



GASKET

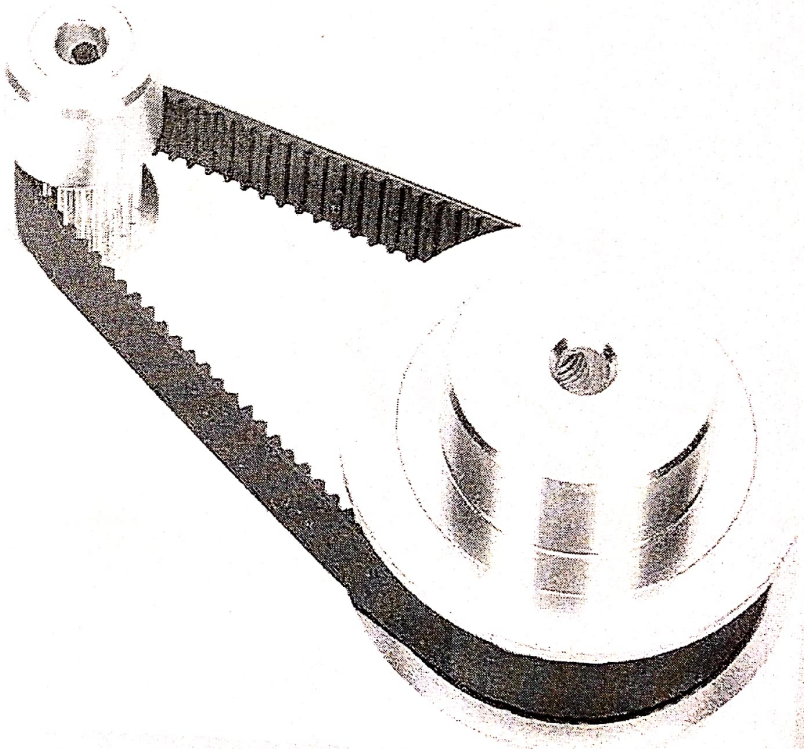
A combination of cork and rubber, for example neoprene or nitrile, yields a gasket resistant to solvents, oils, and fuels. Some of the materials used in the formulations and grades include: Cork & Neoprene Blend. Cork & Viton Blend.



BELT DRIVES

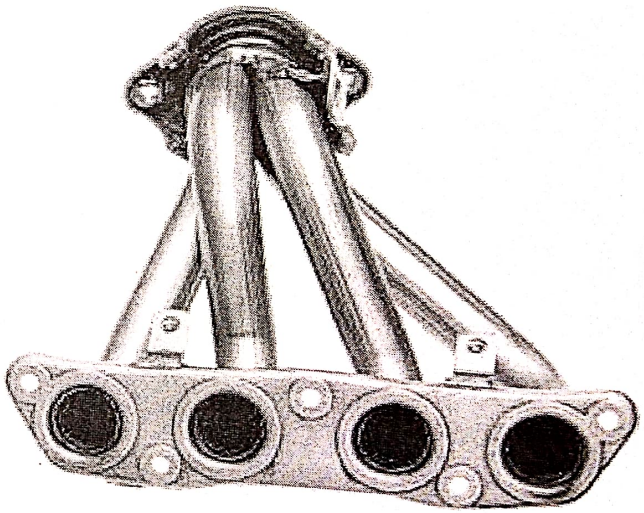
Engine belts are made of rubber or synthetic materials that are reinforced with cotton, Kevlar, or other fibers to prevent stretching and provide structure. The rubber provides elasticity and resilience, while the reinforcing fibers provide strength and stability to maintain the belt's shape.

Some common materials used to make industrial power transmission belts include: Reinforced rubber, Urethane and polyurethane



EXHAUST MANIFOLD

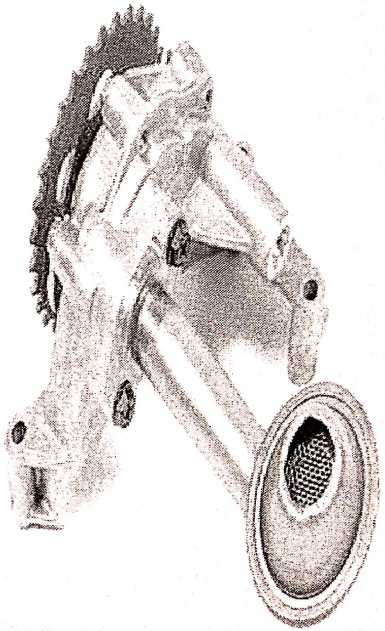
Exhaust manifolds are usually made of cast iron or stainless steel. Cast iron is a popular choice because it's heat-resistant, durable, and cost effective. Stainless steel is also a popular choice because it's corrosion its resistant and lasts a long time.



OIL PUMP

Engine oil pumps can be made from carbon steel, chromium steel, or cast iron, depending on the temperature of the fluid:

- Carbon steel: Used for pressure-resistant parts below 370°C
- 5% or 13% chromium steel: Used above 370°C
- Cast iron: Used below 230°C



THANK YOU...!!!

B.E. Fourth Semester (Mechanical Engineering) (C.B.C.S.) Summer 2023

Material Science - 4 ME 01

P. Pages : 2 **AD - 2646**

Time : Three Hours Max. Marks : 80

* 0 6 1 5 *

Notes :
1. Answer three question from Section A and three question from Section B.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Use of scientific calculator is permitted.
6. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) How are engineering materials classified? State the main characteristics and applications of each class. 7

b) Define 'Co-ordination Number'. Explain how the co-ordination number for BCC and FCC are calculated. 6

OR

2. a) Explain in brief solidification of an ingot in a mould. Also show the different types of grains formed during solidification with a neat sketch. 6

b) Describe the procedure of finding 'Miller Indices for crystallographic planes with an example. Also draw (011) and (123) planes. 7

3. a) Draw a neatly labelled Fe-C equilibrium diagram and explain the three invariant reactions occurring on it. 8

b) What are composites? Discuss their advantages and applications.

OR

4. a) Draw a phase diagram showing 'Eutectic reaction' and explain the cooling of an alloy with hypo-eutectic composition from liquid state to room temperature.

b) Draw Fe-C diagram and calculate the weight percentage of phases present at room temperature of (i) 0.4%C steel (ii) 0.9%C steel and (iii) 1.2%C steel

5. a) Why alloying elements are added to steel? Also explain how alloy steels are classified? 6

b) Explain in brief the properties, applications and heat treatment given to following alloy steels. 7

i) Hadfield's Manganese steel ii) High Carbon High Chromium Steel (HCHC)

OR

6. a) What is 'Weld Decay'? How can the effect of weld decay be rectified? 6

b) What are 'High Speed Steels' (HSS)? Describe the heat treatment given to HSS for achieving maximum red hardness. 7

SECTION – B

7. a) Distinguish between the following 7
   i) Malleable cast iron and Nodular Cast Iron
   ii) White cast Iron and Grey cast Iron

   b) What are Babbits? Describe briefly the compositions and applications of any two types of Babbits. 6

OR

8. a) Describe the composition and applications of cartridge Brass, Naval Brass and Gun metal. 6

   b) State and explain the factors that govern the production of white cast iron and Grey cast iron. 7

9. a) Explain the following 9
   i) Austempering
   ii) Martempering
   iii) Patenting

   b) Explain the 'Jominy End Quench' test to determine the hardenability. 5

OR

10. a) Define 'Annealing'. Discuss various sub-types of annealing process. 7

    b) What is tempering. Describe with a suitable sketch various stages of tempering. 7

11. a) Explain the following with a neat diagram. 6
    i) Recovery
    ii) Recrystallization
    iii) Grain Growth

    b) What is 'Powder Metallurgy'? Explain any three methods of production of metal powders. 7

OR

12. a) What is case or surface hardening? Describe with suitable diagram the methods of Flame and Induction hardening. 7

    b) Explain the steps in the powder metallurgy process. 6

****

Shri Sant Gajanan Maharaj
College of Engineering, Shegaon

(12 Pages)

Name: Hrutik Santram Kushwaha Roll No: 49

Year / Branch: Mechanical Eng Test No. 11

Subject: M.S Date: 29/04/24 Max. Marks: 30

Q. No.	1	2	3	4	5	6	Total
Marks Obtained	15		13				28/30

Q1) a) Alloying elements are added in the steel to improove their chemical and physical ~~prote~~ properties.

2) Due to alloying their mechanical properties are also increases such as

1) High impacct strength, Good vibration absorption
2) Greater corrosion resistance
3) lower melting point
4) Better creep and fatique resistance.
5) Impart shining, hight ductality and mellability.
6) Shifting of critical temperature.

Hence the alloying elements are added in the steel.

ii) Alloying elements are classified as follow.

1) Neutral element: Cobalt are the neutral element which not support to graphitization or nor carbide formation.

2) Graphitization element are also divided in to two type such as ferritic stabilizer and Austenitic stabilizer.

1) Ferritic stabilizer: Sulphur, phosphorus, silicon are ferritic stabilizer.

ii) Austenitic stabilizer: Mangenese are the austenitic stabilizer.

2) They form austenit in the solid solution hence they are called as austenitic stabilizer

3) Carbide formers: These elements are form carbide hence they are called as carbide formers.

2) They increase the strength of the material also make brittle if excess amount are present

eg: Cr, W, V, Nb etc.

Q2) b)

During the welding of the austenitic steel chromium carbide are move toward the grain boundry hence decaying process are start due to lowing of cromium percentage from below 13 % of upto 13% hence they are called as weld decay.

2) They are occurs during the welding of the austenitic steel only.

3) If the temperature of weld region are above 1000°C then weld decay are not occurs.

4) When the temperature of the weld region are at 600-800°C weld decay are form.

5) Because in this temperature cromium carbide are form and start to precipating toward the grains boundry.

6) Hence they are collecting chromium from the neighbouring ~~atom~~ atoms ~~at~~ upto 70% of the total chromium.

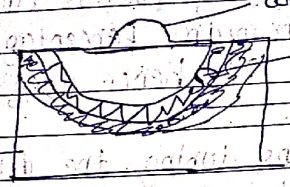
7) Hence the % of chromium in the other region are ~~20~~ / 13 % of below hence the corrosion resistance property are decreases in that region and corrosion are started.

8) ~~Chromium less~~

8) In a place where % chromium are low are act as a anode and ~~Cr-Fe~~ C other region are act as cathode

9) Hence the corrosion are occurs at anode and decaying of metals are started due to granular corrosion.

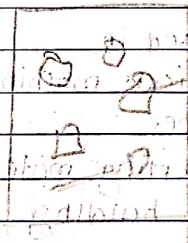
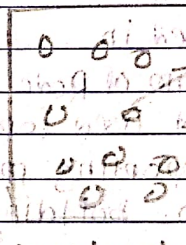
$$3Fe + C + Cr \xrightarrow{\Delta} (Fe_3Cr)_4C$$



weld decay are rectified as follows

1) by providing proper heat treatment by heating at 1000°C for long time.
2) by adding stronger carbide forming element like Cb, Ti, Ta, etc.

Q3)

a) malleable cast iron	nodular cast iron
1) made from white cast iron	1) made from grey cast iron
2) form by malleablizing heat treatment	2) made by adding nodulizing element like Mg, Li, Ca etc.
3) Graphite present in the form of spheroids, rosettes.	3) Graphite in the form of nodules,
4) high hardness upto 280 VHN	5) low hardness upto 200 VPN
5) high strength than nodular cast iron	6) low strength than malleable cast iron.
7)  microstructure	7)  microstructure

	White cast Iron	Grey cast iron
1)	White in appearence hence called white cast Iron	1) Grey in appearence hence called as grey cast iron
2)	Graphitization are not occurs	2) Graphitization are occurs.
3)	Carbon are presen in combine form :- eg cementide	3) Carbon are present in the form of flakes.
4)	Hard than grey cast iron 350 VPN	4) Hardness are lower than white cast iron 80 VPN
5)	eg: used in Drum of Rode Roller 2) not used for supporting material in building	eg: used in various machine bases pipes. 2) supporting material for buldiing.

23) b) Cartridge Brass:

They contains Brass upto 30% of Zn and 70% of copper

2) They are generally cold work brass.
3) they have high ductility, mellability.
4) Also high corrosion resistance because have 30% of Zn.
5) Seasonal cracking are occurs

$$Cu^{2+} + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+}$$

Copper ammonia — cupra ammonia

eg: used in cartridge of bullets., containers by drawing coils, springs,

2) Muntz metal:

They ~~contoni~~ contains 40% Zn and 60% of copper.

2) they are also called as 60-40 Brass.
3) They are generally hot rolled.
4) High corrosion resistance because contains 40% of Zn
5) Seasonal cracking are not occurs.
6) High strength but low mellability and low ductality because of high zinc.

eg: Condensor coils, nut, bolt, radiators fins, rivets etc.

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Session : 2023-24 (Spring Semester)

Feedback On Class Test 2

Class / Branch : **2M**

Subject / Subject Code : **MS / 4ME01**

Faculty Name : **VISHNU T. MHASKE**

Date : **07-05-2024**

Sr.No	Particulars	Particular Value
1	Syllabus for Current Test (Mention Unit No)	03,04
2	Question Paper Set Is As Per Prescribed Format (Y/N)	Yes
3	Solution During Feedback	Discussed
4	No. Of Students Provided	74
5	% of students present for Class Test	97.30
6	% of students absent for Class Test	2.70
7	Pass %	69.44
8	Fail %	30.56
9	Average Marks of The Class	15.19
10	Marks Uploaded Date	03-05-2024
11	Course Outcomes Covered in Class Test(Mention No.)	CO3 , CO4
12	No.Of Correction/Revalued Answer Books	01
13	RBTLs (Learning Levels) Addressed in Class Test	L2

Signature Of Teacher

Signature Of HOD

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Session : 2023-24 (Spring Semester)

Feedback On Class Test 1

Class / Branch : 2M

Subject / Subject Code : MS / 4ME01

Faculty Name : VISHNU T. MHASKE

Date : 15-03-2024

Sr.No	Particulars	Particular Value
1	Syllabus for Current Test (Mention Unit No)	01,02
2	Question Paper Set Is As Per Prescribed Format (Y/N)	Yes
3	Solution During Feedback	Discussed
4	No. Of Students Provided	74
5	% of students present for Class Test	81.08
6	% of students absent for Class Test	18.92
7	Pass %	66.67
8	Fail %	33.33
9	Average Marks of The Class	13.35
10	Marks Uploaded Date	15-03-2024
11	Course Outcomes Covered in Class Test(Mention No.)	CO1 , CO2
12	No.Of Correction/Revalued Answer Books	19
13	RBTLs (Learning Levels) Addressed in Class Test	L1

Signature Of Teacher

Signature Of HOD

Attendance Report For 2M

Teacher Name : VISHNU MHASKE

Date : 13-05-2024

Sr No.	Subject	Attendance Date	Submission Date	Present	Absent	Total
1	MS	01-01-2024	03-02-2024	0	74	74
2	MS	29-01-2024	11-03-2024	0	74	74
3	MS	30-01-2024	03-02-2024	17	57	74
4	MS	01-02-2024	03-02-2024	30	44	74
5	MS	02-02-2024	11-03-2024	35	39	74
6	MS	05-02-2024	26-02-2024	25	49	74
7	MS	05-02-2024	11-03-2024	46	28	74
8	MS	06-02-2024	11-03-2024	0	74	74
9	MS	07-02-2024	11-03-2024	29	45	74
10	MS	08-02-2024	23-02-2024	9	65	74
11	MS	09-02-2024	26-02-2024	25	49	74
12	MS	12-02-2024	26-02-2024	40	34	74
13	MS	12-02-2024	11-03-2024	38	36	74
14	MS	13-02-2024	26-02-2024	45	29	74
15	MS	15-02-2024	23-02-2024	24	50	74
16	MS	16-02-2024	23-02-2024	28	46	74
17	MS	20-02-2024	26-02-2024	36	38	74
18	MS	22-02-2024	26-02-2024	41	33	74
19	MS	23-02-2024	26-02-2024	28	46	74
20	MS	26-02-2024	11-03-2024	30	44	74
21	MS	27-02-2024	11-03-2024	48	26	74
22	MS	29-02-2024	11-03-2024	32	42	74

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Test I Mark Report

Class Name : 2M Subject Name : MS

Teacher Name : Prof. VISHNU T MHASKE

R No.	Student Name	Mark Out Of 30	Attendance Status
1	Ku. Ashwini Harsule	18	Present
2	Ku. DHANSHRI TAYADE	12	Present
3	Ku. Divya Chandle	5	Present
4	Ku. GAYATRI BHORE	13	Present
5	Ku. KSHITIJA DESHMUKH	18	Present
6	Ku. MANSI TALEKAR	22	Present
7	Ku. PRACHI ITNARE	20	Present
8	Ku. Prachi Gawali	5	Present
9	Ku. Pragati Sonone	10	Present
10	Ku. Punam Khandare	17	Present
11	Ku. RUCHIKA NIKOLE	13	Present
12	Ku. RUTUJA DESHMUKH	22	Present
13	Ku. SAKSHI BHOSLE	16	Present
14	Ku. SAMIKSHA CHENDALANE	10	Present
15	Ku. Samiksha Dhoke	9	Present
16	Ku. Sanika Deshmukh	14	Present
17	Ku. Sejal Pahurkar	13	Present
18	Ku. Shravani Joshi	AB	Absent
19	Ku. Shweta Nalkande	2	Present
20	Ku. Sneha Gite	AB	Absent
21	Ku. Sonal Dongre	13	Present
22	Ku. Sonu Rekhate	29	Present
23	Ku. Unnati Deshmukh	14	Present
24	Ku. Vaishnavi Deshmukh	13	Present
25	Ku. VAISHNAVI UMAK	AB	Absent
26	Ku. Vaishnvi Mirge	AB	Absent
27	Abhijeet Nanotkar	12	Present
28	Abhijit Nage	21	Present
29	Abhishek Khodre	AB	Absent
30	Abhishek Nimbalkar	12	Present
31	ABHISHEK SHELKE	AB	Absent
32	Adinath Udgirikar	7	Present
33	Adinath Gogate	0	Present
34	Akash Suralkar	16	Present
35	Amit Wankhade	6	Present
36	Atharv Nage	AB	Absent
37	ATHARVA JOSHI	14	Present
38	Avinash Honale	AB	Absent
39	CHETAN NIMBOLKAR	13	Present
40	CHETAN BANAIT	16	Present

41	Devashish Sadavarte	AB	Absent
42	Devendra SAWDEKAR	5	Present
43	DHAWAL LOKHANDE	6	Present
44	Gaurav Pande	7	Present
45	GAZAL BARAI	8	Present
46	GUNJAN DHAGE	4	Present
47	Harshal Malik	14	Present
48	HIMANSHU ZADOKAR	22	Present
49	HRUTIK KUSHWAHA	27	Present
50	Jay ZOPE	16	Present
51	KAUSHAL GHULAXE	5	Present
52	MANDAR PAWAR	16	Present
53	MOHIT WAGHMARE	17	Present
54	PRASHANT DHAMODE	15	Present
55	Pratik Kalskar	3	Present
56	Rohit Kurhade	18	Present
57	Rohit Dautpure	8	Present
58	Sagar Pande	18	Present
59	SAMARTH PARASKAR	5	Present
60	Shivam Mehenge	AB	Absent
61	Shivkumar Ingle	17	Present
62	Shivshankar Jadhav	AB	Absent
63	SHUBHAJIT MOHOD	23	Present
64	SUJAL GIRI	14	Present
65	Suyash Pimple	22	Present
66	Swayamchandra Khadse	AB	Absent
67	Tejas Raut	23	Present
68	TUSHAR RAUT	1	Present
69	Vansh Hedau	15	Present
70	VEDANT MATE	1	Present
71	Vijay Sonune	19	Present
72	Vishal Sarkate	AB	Absent
73	VIVEK INGLE	27	Present
74	Vivek Sawant	AB	Absent

Signature Of Teacher

Signature Of HOD

SGM/FRM/DPT-86A

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Teacher Evaluation Component Mark Sheet

Department: Mechanical Engg		Session: Spring 2023- 2024	
Class: 2M	Subject: MS	Code: 4ME01	Max. Marks: 30

R. N.	Student's Name	Tec No.	Marks	R. N.	Student's Name	Tec No.	Marks
1	Ku. Ashwini Sunil Harsule	07	20	21	Ku. Sonal Dhanraj Dongre	07	18
2	Ku. Dhanshri Govardhan Tayade	07	24	22	Ku. Sonu Pandurang Rekhate	02	24
3	Ku. Divya Sunil Chandle	07	18	23	Ku. Unnati Anil Deshmukh	02	24
4	Ku. Gayatri Vijay Bhore	07	21	24	Ku. Vaishnavi Arvindrao Deshmukh	02	24
5	Ku. Kshitija Prashant Deshmukh	07	21	25	Ku. Vaishnavi Rajendra Umak	07	16
6	Ku. Mansi Pramod Talekar	07	19	26	Ku. Vaishnvi Shivhari Mirge	07	22
7	Ku. Prachi Ashok Itnare	07	22	27	Abhijeet Dinesh Nanotkar	07	18
8	Ku. Prachi Mahendra Gawali	07	20	28	Abhijit Sanjay Nage	02	24
9	Ku. Pragati Kamlakar Sonone	07	18	29	Abhishek Gopalrao Khodre	07	22
10	Ku. Punam Ashok Khandare	07	22	30	Abhishek Murlidhar Nimbalkar	07	21
11	Ku. Ruchika Shrikrushna Nikole	07	22	31	Abhishek Rajesh Shelke	07	19
12	Ku. Rutuja Sanjay Deshmukh	07	20	32	Adinath Girish Udgirikar	09	25
13	Ku. Sakshi Vishnudas Bhosle	02	24	33	Adinath Mangesh Gogate	07	23
14	Ku. Samiksha Anil Chendalane	07	19	34	Akash Gopal Suralkar	09	25
15	Ku. Samiksha Mahesh Dhoke	07	17	35	Amit Govinda Wankhade	07	18
16	Ku. Sanika Vivek Deshmukh	02	24	36	Atharv Atul Nage	07	23
17	Ku. Sejal Dipankar Pahurkar	07	21	37	Atharva Ajay Joshi	02	24
18	Ku. Shravani Anant Joshi	02	24	38	Avinash Shrikrushna Honale	07	23
19	Ku. Shweta Prabhakar Nalkande	07	14	39	Chetan Baliram Nimbolkar	07	23
20	Ku. Sneha Rajesh Gite	02	24	40	Chetan Kamlakar Banait	09	25

13/05/24

Approval of Head

Name & Signature of Teacher

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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

Teacher Evaluation Component Mark Sheet

Department: Mechanical Engg.		Session: Spring 2023 – 2024	
Class: 2M	Subject: MS	Subject code: 4ME01	Marks: 30

R. N.	Student's Name	Tec No.	Marks	R. N.	Student's Name	Tec No.	Marks
41	Devashish Mahendra Sadavarte	07	23	61	Shivkumar Govind Ingle	09	25
42	Devendra Anand Sawdekar	07	24	62	Shivshankar Ishwar Jadhav	07	18
43	Dhawal Jagdishrao Lokhande	07	25	63	Shubhajit Siddharth Mohod	07	21
44	Gaurav Tukaram Pande	09	25	64	Sujal Sanjay Giri	07	23
45	Gazal Prabhakar Barai	09	25	65	Suyash Subhash Pimple	09	25
46	Gunjan Mahendra Dhage	07	23	66	Swayamchandra Khadse	07	20
47	Harshal Mahendra Malik	07	22	67	Tejas Vishwasrao Raut	07	25
48	Himanshu Sanjay Zadokar	07	22	68	Tushar Madhukar Raut	07	18
49	Hrutik Santram Kushwaha	09	25	69	Vansh Krushnakumar Hedau	02	24
50	Jay Pravin Zope	09	25	70	Vedant Manoj Mate	07	20
51	Kaushal Dilippant Ghulaxe	07	17	71	Vijay Gajanan Sonune	09	25
52	Mandar Tanaji Pawar	09	25	72	Vishal Dilip Sarkate	09	25
53	Mohit Mahendra Waghmare	07	24	73	Vivek Bharat Ingle	07	24
54	Prashant Pandurang Dhamode	09	25	74	Vivek Rajesh Sawant	07	21
55	Pratik Kailas Kalskar	07	24				
56	Rohit Chandu Kurhade	07	18				
57	Rohit Satishrao Dautpure	07	24				
58	Sagar Anil Pande	07	22				
59	Samarth Suresh Paraskar	07	21				
60	Shivam Najukrao Mehenge	07	21				

Approval of Head

Name & Signature of Teacher

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Shri Sant Gajanan Maharaj College of Engineering, Shegaon

Session: 2023-24

Result Analysis (Summer-2024)

Department: Mechanical Engineering

Sub	No. of Students		With Internal (Out of 100)			Without Internal (Out of 80)			Mean % of marks*	Mean of SGPA/ CGPA*	No. of Students**
	Adm	App	No. of Students			No. of Students					
			Pass	fail	Pass %	Pass	fail	Pass %			
Semester: IV											
MS	74	74	49	25	66.22	41	33	55.41	45.33	6.99	37
EC-I	74	73	49	24	67.12	41	32	56.16			
MT	74	74	51	23	68.92	42	32	56.76			
BEDC	74	73	41	32	56.16	20	53	27.40			
HPS	74	73	46	27	63.01	35	38	47.95			
EVS	74	73	62	11	84.93	44	29	60.27			
Semester: VI											
DME	65	64	38	26	59.38	14	50	21.88	45.25	6.31	37
DOM	65	64	39	25	60.94	18	46	28.13			
CSE	65	65	46	19	70.77	36	29	55.38			
NES	31	31	27	4	87.10	22	9	70.97			
LM	34	34	31	3	91.18	28	6	82.35			
EAM	17	17	15	2	88.24	11	6	64.71			
WC	25	25	19	6	76.00	8	17	32.00			
DCI	23	23	18	5	78.26	9	14	39.13			
Semester: VIII											
ORT	71	70	60	10	85.71	32	38	45.71	49.84	7.78	57
ICE	71	70	62	8	88.57	44	26	62.86			
PPC	61	60	46	14	76.67	31	29	51.67			
AI	10	10	10	0	100.00	9	1	90.00			
RIA	71	70	58	12	82.86	36	34	51.43			

Adm: Admitted App: Appeared

Note: Consider passing percentage 40

*** Mean of the SGPA/CGPA/ % of marks of all successful students**

**** Number of students who have successfully completed (successfully completed implies zero backlogs)**

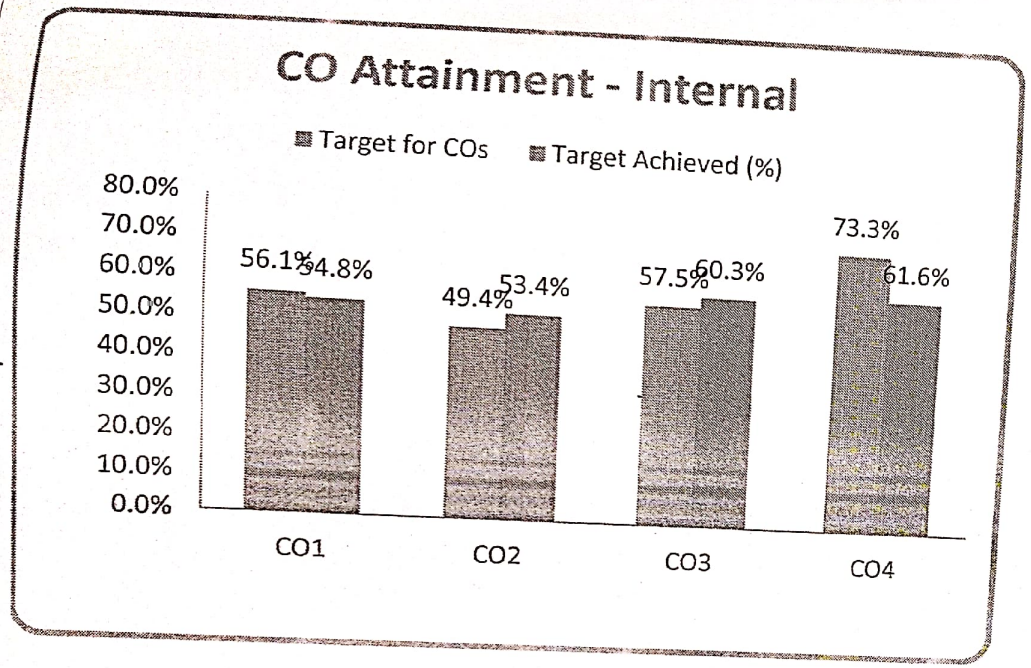
Head of the Department

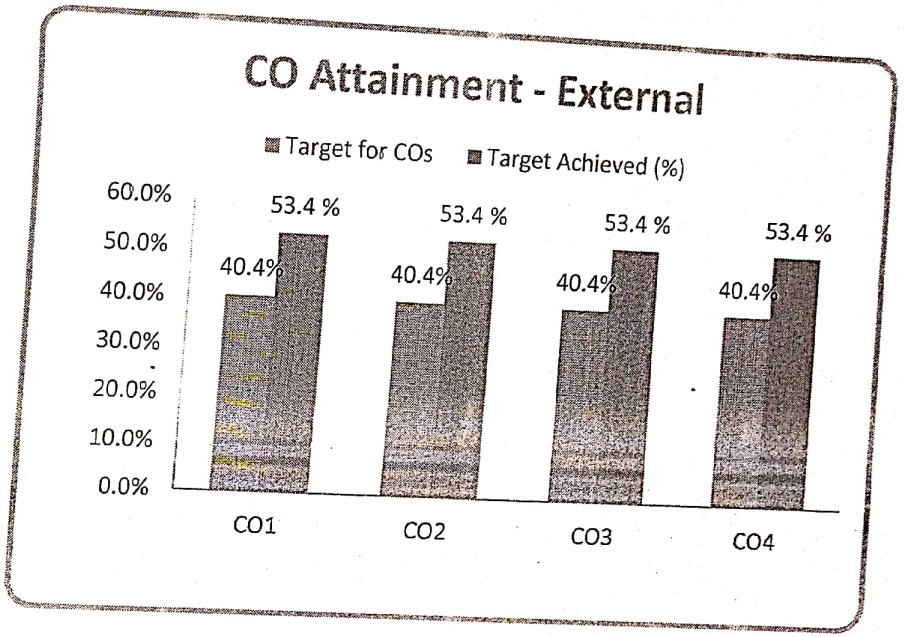
SSGMCE
Shegaon, MS, India

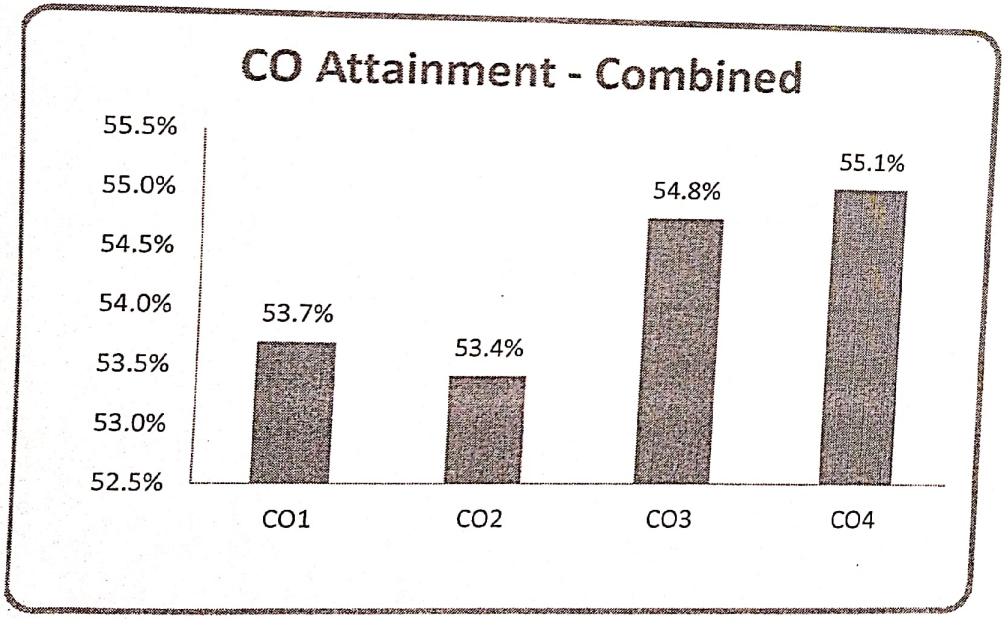
ATTAINMENT OF COURSE OUTCOMES SUMMARY

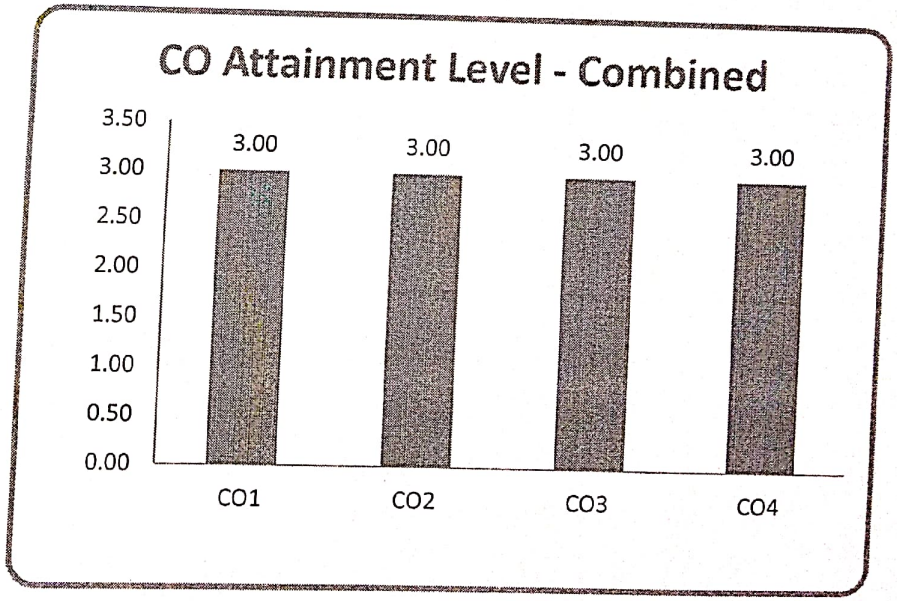
UG - Mechanical Engg.	CLASS	2M	COURSE CODE	4ME01	WEIGHTAGE		ATTAINMENT LEVEL		
					Int.	Ext.	1	2	3
	COURSE	Material Science			20 %	80 %	43 %	48 %	53 %
ACADEMIC YEAR	2023-24	FACULTY	Prof. V. T. Mhaske						
SEMESTER	IV								

SL. NO.	COs	COURSE OUTCOMES	Target for COs		Target Achieved (Nos.)		Target Achieved (%)			Attainment Level			Result
			Int.	Ext.	Int.	Ext.	Int.	Ext.	Avg	Int.	Ext.	Avg	
1	CO1	Demonstrate the concept, classification and applications of material science	56.1%	40.4%	40	39	54.8%	53.4 %	53.7%	3.0	3.0	3.00	Y
2	CO2	Demonstrate phase diagrams, microstructure of basic alloys and their properties.	49.4%	40.4%	39	39	53.4%	53.4 %	53.4%	3.0	3.0	3.00	Y
3	CO3	Explain various heat treatment process and its effects on microstructure and mechanical properties of materials	57.5%	40.4%	44	39	60.3%	53.4 %	54.8%	3.0	3.0	3.00	Y
4	CO4	Explain Powder metallurgy, hot and cold working techniques and their effects on mechanical properties of the material.	73.3%	40.4%	45	39	61.6%	53.4 %	55.1%	3.0	3.0	3.00	Y
Average			59.1%	40.4%	42	39	57.5%	53.4 %	54.2 %	3.0	3.0	3.00	


CO Attainment - Internal
Target for COs
Target Achieved (%)
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
56.1%
54.8%
49.4%
53.4%
57.5%
60.3%
73.3%
61.6%
CO1
CO2
CO3
CO4


CO Attainment - External
Target for COs
Target Achieved (%)
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
40.4%
53.4 %
40.4%
53.4 %
40.4%
53.4 %
40.4%
53.4 %
CO1
CO2
CO3
CO4


CO Attainment - Combined
55.5%
55.0%
54.5%
54.0%
53.5%
53.0%
52.5%
53.7%
53.4%
54.8%
55.1%
CO1
CO2
CO3
CO4


CO Attainment Level - Combined
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
3.00
3.00
3.00
3.00
CO1
CO2
CO3
CO4

10
27

SSGMCE Shegaon, MS, India	ASSESSMENT AND EVALUATION OF PROGRAM SPECIFIC OUTCOMES		
UG - Mechanical Engg.	MAPPING CORELATION		
	HIGH	3	100%
ACADEMIC YEAR 2023-24	MEDIUM	2	67%
SEMESTER IV	LOW	1	33%

CLASS	2M	COURSE	Material Science	COURSE CODE	4ME01
FACULTY	Prof. V. T. Mhaske				

CO-PSO CORRELATION MATRIX

CO	CO ATTAINMENT		PROGRAM SPECIFIC OUTCOMES			
	%	Y/N	PSO1	PSO2	PSO3	PSO4
CO1	3	Y	1	1		
CO2	3	Y	1	1		
CO3	3	Y	1	1		
CO4	3	Y	1	1		
AVERAGE			1.00	1.00		

EVALUATION OF PSOs BASED ON CORRELATION MATRIX & CO ATTAINMENT

CO	CO ATTAINMENT		PROGRAM SPECIFIC OUTCOMES			
	%	Y/N	PSO1	PSO2	PSO3	PSO4
CO1	3	Y	1.00	1.00		
CO2	3	Y	1.00	1.00		
CO3	3	Y	1.00	1.00		
CO4	3	Y	1.00	1.00		
PSO Attainment Level			1.00	1.00		
PSO Attainment %			33%	33%		

Assignment - 01 [Unit-01]

1. What is Material & Explain Detail Classification of Engineering Materials with their properties and applications.

2. Defined :-
   - Crystal Lattice
   - Atomic Density
   - Cordination Number
   - Atomic packing factor

3. What is solid solution & explain its types.

4. What is atomic Packing factor & Find APF for simple cubic, BCC & FCC structure

5. What is :-
   1. Hume - Rothery's Rule
   2. Gibbs phase rule
   3. Lever Rule

6. Explain Solidification of Metals with net sketch. Also explain different grains during Solidification.

7. What is miller Indices & Explain in detail for representation of planes & direction.

Assignment - 02 [Unit 02]

1. Draw Fe-C Equilibrium diagram. Explain different phases of iron on Fe-C diagram.

2. Draw phase change diagram. Explain Peritectic, Eutectic & Eutectoid transformation Reaction in details.

3. Draw Fe-Fe_3C diagram. Explain Transformation of steels which takes place in structures of steel containing 0.4%, 0.83% & 1.2% carbon with amount of phases.

4. What is composite material & give it's classification & applications.

5. What is Iron-Iron Carbide diagram. Explain:-
   1. hypo-peritectic & hyper-peritectic transformation
   2. hypo-Eutectoid & hyper-Eutectoid transformation
   3. hypo-Eutectic & hyper-Eutectic transformation.

Assignment No:. 3

What is need of alloying elements ? Explain how Alloying Elements are classified.

Explain effect of alloying Elements on steel. Explain briefly how alloy steels are classified.

What is sensitization of Austenitic stainless steel ? How it can be avoided.

What is weld decay ? How can effect of weld decay be rectified ?

What are the effect of alloying Elements on Eutectoid temp., Eutectoid composition & S- curve in plain Carbon steel.

What are High speed steel ? Explain with sketch, the steps in the heat treatment of HSS.

7. Explain important characteristics composition and application of following steels :.

   1. OHNS steel
   2. Hadfield steel
   3. HCHC steel

8. What is stainless steel ? Explain different type of stainless steel.

Assignm

Assignment 04

1. Discuss the factors affecting mode of solidification of cast iron.
2. Draw Maurer's diagram.
3. Explain Important characteristics, composition & application of :-
   1. White Cast Iron
   2. Malleable Cast Iron
   3. Grey cast Iron
   4. Nodular Cast Iron [Also distinguish between them]
4. state & explain the factors that governs the production of
   1. white cast iron
   2. Grey Cast iron
   3. Malleable Cast Iron
   4. Nodular Cast iron
5. Explain with neat sketch the cooling of grey cast iron from liquid state to room temperature.
6. Described various steps used in production of Malleable Cast iron.
7. Explain important characteristic, composition & application of
   1. Cartridge Brass 6. Babbit Metal
   2. Naval Brass
   3. Gun Metal
   4. phosphor Bronze
   5. Muntz Metal
8. What are Brasses & Explain properties, composition & Application of any two types of Brasses
9. what are Babbits? Explain compositions & application of any two types of Babbits.
10. Explain Season Cracking in details.
11. What you mean by precipitation hardening.

Assignment 05

1. Defined annealing. Discuss various sub-types of annealing.

2. Explain the Following:
   1. Pearlite transformation
   2. Bainite transformation

3. Explain with neat sketch the steps in plotting the TTT diagram (S-Curve). Draw superimposed curve showing different heat treatment process.

3. What is hardening? Explain with neat sketch stages in hardening.

4. Explain the Following
   1. Austempering
   2. Martemporing
   3. Patenting.

5. what is tempering? Explain various stages in tempering

6. What is hardenability? Explain Jominy End Quench Test with net sketch.

Assignment No:- 06

1. What is Powder Metallurgy & Explain steps in powder Metallurgy Process with suitable diagram.

2. What is powder Metallurgy & Explain any three methods of Production of metal powder's. Also state application.

3. What is surface hardening & describe with suitable diagram the method of case hardening :-
   1. Flame hardening
   2. Induction hardening
   3. Carburizing
   4. Nitriding

4. Explain following:-
   1. Ludar Band phenomenon
   2. stress strain Curve for Mild steel

5. Explain with neat sketch
   1. Recovery
   2. Recrystallization
   3. grain growth

6. Explain phenomenon with neat sketch :- strain ageing or strain hardening. How it can be eliminated.