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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Department of Mechanical Engineering

BOARD OF STUDIES (BOS) PROCEEDING

DEPARTMENT OF MECHANICAL ENGINEERING

(MEETING DATED 24th May 2022)

CONTENTS

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

MINUTES OF MEETING OF BOARD OF STUDIES (BoS)

An online meeting of following members (external and internal) was held on 24th May, 2022 at 11:00 AM through online mode (Google Meet Link **meet.google.com/hno-owxs-xrb**)

Following members were present:

(1)	Dr. M.K. Gaur	Head of the Department and Chairman of the Committee
(2)	Prof. A.K. Agrawal	Professor, IIT BHU, AC Nominee
(3)	Dr. Prashant Kumar Jain	Professor, IIITDM, Jabalpur, RGPV Nominee
(4)	Dr. K. K. Jain	Professor, NITTTR, Bhopal, AC Nominee
(5)	Dr. Pratesh Jayaswal	Member
(6)	Dr. Manish Ku. Sagar	Member
(7)	Dr. C. S. Malvi	Member
(8)	Mr. R. P. Kori	Member
(9)	Mr. Vedansh Chaturvedi	Member
(10)	Dr. Jyoti Vimal	Member
(11)	Mr. Sharad Agrawal	Member
(12)	Mr. Vaibhav Shivhare	Member
(13)	Dr. Amit Aherwar	Member
(14)	Mr. Bhupendra K Pandey	Member
(15)	Dr. Nitin Upadhyay	Member
(16)	Dr. Surendra Ku. Chourasiya	Member
(17)	Dr. Harbhajan Ahirwar	Member
(18)	Dr. Gavendra Norkey	Member
(19)	Dr. Dinesh Kumar Rathore	Member
(20)	Dr. Ashish Agrawal	Member
(21)	Soumya Shrivastava	Student, III-year Mechanical
(22)	Shubham Chhipa	Student, III-year Mechanical
(23)	Somya Kanthariya	Student, III-year Automobile

Following members were absent:

(1) Prof. P. M. V. Subbarao	Professor, IIT, Delhi
(2) Dr. Pavan Kumar Kankar	Associate Professor, IIT, Indore, AC Nominee
(3) Mr. Rajesh Dixit	Zonal Head, Yuken India Ltd. New Delhi
(4) Er. Rajiv Singh Bais	Chief Manager R&D, Siemens Ltd. Gurgaon, Industry Expert

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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(Approved by Academic Development Cell of the institute - BoS Meeting Scheduled during 23-28, May 2022)

Agenda of the BoS Meeting

Course where revision was carried out

Course/ Subject name	Course Code	Year/Date of introduction	Year/Date of revision	Percentage of content added or replaced	Agenda item No.	Page no.	Link of relevant documents/minutes
Industrial Engineering	190511/ 120511	09/04/2019	24/05/2022	10% Added	Item ME9	3-4	https://drive.google.com/file/d/1B4jLqizRNUy4AsTX47TeUR9BSVTeVtJa/view?usp=sharing
Design of M/c Elements	190514	09/04/2019	24/05/2022	8% Removed	Item ME9	5-7	
Thermal Engineering	120514	09/04/2019	24/05/2022	10% replaced	Item ME9	8-9	
Maintenance Engineering	900215	30/05/2020	24/05/2022	10 % Removed, 10 % Replaced	Item ME5	10-11	

Course focusing on employability/entrepreneurship/skill development

Course/ Subject name	Course Code	Activities/content which have a bearing on increasing skill and employability	Agenda item No.	Page no.	Link of relevant documents/ minutes
Foundation of Computational Fluid Dynamics	120751	Students will be exposed to basics of CFD	Item ME4	3-4	https://drive.google.com/file/d/1pjUQhSMkc7uAAJSxiDoujAS6Ptr4vHsu/view?usp=sharing
Advanced Machining Processes	120753	Aims at bringing the students up-to-date with the latest technological	Item ME4	5	
Farm Machinery	190751	Design of horticultural machines and equipment	Item ME4	6	
Reliability and Vibration Lab	120701	Various vibration monitoring tools	Item ME6	7	
Automotive maintenance lab	190701	Maintenance strategy and schedule of different vehicles	Item ME6	8	

New Course Added

Course/Subject name	Course Code	Activities/content which have a bearing on increasing skill and employability	Agenda item No.	Page no.	Link of relevant documents/minutes
Applied Thermodynamics for Engineers	M120703	Application of laws of thermodynamics in solving engineering problems	Item ME7	2	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing
Data Science	-	develop the ability to build and assess data-based models	Item ME8	3-4	

Fedback on curriculum received from stakeholders: Analysis & ATR

Stakeholder	Student	Faculty	Alumni	Employer
No. of responses	264	23	14	66
Link of analysis	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing
ATR Link	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing
Link showing Excel sheet of google form details of stakeholders	https://drive.google.com/file/d/1VQ5J9TCvX856P8hzkz0OUwVPWM_SHC7k/view?usp=sharing	https://docs.google.com/spreadsheets/d/1HzJ8mpES9fzuAUg1sswEwTwJPOSXI tu8/edit?usp=sharing&ouid=108885958461624947473&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/1ekacl9IewtIFw-J4Yeh813vFXAyCSnTx/edit?usp=sharing&ouid=108885958461624947473&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/1ekacl9IewtIFw-J4Yeh813vFXAyCSnTx/edit?usp=sharing&ouid=108885958461624947473&rtpof=true&sd=true

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BoS Agenda Items

Item ME1

To confirm the minutes of previous BoS meeting held in the month of December 2021

The minutes of the last BoS held on 22nd December 2021 were confirmed. The BoS Minutes were presented & approved in Academic Council Meeting held on 28 December ,2021.

Item ME2

To prepare and finalize the **scheme structure of B.Tech. VII Semester** with the provision of *Two Departmental Electives (DEs) and Two Open Category (OC) Course* **(in which one Departmental Elective is to be offered in online mode with credit transfer)** for the batch admitted in 2019-20.

S.No.	Subject Code	Category	Subject Name & Title
1.	DE	DE	Departmental Elective-3 (DE-3)
2.	DE*	DE	Departmental Elective -4 (DE-4)
3.	OC	OC	Open Category-2(OC-2)
4.	OC	OC	Open Category -3(OC-3)
5.	100008	MC	Intellectual Property Rights (IPR) (MC)
6.	190701/120701	DLC	Automotive Maintenance (DLC-6)/ Reliability and Vibration Lab (DLC-6)
7.	190702/120702	DLC	Summer Internship Project-III (04 weeks) (Evaluation)(DLC-7)
8.	190703/120703	DLC	Creative Problem Solving (Evaluation) (DLC-8)

3. Item ME2.docx

Item ME3

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2019-20)*** under ***Departmental Elective (DE) Course*** (in traditional mode) for B. Tech. ***VII Semester*** along with their COs.

Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120711	Refrigeration and Air-Conditioning	1	190711	Vehicle Dynamics
2	120713	Metrology, Measurement and Control	2	190713	Hybrid Electric Vehicles
3	120714	Total Quality Management			

4. Item ME3.docx

Item ME4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in ***online mode under*** **Departmental Elective (DE)** Course, with credit transfer in the B. Tech. ***VII Semester under*** the flexible curriculum (*Batch admitted in 2019-20*).

Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120751	Foundation of Computational Fluid Dynamics	1	190751	Farm Machinery
2	120752	Introduction to Composites	2	190753	Introduction to Mechanical Vibration
3	120753	Advanced Machining Processes			

5. Item ME4.docx

Item ME5

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2019-20)*** under the ***Open Category (OC) Courses*** (in traditional mode) for B. Tech. ***VII semester*** students of other departments along with their COs.

Open Category (OC-2)			Open Category (OC-3)		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	900203	Industrial Automation	1	900214	Engineering Materials for Industrial Applications
2	900204	Solar Energy	2	900215	Maintenance Engineering

6. Item ME5.docx

Item ME6

To prepare and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2019-20).***

Automotive Maintenance (190701)	Reliability and Vibration Lab (120701)
1. Study and layout of an automobile repair, service and maintenance shop. 2. Study and preparation of different statements/records required for the repair and maintenance works. 3. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring. 4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage 5. Calibration of fuel injection pump 6. Minor and major tune up of gasoline and diesel engines. 7. Study and checking of wheel alignment - testing of camber, caster. 8. Brake adjustment and Brake bleeding. 9. Battery testing and maintenance	1. Determination of Critical Speed in Whirling of Shafts. 2. Determination of Natural Frequency in Longitudinal Vibrating System. 3. Determination of Natural Frequency in Torsional Vibration System. 4. To verify the relation of compound pendulum & to determine the radius of gyration 5. To study the undamped free vibration of spring mass system. 6. To study the forced vibration of simply supported beam for different damping. 7. Undamped tensional vibrations of single and double rotor system. 8. To study the damped torsional vibration of single rotor system and to determine the damping coefficient. 9. To study the forced damped vibration of spring mass system. 10. Study the machine fault diagnostic system based on vibration analysis.

7. Item ME6.docx

Item ME7

To propose the list of "Additional Courses" which can be opted for getting an

(i) Honours (for students of the host department)

(ii) Minor Specialization (for students of other departments)

[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. ***VII semester students*** *(for the batch admitted in 2019-20)] and for* B.Tech. ***V semester*** *(for the batch admitted in 2020-21)]*

Honor's		Minor Specialization	
V (for the batch admitted in 2020-21)	VII (for the batch Admitted in 2019-20)	V (for the batch admitted in 2020-21)	VII (for the Batch admitted in 2019-20)

	1. Principle of Hydraulic Machines and System Design (12 Weeks) 2. System design for sustainability (12 Weeks) 3. Manufacturing Systems Technology Part I & II (12 Weeks)	1.Fundamentals of Artificial Intelligence (12 Weeks) 2. Rapid Manufacturing (12 Weeks) 3. Heat Exchangers: Fundamentals and Design Analysis (12 Weeks)	1. Basics of Materials Engineering (12 Weeks) 2. Fluid Mechanics (12 Weeks)	1. Engineering Metrology (12 Weeks) 2. Applied Thermodynamics for Engineers (12 Weeks)

Item ME8

8. Item ME7.docx

To prepare and recommend the ***scheme structure of B.Tech. V Semester under*** the flexible curriculum (*Batch admitted in 2020-21.*

S.No.	Automobile Engineering			Mechanical Engineering		
	Subject Code	Category	Subject Name & Title	Subject Code	Category	Subject Name & Title
1.	190511	DC	Industrial Engineering (DC-10)	120511	DC	Industrial Engineering (DC-10)
2.	190513	DC	Heat and Mass Transfer (DC-11)	120513	DC	Heat and Mass Transfer (DC-11)
3.	190514	DC	Design of Machine Elements (DC-12)	120514	DC	Thermal Engineering (DC-12)
4.	190515	DC	Automotive Chassis (DC-13)	120515	DC	Machine Design (DC-13)
5.			Data Science			Data Science
6.	190516	DLC	Minor Project-I	120516	DLC	Minor Project-I
7.	190517	DLC	Self-learning/ Presentation*	120517	DLC	Self-learning/ Presentation*
8.	200xxx	CLC	Novel Engaging Course	20xxx	CLC	Novel Engaging Course
9.	190518	DLC	Summer Internship Project–II (Institute Level Evaluation)	120518	DLC	Summer Internship Project–II (Institute Level Evaluation)

Item ME9

9. Item ME8.docx

To prepare and recommend the syllabi for all ***Departmental Core (DC) Courses*** of B. Tech. ***V Semester (for batch admitted in 2020-21)*** under the flexible curriculum along with their COs.

Automobile Engineering			Mechanical Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190511	Industrial Engineering	1	120511	Industrial Engineering
2	190513	Heat and Mass Transfer	2	120513	Heat and Mass Transfer
3	190514	Design of Machine Elements	3	120514	Thermal Engineering
4	190515	Automotive Chassis	4	120515	Machine Design

10. Item ME9.docx

Item ME10

To prepare and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech.V semester ***(for batch admitted in 2020-21).***

S.No.	Name of Subject	Code
1	Heat and Mass Transfer	190513/120513
2	Design of Machine Elements	190514
3	Automotive Chassis	190515
5	Machine Design	120515

11. Item ME10.docx

Item ME11

To prepare and recommend the suggestive list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory component-based courses to be offered in B.Tech. V Semester ***(for the batch admitted in 2020-21).***

Automobile Engineering			Mechanical Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190513	Heat and Mass Transfer	1	120513	Heat and Mass Transfer
2	190515	Automotive Chassis	2	120515	Machine Design

12. Item ME11.docx

Item ME12

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2020-21)*** in online mode under ***Self-Learning/ Presentation***, in the B.Tech. ***V Semester.***

S.No.	Name of Subject	Code	Week
1.	Foundations of Cognitive Robotics	120517/190517(i)	4
2.	Polymer Assisted Abrasive Finishing Processes	120517/190517(ii)	4
3.	Welding of Advanced High Strength Steels for Automotive Applications	120517/190517(iii)	4

13. Item ME12.docx

Item ME13

To prepare and recommend the ***Scheme & Syllabi (along with the Course Outcomes) of B.Tech. III semester*** **of the newly started B. Tech. programmes in the emerging areas (AI & ML, AI & DS, CSD) (started from 2021-22 Session)** *{Applicable for the concerned departments}*

Item ME14

To prepare and recommend the list of experiments and skill based mini projects of ***B.Tech. III semester*** **of the newly started B. Tech. programmes in the emerging areas (AI & ML, AI & DS, CSD) (started from 2021-22 Session)** *{Applicable for the concerned departments}*

Item ME15

To review, prepare, finalize and recommend the ***Scheme & Syllabi (along with the Course Outcomes) of III semester*** **B. Tech. programmes (batch admitted 2021-22 Session)**

S.No.	Automobile Engineering			Mechanical Engineering		
	Subject Code	Category	Subject Name & Title	Subject Code	Category	Subject Name & Title
1.	100025	BSC	Engineering Mathematics-II (BSC-3)	100025	BSC	Engineering Mathematics-II (BSC-3)
2.	190319	DC	Manufacturing Process (DC-2)	120311	DC	Manufacturing Process (DC-2)
3.	~~190312~~ 190317	DC	Mechanics of Materials (DC-3)	~~120312~~ 120319	DC	Mechanics of Materials (DC-3)
4.	190313	DC	Automotive Engines (DC-4)	120313	DC	Theory of Machines –I (DC-4)
5.	190314	DC	Fluid Mechanics & Hydraulic Machines (DC-5)	120314	DC	Fluid Mechanics and Hydraulic Machines (DC-5)
6.	190315	DLC	Software lab (DLC-1)	120315	DLC	Software Lab (DLC-1)
7.	190316	DLC	Self-learning/ Presentation*	120316	DLC	Self-learning/ Presentation*
8.	200XXX	CLC	Novel Engaging Course	200XXX	CLC	Novel Engaging Course
9.	190318	DLC	Summer Internship Project–I (Institute Level Evaluation)	120318	DLC	Summer Internship Project–I (Institute Level Evaluation)

14. Item ME15.docx

Item ME16

To review, prepare, finalize and recommend the list of experiments/ Lab manual and skill based mini projects for various laboratory courses to be offered in III Semester ***(for the batch admitted in 2021-22)***.

Automobile Engineering	Mechanical Engineering

S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190313	Automotive chassis	1	120313	Theory of Machine-I
2	190314	Fluid Mechanics and Hydraulic Machines	2	120314	Fluid Mechanics and Hydraulic Machines

15. Item ME16.docx

Item ME17

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batches admitted in 2021-22)*** in online mode under ***Self-Learning/ Presentation***, in the ***III Semester*** .

S.No.	Name of Subject	Code	Week
1	Manufacturing Processes – Casting and Joining	120316/190316(i)	4
2	Laws of Thermodynamics	120316/190316 (ii)	4
3	Principles of Vibration Control	120316/190316 (iii)	4

16. Item ME17.docx

Item ME18

To review the ***Scheme & Syllabi, list of experiments and skill based mini projects of First semester of the B. Tech. programmes (for the batch 2022-23)***.

17. Item ME18.docx

Item ME19

To review the CO attainments, to identify gaps and to suggest corrective measures for the improvement in the CO attainment levels for (i) I year November 2021 – February 2022 Semester (ii) July-December 2021 Session for II-to-IV-year students

Mechanical Engineering			
Total Number of courses	Total Number of COs	Number of COs not Attained	Percentage of COs not Attained
41	246	18	7.32%
Automobile Engineering			
Total Number of courses	Total Number of COs	Number of COs not Attained	Percentage of COs not Attained
41	246	31	12.60%

18. Item ME19.xlsx
18. Item ME19 (a).xlsx

Item ME20

To review PO attainment of 2017-2021 batch, CO-PO mapping matrix with attainments and gap analysis

Item ME21

To review curricula feedback from various stakeholders, its analysis and impact

{Stakeholder feedback analysis must also contain an Action Taken Report (ATR) and the details/data of the stakeholders who have responded through GOOGLE form (such as Name, organization, mail id, phone no., if available) must also be shared along with the feedback of the alumni/employer}

19. Item ME21.docx

Item ME22

To review the Course Outcomes (COs) feedback of various courses, its analysis, and ATR

Compiled in Item no.19

Item ME23

Any other matter

Apart from the above points, the following points were discussed/Suggested in meeting;

1. In Industrial Engineering (V Sem) syllabus is revised and some portion is added to unit I, also Course outcomes (COs) revised.
2. Thermal Engineering (V Sem) syllabus is too lengthy to cover in scheduled time duration. Therefore, the course has been split and revised for 2020-21 admitted batch, it has been discussed that the gas dynamics portion must be added in the course. Also, some introductory part of refrigeration is added in Engineering thermodynamics IV sem for 2021 admitted batch.

3. Belt and chain drive portion is removed from Design of Machine elements (V sem).
4. As maintenance Engineering is open category subjects without lab. Therefore, MATLAB portion may be removed from the syllabus.
5. To meet the current requirement Data Science is added in V sem Mechanical and automobile Engineering.

The meeting was ended with vote of thanks to the chairperson and committee members.

Dr. Ashish Agrawal (BoS Member)	**Dr. Dinesh Kumar Rathore** (BoS Member)	**Dr. Gavendra Norkey** (BoS Member)	**Dr. Harbhajan Ahirwar** (BoS Member)
Dr. Nitin Upadhyay (BoS Member)	**Dr. Surendra Ku. Chourasiya** (BoS Member)	**Mr. B. K. Pandey** (BoS Member)	**Dr. Amit Ahirwar** (BoS Member)
Mr. V. Shivhare (BoS Member)	**Mr. Sharad Agrawal** (BoS Member)	**Dr. Jyoti Vimal** (BoS Member)	**Mr. V. Chaturvedi** (BoS Member)
Mr. R. P. Kori (BoS Member)	**Dr. C. S. Malvi** (BoS Member)	**Dr. M. K. Sagar** (BoS Member)	**Dr. Pratesh Jayaswal** (BoS Member)
online Present **Prof. Prashant K. Jain** (RGPV Nominee)	on-line Present **Dr. K. K. Jain** (AC Nominee)	on-line Present **Prof. A.K. Agrawal** (AC Nominee)	**Dr. M. K. Gaur** (BoS Chairman)

DEAN (ACADEMICS)
M.I.T.S
GWALIOR

Item ME2	To prepare and finalize the **scheme structure of B.Tech. VII Semester** with the provision of *Two Departmental Electives (DEs) and Two Open Category (OC) Course* **(in which one Departmental Elective is to be offered in online mode with credit transfer)** for the batch admitted in 2019-20.

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Department of Mechanical Engineering

Scheme of Examination: Bachelor of Technology (B.Tech.) Automobile Engineering
VII Semester

For batches admitted in Session 2019-20

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot		MOOCs						
				End Sem	Mid Sem. Exam	Quiz/ Assign-ment	End Sem.	Term Work, Lab Work & Sessional	Assignment	Exam		L	T	P	
1	DE	DE	Departmental Elective-3 (DE-3)	70	20	10	-	-		-	100	4	-	-	4
2	DE*	DE	Departmental Elective -4 (DE-4)	-	-	-			25	75	100	2	-	-	2
3	OC	OC	Open Category-2(OC-2)	70	20	10	-	-	-	-	100	2	1	-	3
4	OC	OC	Open Category -3(OC-3)	70	20	10	-	-	-	-	100	3	-	-	3
5	100008	MC	Intellectual Property Rights (IPR) (MC)	70	20	10	-	-	-	-	100	2	-	-	2
6.	190701	DLC	Automotive Maintenance (DLC-6)	-	-	-	50	50	-	-	100	-	-	4	2
7	190702	DLC	Summer Internship Project-III (04 weeks) (Evaluation)(DLC-7)	-	-	-	50	50	-	-	100	-	-	4	2
8	190703	DLC	Creative Problem Solving (Evaluation) (DLC-8)	-	-	-	25	25	-	-	50	-	-	2	1
			Total	280	80	40	125	125	25	75	750	13	1	10	19
Additional Course for Honours or minor Specialization			Permitted to opt for maximum two additional courses for the award of (i) Honours in parent discipline or (ii) Honours with Minor Specialization in engineering discipline other than the parent discipline												

DE-3 (Through Traditional Mode)			DE-4* (online mode)			Open Category (OC-2)			Open Category (OC-3)		
S.No	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190711	Vehicle Dynamics	1	190751	Farm Machinery	1	900203	Industrial Automation	1	900214	Engineering Materials for Industrial Applications
2	190713	Hybrid Electric Vehicles	2	190753	Introduction to Mechanical Vibration	2	900204	Solar Energy	2	900215	Maintenance Engineering

*This course must be run through SWAYAM/NPTEL/ MOOC

DEAN (ACADEMICS)
M.I.T.S
GWALIOR

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering

Scheme of Examination: Bachelor of Technology (B.Tech.) Mechanical Engineering

VII Semester

For batches admitted in Session 2019-20

S.No.	Subject Code	Category	Subject Name & Title	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot		MOOCs						
				End Sem	Mid Sem.	Quiz/ Assignment	End Sem.	Lab Work & Sessional	Assignment	Exam		L	T	P	
1	DE	DE	Departmental Elective-3 (DE-3)	70	20	10	-	-	-	-	100	4	-	-	4
2	DE*	DE	Departmental Elective -4 (DE-4)	-	-	-	-	-	25	75	100	2	-	-	2
3	OC	OC	Open Category-2(OC-2)	70	20	10	-	-	-	-	100	3	1	-	3
4	OC	OC	Open Category -3(OC-3)	70	20	10	-	-	-	-	100	3	-	-	3
5	100008	MC	Intellectual Property Rights (IPR) (MC)	70	20	10	-	-	-	-	100	2	-	-	2
6	120701	DLC	Reliability and Vibration Lab (DLC-6)	-	-	-	50	50	-	-	100	-	-	4	2
7	120702	DLC	Summer Internship Project-III (04 weeks Evaluation) (DLC-7)	-	-	-	50	50	-	-	100	-	-	4	2
8	120703	DLC	Creative Problem Solving (Evaluation) (DLC-8)	-	-	-	25	25	-	-	50	-	-	2	1
			Total	280	80	40	125	125	25	75	750	13	1	10	19
Additional Courses for obtaining Honours or minor Specialization by desirous students			Permitted to opt for maximum two additional courses for the award of (i) Honours in parent discipline or (ii) Minor Specialization in engineering discipline other than the parent discipline												

DE-3 (Through Traditional Mode)			DE-4* (Online mode)			Open Category (OC-2)			Open Category (OC-3)		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120711	Refrigeration and Air Conditioning	1	120751	Foundation of Computational Fluid Dynamics	1	900203	Industrial Automation	1	900214	Engineering Materials for Industrial Applications
2	120713	Metrology, Measurement and Control	2	120752	Introduction to Composites	2	900204	Solar Energy	2	900215	Maintenance Engineering
3	120714	Total Quality Management	3	120753	Advanced Machining Processes						

*This course must be run through SWAYAM/NPTEL/ MOOC

DEAN (ACADEMICS)
M.I.T.S.
GWALIOR

Item ME3	To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2019-20)*** under ***Departmental Elective (DE) Course*** (in traditional mode) for B. Tech. ***VII Semester*** along with their COs

Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120711	Refrigeration and Air-Conditioning	1	190711	Vehicle Dynamics
2	120713	Metrology, Measurement and Control	2	190713	Hybrid Electric Vehicles
3	120714	Total Quality Management			

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120711: Refrigeration and Air-conditioning

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Elective –DE3	Refrigeration and Air-conditioning	120711	4	-	-	Max.Marks-70 Min.Marks-22 Duration-3hrs

Course Objectives: To make the students to understand

1. The fundamental principles and different methods of refrigeration and air conditioning.
2. Different refrigerants with respect to properties, applications and environmental issues.
3. The various equipment, operating principles, operating and safety controls employed in refrigeration air conditioning systems.

Pre-requisite: Engineering Thermodynamics

Syllabus

Unit I: Introduction to Refrigeration: –Basic Definition, ASHRAE Nomenclature, Air Refrigeration: Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits, analysis.

Unit II: Vapour Compression Refrigeration System(VCRS): Carnot Vapour compression refrigeration cycle, Working and analysis, Limitations, Standard Vapour Compression Refrigeration system, Working and analysis, Effects of sub cooling and super heating, Multi-Pressure or Compound Vapour Compression Refrigeration Systems, Flash Gas removal, Flash inter cooling and water inter cooling.
Refrigerants: Classification, Selection of Refrigerants and Nomenclature of refrigerants, Desirable Properties of an ideal refrigerant, A discussion on Ozone layer Depletion and Global Warming.

Unit III: Vapour Absorption Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems, Water Lithium Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration system
Refrigeration System Equipment – Compressors, Condensers, Expansion Devices and Evaporators, System with Rectifier and Analyser Assembly

Unit IV: Psychrometry: Introduction to Air-Conditioning, Basic Definition, Classification, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Psychrometry –Air-water vapour mixtures, Psychrometric Properties, Psychrometric or Air-Conditioning processes, Psychrometric Chart.

Unit V: Air-Conditioning: Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Numerical Problems, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems

Course outcomes: After the successful completion of this course, the student will be able to:

1. **Understand** vapour compression refrigeration system.

2. **Describe** the working principles of air, vapour absorption, thermoelectric and steam-jet refrigeration systems.
3. **Obtain** cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems.
4. **Analyze** the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
5. **Develop** thermal comfort conditions with respect to temperature and humidity
6. **Estimate** cooling and heating loads in an air-conditioning system.

Text Books:

1. Arora C,P., Refrigeration and Air-conditioning, Tata McGraw –Hill Latest Edition, New Delhi

References Books :

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, McGraw - Hill, New Delhi

For batch admitted in Academic Session 2019-20

120713: Metrology, Measurement and Control

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Elective –DE3	Metrology, Measurement and Control	120713	4	-	-	Max.Marks-70 Min.Marks-22 Duration-3hrs.

Course Objectives: To make the students to understand:
1. The types of errors, design of limit gauges and various comparative measurements.
2. The fundamentals of gears, thread measurements and measurements of surface finish.
3. Non-contact measurement techniques using optical methods and vision techniques.
4. Coordinate metrology and Form Measurement.
5. The use of control chart.

Prerequisite: Nil

Syllabus

Unit –I: General Concepts of Measurement; Definition-standards of measurement, errors in measurement, limit-gauging, various systems of limits, fits and tolerance, interchangeability, ISI and ISO system. basic principles and design of standards of measuring gauges, types of gauges and their design, accuracy and precision, calibration of instruments, principles of light interference, interferometer, measurement and calibration.

Unit –II: Linear and Angular Measurements; Slip gauges, micrometers, verniers, dial gauges, surface plates, comparators- mechanical, electrical, pneumatic and optical comparator, angular measuring instruments- sine bar, angle gauges, spirit level, autocollimators, clinometers; measurement of straightness, flatness and squareness.

Unit –III: Measurement of Surface Finish and Measuring Machines; Surface finish- definitions, types of surface texture, surface roughness measurement methods, comparison, profile-meters, pneumatic and replica, measurement of run out and concentricity, length bar measuring machine, optical projection, comparator, tool makers microscope.

Unit –IV: Metrology of Screw Threads and Gears: Internal/external screw thread, terminology, measurement of various elements of threads, thread micrometer method, two wire and three wire methods; gear terminology, measurement of various elements, constant chord method, base tangent method, plug method; gear tester, gear tooth measurement; rolling gear tester.

Unit –V: Computer Aided and Laser Metrology; Co-ordinate measuring machine; applications; laser micrometer, laser interferometer, laser scanning gauge, non contact and in- process inspection, vision system.

Course Outcomes: After successful completion of this course students will be able to:
1. **State** the basic of standards of measurement, limits, fits & tolerances.
2. **Compare** quality in engineering products.
3. **Apply** the principle of measurement in QC & QA aspects and calibration of measuring instruments.
4. **Analysis** the accuracy in the measurement.
5. **Evaluate** the product quality in manner of dimensional accuracy.
6. **Design** limit gauges.

Text & References Books:

1. Jain R.K.; Engineering metrology; Khanna publishers.
3. Gupta. I.C. "A text book of engineering metrology", Dhanpat rai and sons.
4. Galye G.N et al; Metrology for engineers; elbs.
5. Rajput R.K; Engineering metrology and instrumentation; Kataria &sons publishers.

120714: Total Quality Management

Category	Title	Code	Credit-4			Theory Paper
Departmental Elective –DE3	Total Quality Management	120714	L	T	P	Max.Marks-70 Min.Marks-22
			4	-	-	Duration-3hrs.

Course objectives: To make the student to understand:

1. The philosophy and core values of Total Quality Management (TQM).
2. How to evaluate best practices for the attainment of total quality.
3. The concept of ISO 9000 and quality manual.
4. The various methods of design and development to improve quality of product.
5. Impact of quality on economic performance and long-term business success of an organization.

Prerequisite: Nil

Syllabus

Unit - I Introduction: Introduction, Need for quality, Evolution of quality, Definitions of quality, Dimensions of product and service quality, Basic concepts of TQM, TQM Framework, Contributions of Deming, Juran and Crosby, Barriers to TQM, Quality statements, Customer focus, Customer orientation, Customer satisfaction, Customer complaints, Customer retention, Costs of quality.

Unit - II Principles: Leadership, Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal, Continuous process improvement, PDCA cycle, 5S, Kaizen, Kanban, Supplier partnership, Partnering, Supplier selection, Supplier Rating.

Unit - III Tools and Techniques: The seven traditional tools of quality, New management tools, Six sigma: Concepts, Methodology, applications to manufacturing, lean manufacturing, Agile manufacturing, Service sector including IT, Bench marking ,Reason to bench mark, Bench marking process, FMEA, Stages, Types.

Unit- IV Tools and Techniques: Control Charts, Process Capability, Concepts of Six Sigma, Quality Function Development (QFD), Taguchi quality loss function, TPM Concepts, improvement needs, Performance measures.

UNIT- V Quality Systems: Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000 – ISO 14000 – Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors.

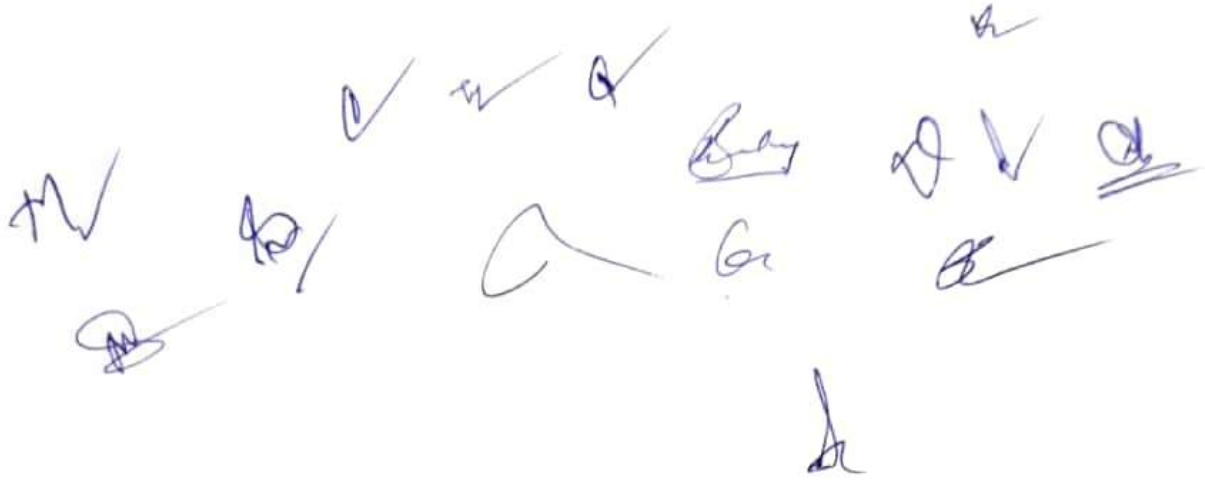
Course outcomes: After successful completion of this course students will be able to:

1. **Discuss** about quality measures, Quality control techniques.
2. **Describe** various theories of Total quality management.
3. **Determine** the cost of poor quality and process effectiveness and efficiency to track performance quality.
4. **Apply** appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies.
5. **Evaluate** the performance excellence of an organization, and determine the set of performance indicators

6. **Enhance** management processes, such as benchmarking and business process reengineering

Text & References Books:

1. TQM by Dr, K.C.Arora, S.K.Kataria and sons Publication, Delhi.
2. Jack Hiradsky TQM Hand book McGraw Hill New York
3. JH Taylor TQM Field Manual Me. Grew Hill Newyork
4. Chrisk Hakes: TQM-The key to business, Chapman and Holland.
5. Kim Todd, "World-class Performance", McGraw Hill, London
6. W J Sivanesan Production/Operations Management. Rich



For batches admitted in Academic Session 2019-20

190711: Vehicle Dynamics

Category	Title	Code	Credit-4			Theory Paper
Departmental Elective- DE3	Vehicle Dynamics	190711	L	T	P	Max.Marks-70 Min.Marks-22
			4	-	-	Duration-3hrs.

Prerequisite: Automotive chassis, Automotive transmission, theory of machine.

Course Objectives:

To make the students to understand:

1. Tire and road interaction characteristics.
2. The handling characteristics of vehicle.
3. The longitudinal, lateral and vertical dynamics under braking, acceleration and cornering.
4. How noise and vibrations are generating inside and outside of the vehicle and transfer to the passenger's compartment.

Syllabus

Unit -1 Introduction: Vehicle Dynamics Definitions as prescribed by SAE, Newtonian and: lagrangian formulations of multibody systems. Handling and stability characteristics: Steering geometry, fundamental equations for true rolling, Ackerman steering gear. Steady state handling neutral steer, under steer and over steer, steady state response, yaw velocity, lateral acceleration, curvature response, directional stability.

Unit -2 Performance characteristics of road vehicle: Various forces opposing vehicle motion, their nature and factors affecting these forces. Tractive effort and power available from the engine, equation of motion, maximum tractive effort and weight distribution, stability of vehicle on slop, road performance curves, acceleration, gradability, drawbar pull. Transient operation of vehicles: inertia effects, equivalent mass, equivalent moment of inertia, time taken in synchronization during change of gears, effect of flywheel inertia on acceleration, dynamic of vehicles on banked track, gyroscopic effects , net driving power.

Unit -3 Braking performance: Braking of vehicles, brakes applied to rear wheels, front wheel and all four wheels, motion on straight and curved path, mass transfer effects, braking efficiency, stopping distance, reaction time and stopping time, brake locking anti-lock drives, calculation of mean lining pressure and heat generation during brakes.

Unit- 4 Vehicle ride characteristics: Human response to vibration, vehicle ride models, road surface profile as a random function, frequency response function, evaluation of vehicle vertical vibration to ride comfort criterion.

Unit- 5 Two - wheeler dynamics: Stability & handling, vehicle motion ride control, various vehicle models, gyroscopic effect, effect of tyre and vehicle parameter on stability and handling characteristic.

Course Outcomes:

After successful completion of this course students will be able to:

CO1: **Define** the various forces acting on the vehicle.

CO2: **Explain** the tire and road interaction characteristics.
CO3: **Evaluate** the handling characteristics of vehicle.
CO4: **Examine** the vehicle stability under braking, acceleration and cornering.
CO5: **Develop** the mathematical model to predict the ride characteristics of the vehicle.
CO6: **Evaluate** the dynamic performance of two-wheel vehicle.

Text Books:

1. Rao V. Dukkipati, Jian Pang, "Road Vehicle Dynamics problems and solution",SAE,2010
2. Singiresu S. Rao, "Mechanical Vibrations," 5th Edition, Prentice Hall, 2010
3. J. Y. Wong, "Theory of Ground Vehicles", 4th Edition, Wiley-Interscience, 2008
4. Rajesh Rajamani, "Vehicle Dynamics and Control," 2nd edition, Springer, 2012
5. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014

Reference Books:

1. Dean Karnopp, "Vehicle Dynamics, Stability, and Control", 2nd Edition, CRC Press, 2013
2. R. Nakhaie Jazar, "Vehicle Dynamics: Theory and Application", 2nd edition, Springer, 2013
3. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
4. Hans B Pacejka, "Tyre and Vehicle Dynamics," 2nd edition, SAE International, 2005
5. John C. Dixon, "Tyres, Suspension, and Handling, " 2nd Edition, Society of Automotive Engineers Inc, 1996
6. Jan Zuijdijk, "Vehicle dynamics and damping," First revised edition, Author House, 2013.

190713- Hybrid Electric Vehicles

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Elective- DE3	Hybrid Electric Vehicles	190713	4	-	-	Max.Marks-70 Min.Marks-22 Duration-3hrs.

Pre-requisite:

Basic Electrical Engineering, Automotive Electrical & Electronics System

Course Objectives:

To make the students to understand:

1. To provide knowledge about application of hybrid and electric technology.
2. Study of various components of energy storage devices in Vehicles

Syllabus

Unit -I Introduction to Need for Alternative System: History of electric and hybrid vehicles. Need of electric and hybrid vehicles – comparative study of diesel, petrol, electric and hybrid vehicles. Limitations of electric vehicles. Specification of different electric and hybrid vehicles.

Unit -II Energy Storage Devices and Fuel Cells: Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultra-capacitors. Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

Unit-III Electric Vehicles: Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system, safety and challenges in electric vehicles.

Unit -IV Hybrid Vehicles: Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, hybrid electric drive train design, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

Unit -V Propulsion Motors and Controllers: Types of electric motors – working principle of AC and DC motors. Characteristic of shunt, series and compound type of DC motors- permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

Course Outcomes:

After successful completion of this course students will be able to:

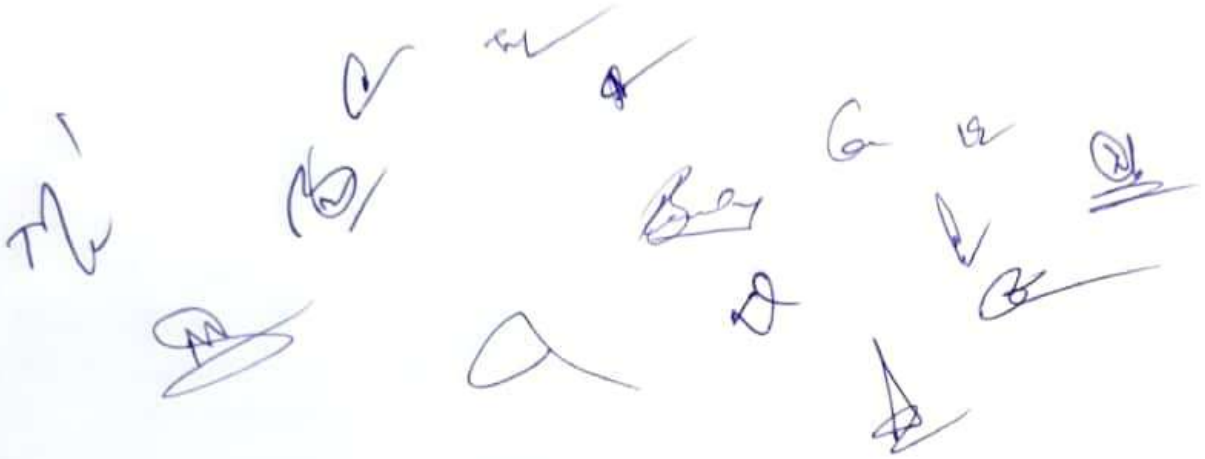
CO1: **State** the Basic concept of hybrid and electric vehicles.
CO2: **Select** the suitable technology related to different energy storage devices.
CO3: **Demonstrate** hybrid and electric technology.
CO4: **Test** the performance of various energy storage devices and Vehicles.
CO5: **Classify** the various category of Electric motors and controllers used in vehicles.
CO6: **Assemble** the various components of energy storage devices in Vehicles.

Text Books:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003.
2. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003.
3. MehrdadEhsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005.

Reference Books:

1. Ron HodKinson, " light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005.
2. LinoGuzzella, " Vehicle Propulsion System" Springer Publications,2005.



Item ME4	To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in ***online mode under*** **Departmental Elective (DE)** Course, with credit transfer in the B. Tech. ***VII Semester under*** the flexible curriculum (*Batch admitted in 2019-20)*

Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120751	Foundation of Computational Fluid Dynamics	1	190751	Farm Machinery
2	120752	Introduction to Composites	2	190753	Introduction to Mechanical Vibration
3	120753	Advanced Machining Processes			

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120751: Foundation of Computational Fluid Dynamics

Category	Title	Code	Credit - 2			Theory Paper
			L	T	P	
Departmental Elective-DE 4	Foundation of Computational Fluid Dynamics	120751	2	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:
https://onlinecourses.nptel.ac.in/noc22_me85/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	16 sep 2022	25 Sep 2022	8 Weeks

COURSE LAYOUT

Week1

Module1: Introduction
Module 2: Review of basic fluid mechanics
Module 3: Review of equations and importance of terms
Module 4: Review of equations (contd.) and non-dimensionalization
Module 5: Vorticity-Stream function equation, classification of equation and the solution nature
Module 6: Classification of equations (contd.), types of boundary conditions and description about standard test cases.

Week2

Module 1: Steps involved in CFD, Information about Computational domain and grid with illustration
Module 2: Information about grid (contd.); Taylor's series expansion
Module 3: Taylor's series expansion, CD / FD / BD for first & second derivative;
Module 4: FD formula for non-uniform mesh; mixed derivative
Module 5: Derivation for higher derivative; FD formula by Polynomial procedure

Week3

Module 1: Different Approximation Methods
Module 2: Properties associated with discretization
Module 3: Errors due to approximation and their analysis – consistency, convergence
Module 4: Stability analysis
Module 5: FD formulation for model equations and explanation

Week 4

Module 1: FV formulation for diffusion equation – 1D
Module 2: Example and extension to 2D and 3D
Module 3: FV formulation for convection and diffusion equation
Module 4 & 5: Treatment of convective terms - different interpolations

Week 5

Module 1 & 2: Illustration on the performance by different approximation for convection terms
Module 3: Time integration methods

Module 4: Arrangement of variables; Introduction to Pressure velocity coupling, MAC
Module 5: SIMPLE
Module 6: Variants of SIMPLE, Projection Method

Week 6

Module 1: Introduction to Turbulent flows
Module 2: Deriving governing equations
Module 3: Reynolds stresses, modeling strategy
Module 4 & 5: Introduction to Standard models and explanation

Week 7

Module 1: Matrix inversion – Direct, Iterative procedure
Module 2: Direct solver / Iterative solver
Module 3 - 5: Iterative solver

Week 8

Module 1 - 5: Demonstration of a test case with a display of working CFD code and details

Books and references

Anderson, D.C., J.C, Tannehil, and R.H.Fletcher, Computational Fluid Mechanics, Hemisphere Publishing Corporation, NewYork.
Ferziger, J.H. and M.Peric, Computational Methods for Fluid Dynamics, Springer, 3rd Edition, 2002
Versteeg, H.K. and W.Malalasekera, An Introduction to Computational Fluid Dynamics – The Finite Volume method, Second Edition, 2007.
Chung, T.J., Computational Fluid Dynamics, Cambridge University Press, 2002.

120752: Introduction to Composites

Category	Title	Code	Credit - 2			Theory Paper
			L	T	P	
Departmental Elective-DE 4	Introduction to Composites	120752	2	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: -
https://onlinecourses.nptel.ac.in/noc22_me87/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25 July 2022	14 Oct 2022	30 Oct 2022	12 Weeks

Course layout

Week 1: Intro and terminology
Week 2: Concept Review
Week 3: Fibers
Week 4: Matrix materials
Week 5: Short fiber composites
Week 6: Short fiber composites
Week 7: Orthotropic lamina
Week 8: Orthotropic lamina
Week 9: Orthotropic lamina
Week 10: Composite laminates
Week 11: Composite laminates
Week 12: Composite laminates

Books and references

Analysis & Performance of Fiber Composites: Bhagwan D. Agarwal & Lawrence J. Broutman

120753: Advanced Machining Processes

Category	Title	Code	Credit - 2			Theory Paper
			L	T	P	
Departmental Elective-DE 4	**Advanced Machining Processes**	**120753**	2	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:
https://onlinecourses.nptel.ac.in/noc22_me119/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Aug 2022	14 Oct 2022	29 Oct 2022	8 Weeks

COURSE LAYOUT

Week 1: Introduction to advanced machining processes and their classification
Week 1: Ultrasonic machining and its modelling and analysis
Week 2: Abrasive jet machining (AJM)
Week 2: Water jet cutting (WJC) and Abrasive water jet machining (AWJM)
Week 2: Magnetic abrasive finishing (MAF) and its modelling
Week 3: Abrasive flow finishing (AFF) and its modelling
Week 3: Magnetorheological finishing (MRF)
Week 4: Magnetorheological abrasive flow finishing (MRAFF) and its modelling and analysis
Week 5: Electric discharge machining (EDM): Principle, applications, process parameters, and modelling
Week 5: Electric Discharge Grinding (EDG), Electric Discharge Diamond Grinding (EDDG), and Wire Electric Discharge Machining (W-EDM)
Week 6: Laser beam machining (LBM)
Week 6: Plasma arc machining (PAM)
Week 6: Electron Beam Machining (EBM)
Week 7: Electro chemical machining (ECM): Principle, applications, and process parameters and modelling
Week 8: Electrochemical Grinding (ECG), Electrostream Drilling (ESD), Shaped Tube Electrolytic Machining (STEM)
Week 8: Chemical machining (ChM)

Books and references

1. V. K. Jain, Advanced Machining Processes, Allied Publishers, 2009
2. Gary F. Benedict, Nontraditional Manufacturing Processes, Taylor & Francis, 1987
3. J. A. McGeough, Advanced Methods of Machining, Springer, 1988
4. Hassan El-Hofy, Advanced Machining Processes: Nontraditional and Hybrid Machining Processes, McGraw-Hill Prof Med/Tech, 2005
5. V. K. Jain, Introduction to Micromachining, Alpha Science International Limited, 2010

190751: Farm Machinery

Category	Title	Code	Credit - 2			Theory Paper
			L	T	P	
Departmental Elective-DE4	**Farm Machinery**	190751	2	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:
https://onlinecourses.nptel.ac.in/noc22_ag07/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25 Jul 2022	14 Oct 2022	29 Oct 2022	12 Weeks

COURSE LAYOUT

Week 1: Importance of farm machines in the contest of enhance production, multiple cropping, labour scarcity etc.
Week 2: Ploughing and first opening of the soil, the design and component details.
Week 3: Machinery of seedbed preparation operation.
Week 4: Equipment for sowing and planting and inter cultivation.
Week 5: Variable Rate Fertilizer Applicator, Microprocessor Based Herbicide Applicator, Spraying etc.
Week 6: Equipment for irrigation
Week 7: Machinery for crop harvesting design and operation
Week 8: Root crop harvesting machinery
Week 9: Machinery for horticultural crops
Week 10: Equipment for crop protection and disease control
Week 11: Machinery for transport and material handling
Week 12: Machinery for land drainage, reclamation and estate maintenance

Books and references

- Principles of Farm machinery Robert Allen Kepner, Roy Bainer, Edgar Lee Barger
- Principles of Agricultural Engineering – Ojha&Michael
- Farm Machinery - Claude Culpin

190753: Introduction to mechanical vibration

Category	Title	Code	Credit - 2			Theory Paper
			L	T	P	
Departmental Elective-DE4	**Introduction to Mechanical Vibration**	190753	2	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:
https://onlinecourses.nptel.ac.in/noc22_ag07/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25 Jul 2022	16 Sep 2022	25 Sep 2022	8 Weeks

Course layout

Week1: Fundamental of Vibrations.
Week2: Free Vibration of Single Degree of Freedom Systems.
Week3: Forced Vibration of Single Degree of Freedom Systems.
Week4: Forced Vibration of Single Degree of Freedom Systems.
Week5: Vibration Measuring Instruments.
Week6: Vibration of Two Degree of Freedom Systems.
Week7: Vibration Absorbers and Critical Speed of Shafts.
Week8: Vibration of Multi Degree of Freedom Systems.

Books and references

- Grover, G.K., " Mechanical Vibrations", 7th Ed., Nem Chand & Bros.
- Rao, S.S., " Mechanical Vibrations", 5th Ed., Addison-Wesley Longman, Incorporated.
- Thomason, W.T., "Theory of Vibrations with Applications", 5th Ed., Prentice-Hall.
- Timoshenko, S.P., "Vibration Problems in Engineering", 2nd Reprint Ed., Wolfenden Press.
- Kelly, S.G., "Mechanical Vibrations", Scgaum's Outlines, Mc Graw Hill Education

Item ME5	To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2019-20)*** under the ***Open Category (OC) Courses*** (in traditional mode) for B. Tech. ***VII semester*** students of other departments along with their COs

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Department of Mechanical Engineering

Open category course offered by department for (July-Dec. 2022)

Open Category (OC-2)			Open Category (OC-3)		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	900203	Industrial Automation	1	900214	Engineering Materials for Industrial Applications
2	900204	Solar Energy	2	900215	Maintenance Engineering

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900203: INDUSTRIAL AUTOMATION

Category	Title	Code	Credit-3			Theory Paper
Open Course-OC2	Industrial Automation	900203	L	T	P	Max.Marks-70
			2	1	-	Min.Marks-22
						Duration-3hrs.

Course Objective: To make the students to understand:

1. The basic principles and elements of automation.
2. The material handling and Identification Technologies.
3. The function of Industrial Robots and their applications for transformational and handling activities.

Pre-requisite: Nil

Syllabus

Unit I Introduction to Automation: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines.

Unit II Material handling and Identification Technologies: Overview of Material Handling Systems, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods.

Unit III Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation, Quality Control Systems: Traditional and Modern Quality Control Methods, Inspection Principles and Practices, Inspection Technologies.

Unit IV Industrial Robotics: Industrial Robots and their applications for transformational and handling activities, Configuration and motions, robot classification and their performance capabilities, hardware of robots, Actuators, sensors and end effectors.

Unit V Overview of Industrial automation using robots: Selection and use of robots in manufacture and assembly, welding robot, machining inspection and painting.

Course Outcome: After the successful completion of this course, the student will be able to:

1. **Identify** potential areas for automation and justify need for automation
2. **Select** suitable major control components required to automate a process or an activity
3. **Translate** and simulate a real time activity using modern tools and discuss the benefits of automation.
4. **Decide** suitable automation hardware for the given application.
5. **Design** appropriate modeling and simulation tool for the given manufacturing application.

Text & References Books:

1. Automation, Production system and computer integrated manufacturing by M.P. Groover, PHI publication.
2. CAD/CAM by P. N. Rao, P. N. Rao, Tata McGraw Hill publication
3. Introduction to Robotics- John J. Craig, Addison Wesley Publishing, 3rd edition, 2010.
4. Robotics for Engineers -YoramKoren, McGraw Hill International, 1st edition, 1985.
5. Industrial Robotics-Groover, Weiss, Nagel, McGraw Hill International, 2nd edition, 2012.

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Department of Mechanical Engineering

For batch admitted in Academic Session 2019-20

900204: SOLAR ENERGY

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Open Course-OC2	Solar Energy	900204	2	1	-	Max. Marks – 70 Min. Marks – 22 Duration – 3 hrs

Course Objective: To make the students to understand:

1. The basic concepts of solar energy and various sun-earth angles.
2. How to develop thermal models and how to carry out economic analysis of solar systems and establish energy balance in different solar energy systems.
3. The different types of collectors, PV systems and their application.

Course Prerequisites: Basic Physics

Syllabus

UNIT – I Solar radiation, basic concepts, various Sun – Earth angles and modeling

UNIT – II Solar collectors and types: flat plate, concentrating solar collectors, Selective coatings, thermal modeling of flat plate collectors, applications of solar collectors.

UNIT – III Active and passive heating and cooling of buildings, Home lighting systems.

UNIT - IV Solar energy storage options, Solar Economics and life cycle cost analysis.

UNIT –V Solar photo voltaic System: Basic concepts of solar cell and PV Panel in series and parallel combination, characteristics curves of PV cell and panels, Photovoltaic materials, Need for different cell design, Applications of photovoltaic for power generation.

Course Outcomes: After successful completion of this course students will be able to:

1. **Define** the basic terms used in solar systems and various sun-earth angles.
2. **Establish** the energy balance and develop the thermal model of different solar systems.
3. **Investigate** the effectiveness of utilizing the solar energy by different solar systems.
4. **Analyze** the life cycle cost and other economic aspects of solar systems
5. **Describe** the application of solar systems and find out the areas of improvement.

Recommended Books:

1. Solar Energy by G.N. Tiwari
2. Solar Energy: Problems, Solution and Experiments by G.N. Tiwari, P. Barnwal, S.C. Solanki and M.K. Gaur
3. Solar Energy by John A. Duffie, William A. Beckman
4. Solar Energy by S.P. Sukhatme and J.K. Nayak

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For batch admitted in Academic Session 2019-20

900214: ENGINEERING MATERIALS FOR INDUSTRIAL APPLICATIONS

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Open Course-OC3	Engineering Materials for Industrial Applications	900214	3	-	-	Max.Marks-70 Min.Marks-22 Duration-3hrs.

Course Objectives: To make the students to understand:

1. The basic fundamentals of materials science and engineering.
2. The different classes of materials, their properties, structures and imperfections present in them.
3. The functional properties of materials and the roles of microstructure, heat treatment defects and environment play in typical engineering applications.

Course Prerequisites: Basic Chemistry

Syllabus

Unit- I Properties of Engineering Materials: Materials for space applications, Materials for Solar applications, Shape Memory Alloys, Materials for High Temperature Applications, Materials of Electronic and Electrical Applications: Semiconductors, Organic Semiconductors, Liquid Crystals, Electroluminescent Materials, Magnetic Materials, Materials for Development of Energy Efficient Building, Materials of Chemical Applications: Plastics, Rubber, Ceramics, Magneto-Rheological Materials

Unit-II Production of Engineering Materials: Production of Electronic Materials- Semiconductors, Magnetic Materials. Production of Civil Materials- Cements, Concrete, Steel and its types. Synthesis of Chemical Engineering Materials- Polymerisation, production of ceramics.

Unit- III Fabrication Techniques of Engineering Materials: Fabrication of ICs, optical fibres, steel, glass, ceramics, plastics.

Unit- IV Composite Materials: Introduction to composites, Particle- Reinforced Composites, Fibre-Reinforced Composites, Influence of Fibre Length and Orientation on properties, Different types of Fibre-Reinforced Composites, Structural Composites, fabrication process of Composites.

Unit - V Nano-materials and Super Alloys: Introduction to Nano technologies, nano-materials and their importance, Various methods of synthesis- Various kind of Nano-structures- Carbon fullerenes and CNT, Metal and metal oxide nano-wires, Self assembly of nano-structures, Core-shell nano-structures, Nano-composites. Physical and Chemical properties.
Super Alloys: Introduction to superalloys, Nickel- Iron Base Alloys, Cobalt- Base Alloys, Nickel-Base Alloys, Strengthening Mechanisms, Compositional Effects.

Course Outcomes: After successful completion of this course students will be able to:

1. **State** the properties of engineering materials.
2. **Understand** the material composition and their effects.
3. **Classify** different engineering material.
4. **Discuss** the production and fabrication techniques of Engineering Materials.
5. **Select** different types of materials as per requirement.

Text & Reference books:

1. Material Science and Engineering **by** Raghvan, V; Prentice Hall of India.
2. Material Science and Engineering by Callister's; Wiley Pub.
3. Elements of Material Science and Engineering **by** Lawrence, H. Vanvlack dison; Wesley.
4. Introduction to Engineering Materials **by** Agrawal, B.K; Tata Mc Graw Hill, N. Delhi.

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900215: Maintenance Engineering

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	Max.Marks-70
Open Course-OC3	Maintenance Engineering	900215	3	-	-	Min.Marks-22 Duration-3hrs.

Course Outcomes: Through this course, student should be able to

- Identify different maintenance categories
- Understand the principles, functions and practices adopted in industry for the successful management of maintenance activities
- Implement the maintenance function and different practices in industries for the successful management of maintenance activities.
- The Condition Monitoring & Non-Destructive Testing.
- The fault Identification, Computerized Maintenance Systems.
- The Maintenance strategies and overall configuration and Maintenance of Machines, structure and System.

UNIT I

Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept, importance of maintenance, elements of good maintenance classification of maintenance programs, corrective preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance-concept, functions, benefits and limitations, training and safety aspects in maintenance.

UNIT II

Condition monitoring, objectives and benefits of condition based monitoring, what to monitor, when to monitor, principles, condition based maintenance techniques: visual/manual monitoring, temperature monitoring, thermography, lubricant monitoring, debris and spectroscopy, performance monitoring, vibration monitoring, current monitoring, and corrosion monitoring, odour monitoring, noise and sound monitoring, Time Domain Analysis, Frequency Domain Analysis, Non Stationary Signal Analysis, Practical Examples of Vibration.

UNIT III

Tribology in Maintenance, Friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes, lubricants and its types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packings, repair methods for basic machine elements: failure analysis, failures and their development.

Unit- IV:

Accelerometers, Rotational Speed Measurements, Introduction to Faults in Rotating Machines, Unbalance Detection, Field Balancing, Misalignment, Gears, Pumps and Cavitation, IC Engines, machinery Diagnostic Chart, Basics of Instrumentation, Signal Conditioning and Filtering, Errors In Measurements, Dynamic Range And Frequency Response.

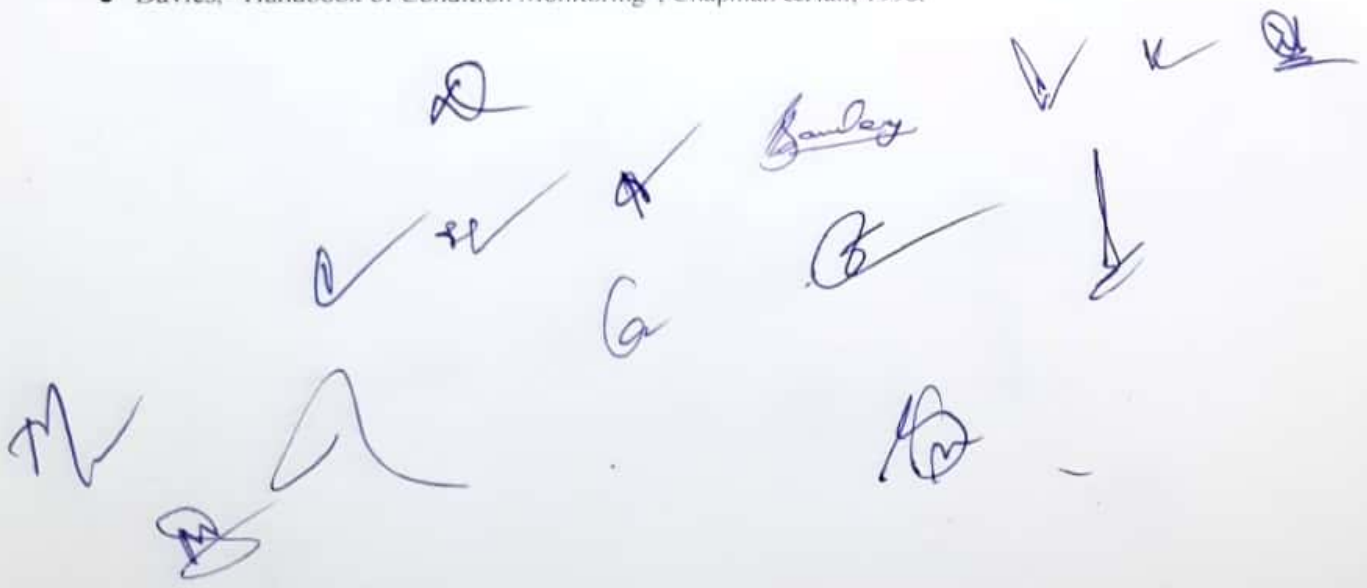
Unit- V: Non-Destructive Testing, Ultrasonics, Eddy Current and Acoustic Emission, Radiography, Dye Penetrant Tests, Tool Condition Monitoring, Experimental Modal Analysis, Introduction to Failure Analysis, Railway Locomotive Noise and Vibration Monitoring, Paper Mill Vibration Monitoring, Overview of CBM facilities at SKF Reliability Lab, Artificial Intelligence in Maintenance Engineering, Expert Systems for fault Diagnosis. IoT in Maintenance Engineering.

Course Outcomes: After successful completion of this course students will be able to:

1. **Describe** the fundamental concepts of maintenance engineering noise and vibration, measurement techniques of Condition Monitoring.
2. **Show** skills of fault diagnosis.
3. **Demonstrate** the need of instrumentation and signal processing for condition monitoring
4. **Examine** the condition of machine parts through Failure analysis of plant machineries
5. **Apply** correct usage of a method or procedure of maintenance.

Text & Reference books:

- A. R. Mohanty, Machinery Condition Monitoring: Principles and Practices, CRC Press, 2014
- Bikash Bhadury. 'Total Productive Maintenance". Allied Publisher Ltd. New Delhi.
- BC langlay. "Plant Maintenance". Prentice-Hall International. New Jersey.
- P Gopalakrishnan and AK Banerji, "Maintenance and Spare Parts Management". Prentice-Hall of India (P) Ltd. New Delhi.
- Kelly, "Maintenance Planning & Control"
- Industrial Maintenance by HP Garg. S. Chand & Company Ltd., New Delhi.
- Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
- Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995
- White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
- Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
- Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5th Edition, 1988.
- Armstrong, "Condition Monitoring", BSIRSA, 1988.
- Davies, "Handbook of Condition Monitoring", Chapman &Hall, 1996.



Item ME6	To prepare and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2019-20)***

120701- (DLC-): Reliability and Vibration Lab

Category	Title	Code	Credit - 2			Practical Paper
			L	T	P	
Departmental Lab Core	**Reliability and Vibration Lab**	**120701**	-	-	4	Max.Marks-50 Min.Marks-16

Course Objectives:

1. To understand the fundamentals of Vibration Theory.
2. To be able to mathematically model real-world mechanical vibration problems.
3. To be able to resolve industrial problems related to vibration and noise.

List of Experiments

1. Determination of Critical Speed in Whirling of Shafts.
2. Determination of Natural Frequency in Longitudinal Vibrating System.
3. Determination of Natural Frequency in Torsional Vibration System.
4. To verify the relation of compound pendulum & to determine the radius of gyration
5. To study the undamped free vibration of spring mass system.
6. To study the forced vibration of simply supported beam for different damping.
7. Undamped tensional vibrations of single and double rotor system.
8. To study the damped torsional vibration of single rotor system and to determine the damping coefficient.
9. To study the forced damped vibration of spring mass system.
10. Study the machine fault diagnostic system based on vibration analysis.

Text Books:

1. **Mechanical Vibrations**: by G K Groover.

References Books:

1. **Theory of Vibrations with Applications**: W T Thomson CBS Publishers Delhi
2. **Mechanical Vibrations**: S SRao Addison-Wesley Publishing Co.
3. **Fundamentals of Vibration:** Leonard Meirovitch , McGraw Hill International Edison.

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190701: Automotive maintenance lab

Category	Title	Code	Credit-2			Lab End term
			L	T	P	
Departmental Laboratory Course (DLC)	**Automotive maintenance lab**	**190701**	-	-	4	Max. Marks: 50 Min Marks: 16

Prerequisite: Basic knowledge IC Engine, Two Strokes, Four stroke Engine

List of Experiments-

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines.
7. Study and checking of wheel alignment - testing of camber, caster.
8. Brake adjustment and Brake bleeding.
9. Battery testing and maintenance

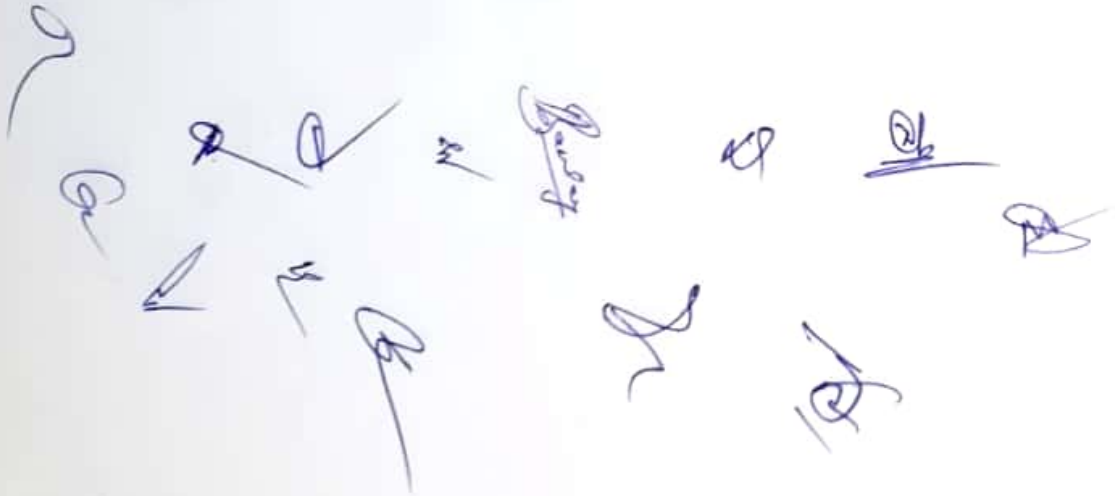
Course Outcomes: After Successful completion of this course lab students will be able to:

CO1. Explain the process involved in repairing/servicing of a vehicle.
CO2. Analyze the different the different tool for operating the maintenance of a vehicle.
CO3. Describe the requirement of wheel alignment.
CO4. Discuss the phenomena ad working of braking system
CO5. Classify different body parts or accessories of a vehicle.
CO6. Illustrate different types and function of battery

Item ME7:	To propose the list of "Additional Courses" which can be opted for getting an ***(i) Honours (for students of the host department)*** ***(ii) Minor Specialization (for students of other departments)*** *[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the* B.Tech. ***VII semester students*** *(for the batch admitted in 2019-20)] and for* B.Tech. ***V semester*** *(for the batch admitted in 2020-21)]*

Honors list (For Mechanical/Automobile Engg. Students)

Sem	V (for the batch admitted in 2020-21)	VI (for the batch admitted in 2019-20)	VII (for the batch Admitted in 2019-20)
Course Name	1. Principle of Hydraulic Machines and System Design (12 Weeks) 2. System design for sustainability (12 Weeks) 3. Manufacturing Systems Technology Part I & II (12 Weeks)	1.Conduction and convection heat transfer (12Weeks) 2.Robot motion planning (8 Weeks) 3. Theory and Practice of Non-Destructive Testing (8 Week)	1.Fundamentals of Artificial Intelligence (12 Weeks) 2. Rapid Manufacturing (12 Weeks) 3. Heat Exchangers: Fundamentals and Design Analysis (12 Weeks)



Minors list (other than Mechanical/Automobile Engg. students)

Sem	V (for the batch admitted in 2020-21)	VI (for the batch admitted in 2019-20)	VII (for the Batch admitted in 2019-20)
Course Name	1. Basics of Materials Engineering (12 Weeks) 2. Fluid Mechanics (12 Weeks)	1. Transport Processes I: Heat and Mass Transfer (12weeks) 2. Introduction to Mechanical Micro Machining (12 weeks)	1. Engineering Metrology (12 Weeks) 2. Applied Thermodynamics for Engineers (12 Weeks)

Item ME8	To prepare and recommend the ***scheme structure of B.Tech. V Semester under*** the flexible curriculum (*Batch admitted in 2020-21*)

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Department of Mechanical Engineering

Scheme of Evaluation
B. Tech. V Semester (Mechanical Engineering)

For batches admitted in academic session 2020-21

S. no.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	*Mode of Exam.
				Theory Slot				Practical Slot				L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation								
				End Sem Exam	#Proficiency in subject course	Mid Sem Exam	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project							
1	120519	MC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4	Blended (2/1)	MCQ
2	120511	DC	Industrial Engineering (DC-10)	50	10	20	20	-	-	-	100	3	-	-	3	Blended (2/1)	PP
3	120513	DC	Heat and Mass Transfer (DC-11)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
4	120514	DC	Thermal Engineering (DC-12)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
5	120515	DC	Machine Design (DC-13)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	AO
6	120516	DLC	Minor Project-I**	-	-	-	-	60	40	-	100	-	-	4	2	Offline (2/0)	SO
7	120517	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)*	-	-	-	-	-	40	-	40	-	-	2	1	Online +Monitoring	SO
8	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50			50			2	1	Interactive	SO
9	120518	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				250	50	100	100	410	160	80	1150	12	3	20	25	-	-
10	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
11	1000005	MAC	Project Management & Financing	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
Additional Course for Honours or minor Specialization				Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization													

#Proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject
*MCQ: Multiple Choice Question **AO: Assignment / Oral **PP: Pen Paper **SO: Submission / Oral
The Minor Project-I may be evaluated by an internal committee for awarding sessional marks.
*Compulsory registration for one online course using SWAYAM/NPTEL/MOOC, evaluation through attendance, assignments and presentation
Note: Students of 2020-21 admitted batch needs to appear and complete an additional MAC course of 30 Hrs. duration on Project Management & Financing. Other modules related to futuristic technologies (Drones/ Robotics etc.)

Mode of Teaching						Mode of Examination				
Theory				Lab	SEC	Theory			Lab	SEC
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO
		Offline	Online							
0	0	10	5	9	1	11	4	4	5	1
0	0	40	20	36	4	44	16	16	20	4

DEAN (ACADEMICS)
M.I.T.S.
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Department of Mechanical Engineering

Scheme of Evaluation

B. Tech. V Semester (Automobile Engineering)

For batches admitted in academic session 2020-21

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted: Theory Slot: End Term Evaluation: End Sem Exam	Theory Slot: End Term Evaluation: *Proficiency in subject/course	Theory Slot: Continuous Evaluation: Mid Sem Exam	Theory Slot: Continuous Evaluation: Quiz/Assignment	Practical Slot: End Sem. Exam	Practical Slot: Continuous Evaluation: Lab work & Sessional	Practical Slot: Continuous Evaluation: Skill Based Mini Project	Total Marks	Contact Hours per week: L	T	P	Total Credits	Mode of Teaching (Online, Offline, Blended)	**Mode of Exam.
1	190519	MC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4	Blended (2/1)	MCQ
2	190511	DC	Industrial Engineering (DC-10)	50	10	20	20	-	-	-	100	3	-	-	3	Blended (2/1)	PP
3	190513	DC	Heat and Mass Transfer (DC-11)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
4	190514	DC	Design of Machine Elements (DC-12)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	AO
5	190515	DC	Automotive Chassis (DC-13)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2/1)	PP
6	190516	DLC	Minor Project-I**	-	-	-	-	60	40	-	100	-	-	4	2	Offline (2/0)	SO
7	190517	Seminar/ Self-Study	Self-learning Presentation (SWAYAM/NPTEL/ MOOC)*	-	-	-	-	-	40	-	40	-	-	2	1	Online -Mentoring	SO
8	200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9	190518	DLA	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				250	50	100	100	410	160	80	1150	12	3	20	25	-	- -
10	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
11	1000005	MAC	Project Management & Financing*	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
Additional Course for Honours or minor Specialization				Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization													

*Proficiency in course/subject includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

**MCQ: Multiple Choice Question **AO: Assignment Oral **PP: Pen Paper **SO: Submission Oral

The Minor Project-I may be evaluated by an internal committee for awarding sessional marks.

Compulsory registration for one online course using SWAYAM/NPTEL/MOOC, evaluation through attendance, assignments and presentation

etc. Students of 2020-21 admitted batch needs to appear and complete an additional MAC course of 30 Hrs. duration on Project Management & Financing./ Other modules related to futuristic technologies (Drones/ Robotics etc.)

Mode of Teaching: Theory: Offline	Theory: Online	Theory: Blended: Offline	Theory: Blended: Online	Lab: Offline	NEC	Mode of Examination: Theory: PP	Theory: A+O	Theory: MCQ	Lab	NEC	Total Credits
0	0	10	5	9	1	11	4	4	5	1	25
0	0	40	20	36	4	44	16	16	20	4	100

DEAN (ACADEMICS)
MITS
GWALIOR

Item ME9	To prepare and recommend the syllabi for all ***Departmental Core (DC) Courses*** of B. Tech. ***V Semester (for batch admitted in 2020-21)*** under the flexible curriculum along with their COs.

Automobile Engineering			Mechanical Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190511	Industrial Engineering	1	120511	Industrial Engineering
2	190513	Heat and Mass Transfer	2	120513	Heat and Mass Transfer
3	190514	Design of Machine Elements	3	120514	Thermal Engineering
4	190515	Automotive Chassis	4	120515	Machine Design

For batches admitted in Academic Session 2020-21

190511/120511: Industrial Engineering

Category	Title	Code	Credits: 2			Theory Paper
			L	T	P	
Departmental Core-DC	Industrial Engineering	190511/120511/ 190501/120501	2	-	-	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: Industrial engineering is concerned with the design, improvement, installation, and management of integrated systems of men, material, and machine. After completing this course, students will learn a set of skills that includes mathematical modeling, probability and statistics, computer science, human factors, interpersonal skills, project management, and an ability to manage and administer large technical engineering and research projects. Thus, industrial engineering may be thought of as applied problem-solving, from inception to implementation.

Syllabus

UNIT-I

Production Systems and Productivity: Production Management: design of production systems (product, job shop and batch). Definition and types of productivity, Measurement of productivity, factors affecting the productivity and productivity improvement programs.

Production Planning and Control: Aggregate production planning, Capacity planning: capacity measurement, long-term and short-term strategies, aggregate production planning, and graphical method to choose aggregate plan.

UNIT-II

Forecasting techniques: Need and type of forecasting, factors affecting forecasting, forecasting in decision making, time series analysis, demand patterns, qualitative methods- measures of forecast accuracy and error analysis in quantitative forecasting.

UNIT-III

Inventory Control – Objectives and functions, need and classifications- codification and standardization ABC analysis, deterministic inventory models, quantity discount; perpetual and periodic inventory control systems. Probabilistic inventory management, economic ordering quantity procurement cost, carrying charges, lead-time, reorder point.

Unit-IV

Facility Locations and Plant Layout: Facility location factors and evaluation of alternate locations; qualitative aspects, quantitative models for layout decisions, types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing, materials handling systems.

Project management - Project Scheduling, Network diagram, critical path method (CPM), Project Evaluation and review techniques (PERT), Time cost trade off.

UNIT-V

Master Production Scheduling and MRP: Functions, planning horizon and planning periods for master production schedule, types of master production schedule. Bill of Material, Independent Demand versus dependent demand. Functions of material requirements planning and manufacturing resource planning (MRP I and MRP II), inputs for MRP system, performance characteristics of MRP system, materials requirement planning explosion.

Course outcomes: After learning the course the students should be able to:

- CO1. **Define** and measure productivity.
- CO2. **Understand** Production planning and control required for industry to analyze the engineering problems.
- CO3. **Apply** engineering design to produce solutions that meet specified needs of manufacturing industry
- CO4. **Analyze** practice through various Management and Operation Tools for Improving Quality and Quantity.
- CO5. **Evaluate** various kinds of problems or issues faced by service and manufacturing industries like Inventory control, sales forcasting economic consideration, optimum utilization of resources, productivity.
- CO6. **Create** new mathematical models for efficient production planning and control.

Text Books:

1. Industrial Engineering and Production Management, Martand Telsang, S. Chand
2. Production and Operation Management by R. Panneerselvam, PHI, Latest Edition
3. Manufacturing planning and control for SCM by Vollmann; TMH, Latest Edition.
4. Purchasing & Materials Management by Dobler & Lee, PHI, Latest Edition

Reference Books:

1. Operations Management by Krajewski, L. J., Ritzman, L. P. and Malhotra, M. K., Prentice Hall, New Delhi; Latest Edition.
2. Production/Operations Management by Ebert, J and Adams, D.J., Prentice Hall of India, New Delhi; Latest Edition.
3. Production and Operations Management: manufacturing and services by Chase, R. B., Aquilano, N. J. and Jacob, F. R., TMH, New Delhi; Latest Edition .
4. Modern Production/Operations Management by Buffa and Sarin, Wiley India; Latest Edition.

List of Open Source Software/learning website:

1. Operation Management, IIT Roorkee, Dr. Inderdeep singh, https://nptel.ac.in/courses/112107238
2. Operation and Supply chain Management, IIT Madras, Prof. G. Srinivasan https://nptel.ac.in/courses/110106045

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Department of Mechanical Engineering

For batch admitted in Academic Session 2020-21

190513/120513: Heat and Mass Transfer

Category	Title	Code	Credits -4			Theory Paper
			L	T	P	
Departmental Core-DC	Heat and Mass Transfer	190513/120513/ 120503/190503	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2 hrs.

Course Objectives: To make the students understand:
1. the comprehensive of physical science and its fundamentals applicable to the engineering discipline of heat and mass transfer.
2. the fundamentals of heat transfer mechanisms in fluids and solids.

Syllabus

UNIT I - Fundamental of Heat Transfer: Modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, thermal conductivity and its variation with temperature, film coefficient of heat transfer, general heat conduction equations, Steady state heat transfer: Thermal resistances and conductance, overall Heat transfer Coefficient, Heat transfer through plane and composite wall, hollow and composite hollow cylinder and sphere, thermal diffusivity, one dimensional steady state conduction with heat generation , critical thickness of insulation. Unsteady State Heat Transfer: Transient and periodic conduction, Lumped System Analysis, heating and cooling of bodies with known temperature distribution, response of thermocouple.

UNIT II - Convection Heat Transfer: Introduction to Free and Forced Convection, laminar and turbulent flow, forced convection through hydrodynamic and thermal boundary layers, analysis of hydrodynamic and thermal boundary layer. Empirical equations of convection heat transfer. Heat Transfer in a circular pipe (forced convection). Applications of dimensional analysis to free and forced convection. Reynolds Number, Prandtl Number, Grashoff Number, Nusselt numbers, and Boit Number

UNIT III - Heat Exchangers: Basic types of heat exchanger. Logarithmic Mean Temperature Difference (LMTD), fouling factor, heat exchanger effectiveness, NTU Methods. Extended surfaces: Pin-Fin and rectangular fin of uniform cross section. Effectiveness and efficiency of Fin. Use of fin analysis for measuring, thermometric error, triangular and parabolic profile.

UNIT IV – Thermal radiation: Basic concept. Monochromatic and total emissive power, absorptivity, reflectivity and transmissivity, Kirchhoff's law, Concept of Black & Grey bodies. Plank's distribution law.Wien's displacement law. Steffen – Boltzmann law, Concept of Shape factor. Condensation heat transfer: Introduction, process, Theory of laminar film condensation. Nusselt's Theory. Drop wise condensation. Influence of the presence of non-condensable gases. Boiling heat transfer: Nature, Boiling regimes, Bubble size consideration, bubble growth and Collapse. Critical diameter, Rosen how Correlation.

Unit V - Diffusion Mass Transfer: Fick's law. Steady state diffusion of gases and liquids through solids, Equi-molal diffusion, isothermal diffusion, isothermal evaporation of water into air. Mass transfer coefficient. Convective Mass Transfer: Mass transfer through boundary layer. Analogy between momentum heat & mass transfer. Dimensional analysis, application to convective mass transfer. Forced convection mass transfer in laminar and turbulent flow through tubes. Simultaneous heat and mass transfer.

Course Outcomes: After successful completion of this course students will be able to:

CO1. Formulate and solve one-dimensional conduction with and without heat generation
CO2. Apply the empirical equations to analyze various convection problems
CO3. Evaluate the performance of various types of heat exchangers
CO4. Develop the mathematical and physical concept of radiation heat transfer
CO5. Apply the physics of heat transfer in the processes like Condensation and Boiling
CO6. Analyze and solve the problems in diffusion and convective mass transfer

Text Books:

1. Kumar D. S, Heat & Mass Transfer, Latest Edition, Katson Publication.
2. Rajput R. K., Heat & Mass Transfer, Latest Edition, S. Chand Publication.

References Books:

1. Arora & Domkundwar, A course in Heat & Mass Transfer, Latest edition, Dhanpat Rai& Co. Publication.
2. Nag P K, Heat Transfer, Latest Edition, McGraw-Hill
3. Holman J. P., Heat Transfer, Latest Edition, TMH.
4. Kreith & Bohn, Principles of Heat Transfer, Latest Edition, CL Engineering Publication.
5. Cengel Yunus A., Heat and Mass Transfer, Latest Edition, TMH.
6. Thirumaleshwer M., Heat and Mass Transfer by, Latest Edition, Pearson

List of Experiments:

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Insulating Powder.
3. Measurement of Emissivity.
4. Determination of Stefan-Boltzmann constant.
5. Determination of Heat Transfer coefficient by Pin-Fin Apparatus.
6. Determination of Effectiveness of Shell and Tube heat exchanger.
7. Determination of Effectiveness of Parallel and Counter Flow Heat Exchanger.
8. Determination of Heat transfer coefficient by Forced Convection.
9. Determination of Heat Transfer coefficient during drop and film wise condensation.
10. To study the drying characteristics of different wet granular materials using natural and forced circulation in a tray dryer.
11. To determine the diffusion coefficient of liquid vapor in air by Stefan's tube.

Lab Course Outcomes: After successful completion of this course students will be able to:

CO1: Determine the thermal conductivity of metal rod and insulating powder.
CO2: Estimate the Stefan-Boltzmann constant and measurement of emissivity.
CO3: Determine the effectiveness of various types of heat exchangers.
CO4: Evaluate the Heat Transfer coefficient in various heat transfer phenomena.
CO5: Evaluate the diffusion coefficient of liquid vapor in air by Stefan's tube.

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Department of Mechanical Engineering

For batch admitted in Academic Session 2020-21

190514: Design of Machine Elements

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Design of Machine Elements	190514/ 190504	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2 hrs.

Note: Use of PSG Design Data book is permitted in exam.

Course Pre-Requisites:

Engineering Mathematics-I
Mechanics of Materials

Course Objectives:

To make the students to understand:
1. develop an ability to apply knowledge of mathematics, science and engineering.
2. develop an ability to design a system, component or process to meet desired needs within realistic constraints.
3. develop an ability to identify, formulate, and solve engineering problems.
4. develop an ability to use techniques, skills and modern engineering tools.

Syllabus:

Unit I - Design Philosophy: Principles of mechanical design; Factor of safety, Limits and fits; Standardization; Selection of materials, Theory of failures.

Unit II- Design of Keys, Shafts and Couplings: Definitions, classifications and applications design of rigid and pin bushed flexible couplings.

Unit III- Design of Permanent and Temporary Joints: Cotter and knuckle joints; screwed fastenings, bolted and riveted joints under direct and eccentric loads. Welded joints: Welded joints, strength of welded joints, eccentrically loaded welded joints, welded joints subjected to bending moments and torsion.

Unit IV- Design of Mechanical Gears: Design of spur, helical, bevel and worm gears.

Unit V- Design of Bearings: Rolling contact bearing: Types of rolling contact bearing, static and dynamic load capacities, Stribeck's equation, equivalent bearing load, load life relationship, bearing life, bearing life, load factor, selection of bearing from manufacturing catalogue. Sliding contact bearing: Bearing material and their properties, bearing types and their constructional details. Design consideration in hydrodynamic bearings.

Course Outcomes:

After successful completion of this course students will able to:

CO1: **Illustrate** the design Philosophy and Principles of mechanical design.
CO2: **Identify** appropriate bearing for a given application.
CO3: **Use** design data books in designing various mechanical components.

CO4: Select appropriate drive for power transmission on the basis of load and speed.
CO5: Analyze the stresses and strain induced in basic mechanical components.
CO6: Design the machine elements against static as well as fatigue load.

Text Books:

1. V.B. Bhandari, "Design of Machine Elements, Tata McGraw- Hill Education.
2. R.K. Jain, "Machine Design", Khanna Publishers, New Delhi, 1997.
3. R C Juvinall Fundamental of Machine Components Design, 4/e, Wiley.
4. P C Gope, Machine Design: Fundamental and Applications, 1/e PHI.
5. R L NORTON, Machine Design an Introduction, Pearson.
6. E J Hearn, Mechanics of Material, BH.

References Books:

1. P.M. Heldt "High speed combustion Engine", Oxford-IBH Publishing Co., Calcutta, 1965.
2. A.Kolchin and V.Demidov, "Design of automotive engine", MIR Publisher, Moscow, 1984.
3. Sundararaja Murthy, T.V. "Machine Design", Khanaa publisher, New delhi.
4. "Design Data book", PSG College of technology, Coimbatore,2000.

NPTEL Link for Design of Machine Elements

http://nptel.ac.in/courses/112105124/

List of Experiments

1. Design and drawing of Single, double and triple riveted joint
2. Design and drawing of Single and double strap butt joint
3. Design and drawing of Welded joint
4. Design and drawing of Socket and Spigot cotter joint
5. Design and drawing of Gib and Cotter joint.
6. Design and drawing of Knuckle joint
7. Study of Theories of failure
8. Design and drawing of Solid and hollow shaft
9. Design and drawing of Rigid coupling
10. Design and drawing of Flexible coupling

Laboratory Course Outcomes:

After successful completion of this course students will be able to:

CO1: List out the various 2D and 3D CATIA commands
CO2: Describe construction details to draft the different design of machine elements
CO3: Demonstrate the concept of machine elements based on different material
CO4: Distinguish various types of Temporary and Permanent joints.
CO5: Select and **choose** the right strategy to draft the machine elements
CO6: Design and create the machine elements under various loading condition

For batches admitted in Academic Session 2020-21

190515: Automotive chassis

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Automotive chassis	190515/190505	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Pre-requisite:

Basics of Internal combustion engines

Course Objectives:

To make the students to:

1. Understand vehicle chassis structure and components of transmission lines.
2. Understand automotive suspension system and steering system.
3. Understand the importance of conventional and advanced braking system.

Syllabus

Unit I Automotive chassis: Definition; chassis layout; types of chassis layout with reference to power plant location, steering position and drive on wheels; chassis components; chassis classification; Automotive frames: Construction; functions; loads acting; materials; types; frame cross sections; frame diagnosis and service; dimensions of wheel base; wheel track; chassis overhang and ground clearance.

Unit II Front axle & steering system: Functions, construction & types of front axle; front wheel geometry; front wheel drive; steering mechanisms; steering linkages & layout; types of steering gear boxes; power & power assisted steering; electronic steering; four-wheel steering; terminology-reversible steering, under-steering, over-steering, turning radius.

Unit III Suspension system: Need; factors influencing ride comfort; types; suspension springs-leaf spring, coil spring & torsion bar; spring materials; independent suspension; rubber suspension; pneumatic suspension; hydraulic suspension, shock absorbers-liquid & gas filled.

Unit IV Braking systems: Introduction, principles of braking; classification; brake actuating mechanisms; Drum brake- theory; principle; construction; working; Disc brake- theory, principle, construction, working; Parking brake- theory, principle; construction, types; Hydraulic system theory, principles, master-cylinder basics, wheel-cylinder basics, tubing & hoses, valves & switches, brake fluid; Power brake- theory, vacuum-booster basics, hydraulic-booster basics, electro-hydraulic booster basics; Advanced brake theories; Exhaust brake; ABS technology; factors affecting brake performance operating temperature, area of brake lining, clearance.

Unit V Wheel: Forces acting on wheels, construction of wheel assembly, types- spoke, disc & built-up wheels; wheel balancing; wheel alignment; Tyres: Static & rolling properties of tyres, construction details, types of tyres- pneumatic & hydraulic; types of tyre-wear & their causes; tyre rotation. Bearings: Functions; classification of bearings; bearing materials; automotive bearings.

Course Outcomes:

After successful completion of this course students will be able to:

CO1: **List** out the various automotive chassis and Frame components.
CO2: **Describe** construction details of various types of automotive chassis and basicFunctions of subsystems in the chassis.
CO3: **Demonstrate** concept of steering mechanism and suspension system while construction of chassis and frame.
CO4: **Distinguish** various types of suspension system, brake system, steering system and wheels & tyres in the vehicles.
CO5: **Select** the suitable subsystems for a vehicle.
CO6: **Design** and create the chassis and frame.

Text Books:

1. Automobile engineering", Dr. Kripal Singh.
2. Automobile engineering" K.M. Gupta.
3. Heldt P.M., "Automotive chassis", Chilton Co., New York.
4. Giles J.G., "Steering, Suspension and tyres", Iliffe Book Co., London

List of Experiments:

1. To study and prepare report on the constructional details, working principles and operation of the **Automotive Clutches**.
2. To study and prepare report on the constructional details, working principles and operation of the **Automotive Transmission systems**.
3. To study and prepare report on the constructional details, working principles and operation of the **Automotive Drive Lines & Differentials**.
4. To study and prepare report on the constructional details, working principles and operation of the **Automotive Engine Systems & Sub Systems**.
5. To study and prepare report on the constructional details, working principles and operation of the **Automotive Suspension Systems**.
6. To study and prepare report on the constructional details, working principles and operation of the **Automotive Steering Systems**.
7. To study and prepare report on the constructional details, working principles and operation of the **Automotive Brake systems**.
8. To study and prepare report on the constructional details, working principles and operation of the **Automotive Tyres& wheels**.

Course Outcomes:

After successful completion of this course students will be able to:

CO1: **List** out the various automotive chassis and Frame components.
CO2: **Describe** construction details of various types of automotive chassis and basic Functions of subsystems in the chassis.
CO3: **Demonstrate** concept of steering mechanism and suspension system while construction of chassis and frame.
CO4: **Distinguish** various types of suspension system, brake system, steering system and wheels & tyres in the vehicles.
CO5: **Select** the suitable subsystems for a vehicle.
CO6: **Design** and create the chassis and frame.

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Department of Mechanical Engineering

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120514: Thermal Engineering

Category	Title	Code	Credits -4			Theory Paper
			L	T	P	Max.Marks-50
Departmental Core-DC	Thermal Engineering	120514	2	1	2	Min.Marks-16 Duration-2 hrs.

Course Objectives: To make the students understand:

1. the fundamental principles of IC engines and combustion phenomena
2. the basic principles of nozzles and diffusers
3. the application of basic thermodynamics and fluid mechanics in steam and gas turbine power plants

Syllabus

UNIT I - Vapor Power Cycles: Vapor Carnot cycle and its limitations, Rankine cycle and modified Rankine cycle, actual vapor power cycle, Reheat cycle, ideal regenerative cycle, actual regenerative cycle, Reheat – regenerative cycle, feedwater heaters, cogeneration of power and process heat, working fluids in vapor power cycle, binary vapor cycles, the efficiency of coupled cycles. Basics of condensers.

UNIT II – IC Engine Basics and Combustion in IC Engines

Basics of CI and SI Engines. Basics of two-stroke and four-stroke IC engines, Valve timing diagram, Performance parameters, Heat balance, Testing of the engine.

Stages of combustion in SI engine, Flame propagation, Rate of pressure rise, Abnormal combustion, Theory of detonation, Effect of engine operating variables on knock, Stages of combustion in CI engines, Delay period - Factors affecting delay period, Knock in CI engines - methods of controlling diesel knock, Combustion chambers for SI and CI engines.

UNIT III – Gas Turbine

Open cycle and closed cycle arrangements, applications, assumptions in ideal cycle analysis, simple gas turbine cycle, heat exchange cycle, intercooled cycle, various combinations of reheat, heat exchange and intercooling, comparison of various cycles, Combined Brayton and Rankine Cycle and GT-ST plants; Advantages of Combined Cycle

UNIT IV – Steam Turbines

Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Utilization factor, Blading, Velocity diagram & work calculations, Impulse Reaction Turbines, Losses in steam turbines, Governing of turbines.

Unit V Nozzles and Diffusers

Introduction, SFEE and continuity equation for nozzles & diffusers, momentum equation for the steam nozzle, entropy change due to friction in the nozzle, nozzle efficiency, critical pressure, stagnation enthalpy & pressure, Relation between area, velocity & pressure in nozzle, the effect of friction on critical pressure ratio, supersaturated flow in nozzles, the effect of variation of back pressure

Course Outcomes: After successful completion of this course students will be able to:

CO1: analyze the performance of steam power plant

CO2: describe the working principles of internal combustion engines and combustion phenomena

CO3: analyze the performance of gas turbine power plant

CO4: describe the working of various types of steam turbine
CO5: solve analytical problems of nozzles and diffusers

Text Books:

1. P K Nag, "Power Plant Engineering", Latest Edition, Tata McGraw Hill Publishing Company Limited,
2. Ganesan V, "Internal combustion engines", Latest Edition, Tata McGraw Hill Education Private Limited,
3. Ganesan V, "Gas Turbines", Latest edition, Latest Edition, Tata McGraw Hill Education Private Limited,
4. P. L. Ballaney, "Thermal Engineering", Latest Edition, Khanna Publishers

References Books:

1. John. B, Heywood, "Internal Combustion Engine Fundamentals", Latest edition, McGraw Hill Publishing Co., New York,
2. Sharma S. P, Chandramohan, "Fuels and Combustion", Latest edition, Tata McGraw Hill Publishing Co.
3. Mathur and Sharma, "A course on Internal combustion Engines", Latest edition, Dhanpat Rai& Co.
4. Rajput R. K, "A textbook of Thermal Engineering", Latest edition, Laxmi Publications
5. B.K. Venkanna, "Fundamentals of Turbomachinery", PHI Learning Private Limited

List of Experiments:

1. Introduction to Computational Fluid Dynamics and its methodology.
2. Perform CFD analysis on flow through pipe with varying Reynolds Number.
3. Performance test of two stoke diesel engine and four stroke diesel engines.
4. Study of compounding of Steam turbine.
5. Study of combined steam and gas turbine plant.

Lab Course Outcomes: After successful completion of this course students will be able to:

CO1: Describe the process involved and advantages in solving a fluid problem using computational fluid dynamics
CO2: Solve the Fluid flow problem using CFD technique.
CO3: Estimate energy distribution by conducting heat balance test on IC engines.
CO4: Determine performance parameters of impulse steam turbine
CO5: Evaluate the performance of steam turbine with compounding.

For batch admitted in Academic Session 2020-21

120515: Machine Design

Category	Title	Code	Credit -4			Theory Paper
Departmental Core-DC	Machine Design	120515/120505	L	T	P	Max.Marks-50
			2	1	2	Min.Marks-16
						Duration-2hrs.

Note: Use of PSG Design Data book is permitted in exam.

Course Pre-Requisites:
1. Mechanics of Materials (Subject Code - 120302)
2. Design of Machine Elements (Subject Code - 120402)

Course Objectives: To make students:
1. Develop an ability to identify, formulate and solve design engineering problems.
2. Develop an ability to use the techniques, skills and modern design engineering tools necessary for engineering practice.
3. Demonstrate the ability to make proper assumptions, perform correct analysis while design upon various mechanical machine elements.

Syllabus

UNIT-I

Stress concentration & fatigue: Stress Concentration-causes, effect in tension, bending and torsion, mitigation, **Fatigue**- cyclic loading, endurance limit, S-N curve, concentration factor, notch sensitivity, design consideration, Goodman and modified Goodman's diagram, Soderberg's equation, Gerber's parabola, design for finite life, cumulative fatigue damage factor.

UNIT-II

Spring: Function, classification, Rate, curvature of coil, scale, resilience, material, Stresses and deflection equations of helical springs, design of compression and tension springs, torsion springs, fatigue loading on springs, surge in spring, critical load, spiral springs, design of leaf spring.

UNIT-III

Gears: Design of Spur, Helical, worm and Bevel Gears: Force analysis, Selection of material, Beam and wear strength, Form or Lewis factor, Dynamic load-Barth equation and Buckingham equation, consideration for maximum power transmitting capacity, Gear lubrication.

UNIT-IV

Sliding contact bearings:

Classification, Selection, Viscosity of Lubricants, Materials, Types, Petroff's relation, loads on bearing, Design, Advantages, Disadvantages, Limitations, Heat Dissipation.

UNIT-V

Rolling contact bearings:

Designation, Types, Friction effect, loads, Fatigue, Deflection & deformation, Selection, bearing life.

Course Outcomes: After successful completion of this course students will be able to:

CO1: **Describe** the design procedure used in automotive industry to design the engine parts
CO2: **Classify** the different types of spring, bearing and Gears

CO3: **Choose** the right strategy for designing the machine components based on material and methods
CO4: **Apply** the design procedure for solving and drafting the different design of machine elements
CO5: **Compare** the various curves and design procedure used
CO6: **Selection** of machine elements under various loading and environmental conditions.

Text Books

1. Shigley, J.E., and CharlesMechanical Engineering Design; TMH
2. Bhandari VB, Design of Machine elements; Tata McGraw Hill Book Co.

Reference Books

1. John KC,Text Book of Machine Drawing; PHI Learning.
2. Machine Design by Mubeen, Pearson.
3. Engineering design by George Dieter; McGraw Hill.
4. Bhatt, ND,Machine Drawing; Charotar.
5. Kulkarni, S.G., Machine Design, McGraw Hill.
6. Narayana and Reddy,Machine Drawing; New age publication.
7. Design data book, PSG College of Technology, Coimbatore
8. Luzzader, WJ, Duff, JM,Fundamental of Engineering Drawing Interactive Graphics; PHI.
9. Mahadevan, Reddy's,Mechanical design data book;CBS Publisher.

NPTEL Link for Design of Machine Elements

https://nptel.ac.in/syllabus/112106137/

https://nptel.ac.in/downloads/112105125/

List of Experiments

1. Design and drawing of helical spring.
2. Design and drawing of Spur gear.
3. Design and drawing of Helical gear.
4. Design and drawing of Worm gear.
5. Design and drawing of bevel gear.
6. Modelling and simulation of Gear box.
7. Study of Sliding Contact Bearings and Ball bearing and its selection
8. Design and drawing of Antifriction Bearing.
9. Design and drawing of Journal Bearing.
10. Assembly drawing of the Foot step bearing.

Laboratory Course Outcomes: After the completion of the course Lab students will be able **to**

1. **Design** and analysis the different part of an I.C Engine like Gear, Spring and Bearing
2. **Compare** the materials used in designing the automobile engine parts.
3. **Use** the software like AUTO CAD, CATIA and ANSYS for modelling and analysis
4. **Select** the spring for a proper application also can select the proper material of spring.
5. **Design** the different types of gear and spring also able to know their practical applications
6. **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

CO3: **Choose** the right strategy for designing the machine components based on material and methods
CO4: **Apply** the design procedure for solving and drafting the different design of machine elements
CO5: **Compare** the various curves and design procedure used
CO6: **Selection** of machine elements under various loading and environmental conditions.

Text Books

1. Shigley, J.E., and CharlesMechanical Engineering Design; TMH
2. Bhandari VB, Design of Machine elements; Tata McGraw Hill Book Co.

Reference Books

1. John KC,Text Book of Machine Drawing; PHI Learning.
2. Machine Design by Mubeen, Pearson.
3. Engineering design by George Dieter; McGraw Hill.
4. Bhatt, ND,Machine Drawing; Charotar.
5. Kulkarni, S.G., Machine Design, McGraw Hill.
6. Narayana and Reddy,Machine Drawing; New age publication.
7. Design data book, PSG College of Technology, Coimbatore
8. Luzzader, WJ, Duff, JM,Fundamental of Engineering Drawing Interactive Graphics; PHI.
9. Mahadevan, Reddy's,Mechanical design data book;CBS Publisher.

NPTEL Link for Design of Machine Elements

https://nptel.ac.in/syllabus/112106137/

https://nptel.ac.in/downloads/112105125/

List of Experiments

1. Design and drawing of helical spring.
2. Design and drawing of Spur gear.
3. Design and drawing of Helical gear.
4. Design and drawing of Worm gear.
5. Design and drawing of bevel gear.
6. Modelling and simulation of Gear box.
7. Study of Sliding Contact Bearings and Ball bearing and its selection
8. Design and drawing of Antifriction Bearing.
9. Design and drawing of Journal Bearing.
10. Assembly drawing of the Foot step bearing.

Laboratory Course Outcomes: After the completion of the course Lab students will be able **to**

1. **Design** and analysis the different part of an I.C Engine like Gear, Spring and Bearing
2. **Compare** the materials used in designing the automobile engine parts.
3. **Use** the software like AUTO CAD, CATIA and ANSYS for modelling and analysis
4. **Select** the spring for a proper application also can select the proper material of spring.
5. **Design** the different types of gear and spring also able to know their practical applications
6. **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

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Department of Mechanical Engineering

Item ME10	To prepare and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech.V semester ***(for batch admitted in 2020-21)***

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Department of Mechanical Engineering

The experiment list of following subjects is reviewed and modified

S.No.	Name of Subject	Code
1.	Heat and Mass Transfer	190513/120513
2.	Design of Machine Elements	190514
3.	Automotive Chassis	190515
4.	Thermal Engineering	120514
5.	Machine Design	120515

190513/120513: Heat and Mass Transfer

List of Experiments:

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Insulating Powder.
3. Measurement of Emissivity.
4. Determination of Stefan-Boltzmann constant.
5. Determination of Heat Transfer coefficient by Pin-Fin Apparatus.
6. Determination of Effectiveness of Shell and Tube heat exchanger.
7. Determination of Effectiveness of Parallel and Counter Flow Heat Exchanger.
8. Determination of Heat transfer coefficient by Forced Convection.
9. Determination of Heat Transfer coefficient during drop and film wise condensation.
10. To study the drying characteristics of different wet granular materials using natural and forced circulation in a tray dryer.
11. To determine the diffusion coefficient of liquid vapor in air by Stefan's tube.

Lab Course Outcomes:

After successful completion of this course students will be able to:

CO1: Determine the thermal conductivity of metal rod and insulating powder.
CO2: Estimate the Stefan-Boltzmann constant and measurement of emissivity.
CO3: Determine the effectiveness of various types of heat exchangers.
CO4: Evaluate the Heat Transfer coefficient in various heat transfer phenomena.
CO5: Evaluate the diffusion coefficient of liquid vapor in air by Stefan's tube.

190514: Design of Machine Elements

List of Experiments

1. Design and drawing of Single, double and triple riveted joint
2. Design and drawing of Single and double strap butt joint
3. Design and drawing of Welded joint
4. Design and drawing of Socket and Spigot cotter joint
5. Design and drawing of Gib and Cotter joint.
6. Design and drawing of Knuckle joint
7. Study of Theories of failure
8. Design and drawing of Solid and hollow shaft
9. Design and drawing of Rigid coupling
10. Design and drawing of Flexible coupling

Laboratory Course Outcomes:

After successful completion of this course students will be able to:

CO1: **List** out the various 2D and 3D CATIA commands
CO2: **Describe** construction details to draft the different design of machine elements
CO3: **Demonstrate** the concept of machine elements based on different material
CO4: **Distinguish** various types of Temporary and Permanent joints.
CO5: **Select** and **choose** the right strategy to draft the machine elements
CO6: **Design** and create the machine elements under various loading condition

190515: Automotive chassis

List of Experiments:

1. To study and prepare report on the constructional details, working principles and operation of the Automotive Clutches.
2. To study and prepare report on the constructional details, working principles and operation of the Automotive Transmission systems.
3. To study and prepare report on the constructional details, working principles and operation of the Automotive Drive Lines & Differentials.
4. To study and prepare report on the constructional details, working principles and operation of the Automotive Engine Systems & Sub Systems.
5. To study and prepare report on the constructional details, working principles and operation of the Automotive Suspension Systems.
6. To study and prepare report on the constructional details, working principles and operation of the Automotive Steering Systems.
7. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
8. To study and prepare report on the constructional details, working principles and operation of the Automotive Tyres & wheels.

Course Outcomes:

After successful completion of this course students will be able to:

CO1: **List** out the various automotive chassis and Frame components.

CO2: **Describe** construction details of various types of automotive chassis and basic Functions of subsystems in the chassis.

CO3: **Demonstrate** concept of steering mechanism and suspension system while construction of chassis and frame.

CO4: **Distinguish** various types of suspension system, brake system, steering system and wheels & tyres in the vehicles.

CO5: **Select** the suitable subsystems for a vehicle.

CO6: **Design** and create the chassis and frame.

120514: Thermal Engineering

List of Experiments:

1. Performance test of two stroke petrol engine and four stroke petrol engines.
2. Performance test of two stoke diesel engine and four stroke diesel engines.
3. Demonstration of C.O.P. and Performance of Air-Conditioner.
4. Determination of C.O.P. in Vapour Compression Refrigeration system
5. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.
6. Study of Governing of Pelton, Francis, Kaplan Turbine
7. Determination of Specific quantities in Pelton, Francis, Kaplan Turbine
8. Determination of C.O.P. in Vapour Absorption Refrigeration system

Lab Course Outcomes:

After successful completion of this course students will be able to:

CO1: Conduct constant speed and variable speed tests on IC engines and interpret their performance.
CO2: Estimate energy distribution by conducting heat balance test on IC engines.
CO3: Determine performance parameters of various refrigeration systems.
CO4: Evaluate the performance of various air-conditioning systems.
CO5: Evaluate performance parameters of various hydraulic turbines.

120515: Machine Design

List of Experiments

1. Design and drawing of helical spring.
2. Design and drawing of Spur gear.
3. Design and drawing of Helical gear.
4. Design and drawing of Worm gear.
5. Design and drawing of bevel gear.
6. Modelling and simulation of Gear box.
7. Study of Sliding Contact Bearings and Ball bearing and its selection
8. Design and drawing of Antifriction Bearing.
9. Design and drawing of Journal Bearing.
10. Assembly drawing of the Foot step bearing.

Laboratory Course Outcomes:

After the completion of the course Lab students will be able **to**

1. **Design** and analysis the different part of an I.C Engine like Gear, Spring and Bearing
2. **Compare** the materials used in designing the automobile engine parts.
3. **Use** the software like AUTO CAD, CATIA and ANSYS for modelling and analysis
4. **Select** the spring for a proper application also can select the proper material of spring.
5. **Design** the different types of gear and spring also able to know their practical applications
6. **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

Item ME11	To prepare and recommend the suggestive list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory component-based courses to be offered in B.Tech. V Semester ***(for the batch admitted in 2020-21)***.

Automobile Engineering			Mechanical Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190513	Heat and Mass Transfer	1	120513	Heat and Mass Transfer
2	190515	Automotive Chassis	2	120515	Machine Design

For batch admitted in Academic Session 2020-21

190513/120513: Heat and Mass Transfer

Category	Title	Code	Credits -4			Theory Paper
			L	T	P	
Departmental Core-DC	Heat and Mass Transfer	190513/120513/ 120503/190503	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2 hrs.

List of Experiments:

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Insulating Powder.
3. Measurement of Emissivity.
4. Determination of Stefan-Boltzmann constant.
5. Determination of Heat Transfer coefficient by Pin-Fin Apparatus.
6. Determination of Effectiveness of Shell and Tube heat exchanger.
7. Determination of Effectiveness of Parallel and Counter Flow Heat Exchanger.
8. Determination of Heat transfer coefficient by Forced Convection.
9. Determination of Heat Transfer coefficient during drop and film wise condensation.
10. To study the drying characteristics of different wet granular materials using natural and forced circulation in a tray dryer.
11. To determine the diffusion coefficient of liquid vapor in air by Stefan's tube.

Skill Based Projects:

1. Model for comparing the thermal conductivity of different metals
2. Model for comparing the heat transfer through a pipe when two insulated materials are used; (i) in first case the insulated material with lower thermal conductivity is wrapped next to the pipe and (ii) in second case when insulated material with higher thermal conductivity is wrapped next to the pipe
3. Model showing the phenomena of convection in fluids.
4. Model showing the comparison of heat transfer through the rectangular metallic surface using and without using fins or extended surface.s
5. Model showing the concept of radiation shields.

Lab Course Outcomes:

After successful completion of this course students will be able to:

CO1: Determine the thermal conductivity of metal rod and insulating powder.
CO2: Estimate the Stefan-Boltzmann constant and measurement of emissivity.
CO3: Determine the effectiveness of various types of heat exchangers.
CO4: Evaluate the Heat Transfer coefficient in various heat transfer phenomena.
CO5: Evaluate the diffusion coefficient of liquid vapor in air by Stefan's tube.

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190515: Automotive chassis

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Automotive chassis	190515/190505	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

List of Experiments:

1. To study and prepare report on the constructional details, working principles and operation of the **Automotive Clutches**.
2. To study and prepare report on the constructional details, working principles and operation of the **Automotive Transmission systems**.
3. To study and prepare report on the constructional details, working principles and operation of the **Automotive Drive Lines & Differentials**.
4. To study and prepare report on the constructional details, working principles and operation of the **Automotive Engine Systems & Sub Systems**.
5. To study and prepare report on the constructional details, working principles and operation of the **Automotive Suspension Systems**.
6. To study and prepare report on the constructional details, working principles and operation of the **Automotive Steering Systems**.
7. To study and prepare report on the constructional details, working principles and operation of the **Automotive Brake systems**.
8. To study and prepare report on the constructional details, working principles and operation of the **Automotive Tyres& wheels**.

Skill Based Projects:

1. Study and Construction of physical model of Chassis layout and its main components.
2. Structural analysis of Chassis of a vehicle and its main components through Design tools.
3. Design, Calculation and simulation of Rack and Pinion mechanism to steer a vehicle using design tools.
4. Study and Construction of physical model of contactless braking system.
5. Study and Structural analysis of Shock absorbers for two-wheeler and four-wheeler.
6. Assembly and dismantling of automotive engine and clutch.

Lab Course Outcomes:

After successful completion of this course students will be able to:

CO1: **List** out the various automotive chassis and Frame components.
CO2: **Describe** construction details of various types of automotive chassis and basic Functions of subsystems in the chassis.
CO3: **Demonstrate** concept of steering mechanism and suspension system while construction of chassis and frame.
CO4: **Distinguish** various types of suspension system, brake system, steering system and wheels & tyres in the vehicles.
CO5: **Select** the suitable subsystems for a vehicle.
CO6: **Design** and create the chassis and frame.

For batch admitted in Academic Session 2020-21

120515: Machine Design

Category	Title	Code	Credit -4			Theory Paper
Departmental Core-DC	Machine Design	120515/120505	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2hrs.
			2	1	2	

List of Experiments

1. Design and drawing of helical spring.
2. Design and drawing of Spur gear.
3. Design and drawing of Helical gear.
4. Design and drawing of Worm gear.
5. Design and drawing of bevel gear.
6. Modelling and simulation of Gear box.
7. Study of Sliding Contact Bearings and Ball bearing and its selection
8. Design and drawing of Antifriction Bearing.
9. Design and drawing of Journal Bearing.
10. Assembly drawing of the Foot step bearing.

Skill Based Projects:

1. Finite element analysis of Helical compression spring for three wheelers automotive suspension
2. To prepare wooden model Multi Leaf spring.
3. To prepare wooden model of Gear box.
4. To prepare wooden model of Bearing.
5. Stress analysis on Spur Gear and durability study by FEA

Laboratory Course Outcomes:

After the completion of the course Lab students will be able **to**

1. **Design** and analysis the different part of an I.C Engine like Gear, Spring and Bearing
2. ***Compare*** the materials used in designing the automobile engine parts.
3. **Use** the software like AUTO CAD, CATIA and ANSYS for modelling and analysis
4. **Select** the spring for a proper application also can select the proper material of spring.
5. **Design** the different types of gear and spring also able to know their practical applications
6. **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

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Item ME12	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2020-21)*** in online mode under ***Self-Learning/ Presentation***, in the B.Tech. ***V Semester***

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Self-study courses-V Sem (July-Dec 2022)

S.No.	Name of Subject	Code	Week
1.	Foundations of Cognitive Robotics	120517/190517(i)	4
2.	Polymer Assisted Abrasive Finishing Processes	120517/190517(ii)	4
3.	Welding of Advanced High Strength Steels for Automotive Applications	120517/190517(iii)	4

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120517/190517: Foundations of Cognitive Robotics

Category	Title	Code	Credit - 1			Theory Paper
			L	T	P	
Self-learning/ Presentation	Foundations of Cognitive Robotics	120517/190517 (i)	-	-	2	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me77/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	19 Aug 2022	25 Sep 2022	4 Weeks

Course layout

Week 1: Introduction

Module 1: Introduction to Cognitive robotics and Human Robot Interaction
Module 2: Smart materials-I
Module 3: Smart materials-II
Module 4: Smart materials-III

Week 2: Brain physiology and neural signal transmission

Module 1: Architecture of the Brain
Module 2: Architecture of the Brain (Contd.)
Module 3: Nerve cells

Week 3: Neural modeling

Module 1: Introduction to Synchronization Models
Module 2: Synchronization Models (Contd.)
Module 3: Electroencephalography (EEG)

Week 4: Intelligence architecture

Module 1: Theories of Intelligence-I
Module 2: Theories of Intelligence-II
Module 3: Kuramoto Model
Module 4: Child-Robot Interaction

Books and references

1. Neuroscience, edited by Dale Purves, et al., published by Sinauer Associates.

2. How the body shapes the way we think-A New View of Intelligence, by Rolf Pfeifer and Josh Bongard, MIT Press.

3. Control Systems: Classical, Modern, and AI-Based Approaches, by Jitendra R. Raol, Ramakalyan Ayyagari, CRC Press.

120517/1805117- Polymer Assisted Abrasive Finishing Processes

Category	Title	Code	Credit	L	T	P	Theory Paper
Self-learning/ Presentation	Polymer Assisted Abrasive Finishing Processes	120517/1805117 (II)				3	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me75/preview

The details of the course are mentioned below:

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	19 Aug 2022	25 Sep 2022	4 Weeks

Course layout

Week 1: Introduction to Polymer Assisted Abrasive Finishing Processes, Importance of Micro to Nano Finishing and Surface roughness representation, Finishing with polymer grinding wheels and polymer medium for vibratory bowl finishing

Week 2: Polymer abrasive medium for vibratory bowl finishing and Pitch Polishing, Polymer Pad and Chemo-mechanical Polishing, Elastic Emission and Elasto Abrasive Finishing

Week 3: Abrasive Flow Machining and Finishing, Polymer Rheological Abrasive Medium/ Fluids for Finishing: Rheology and Tribology, Active abrasive particles and finishing forces during finishing using Polymer assisted Abrasives

Week 4 : Advances in Abrasive Flow Finishing: DBGAFF, Spiral Polishing, CFAAFM, R-AFF, Micro AFF, Vibrations assisted AFF, Electro AFF process, Modeling of Polymer rheological abrasive medium for finishing, Finishing of Bio implants: Knee implant, Hip implants.

Books and references

M. C. Shaw, Principles of Abrasive Processing, Oxford University Press, 1996.2. VK Jain, Micromanufacturing Processes, CRC press, 2012.3. Jain VK, Nanofinishing Science and Technology: Basic and Advanced Finishing and Polishing Processes, CRC Press, 2016.4. G. K. Lal, Introduction to Machining Science, New Age International Publishers, 2007.

120517/190517: Welding of Advanced High Strength Steels for Automotive Applications

Category	Title	Code	Credit - 1			Theory Paper
			L	T	P	
Self-learning/ Presentation	Welding of Advanced High Strength Steels for Automotive Applications	120517/190517 (iii)	-	-	2	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_mm30/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	19 Aug 2022	25 Sep 2022	4 Weeks

Course layout

Week 1: Introduction to physical metallurgy of advanced high strength steels

Week 2: Introduction to welding processes in automotive industries (Advanced Gas Metal Arc, Resistance Spot and Laser Welding Processes).

Week 3: Welding metallurgy of advanced high strength steels – Effect of weld thermal cycles on the stability of phases, solidification behaviour, segregation and hot cracking susceptibility.

Week 4: Mechanical properties of advanced high strength steel weldments – Tensile shear testing, HAZ softening characteristics, role of modified weld thermal cycles (post pulsing and post weld heat treatments) to improve the mechanical properties

Books and references

Nil

Item ME15	To review, prepare, finalize and recommend the *Scheme & Syllabi (along with the Course Outcomes) of III semester* B. Tech. programmes **(batch admitted 2021-22 Session)**

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Scheme of Evaluation

B. Tech. III Semester (Mechanical Engineering)

For batches admitted in academic session 2021-22

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	[3]Mode of Exam.
				Theory Slot				Practical Slot				L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation								
				End Sem. Exam	[1]Proficiency in subject /course	Mid Sem. Exam	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
1	100025	BSC	Engineering Mathematics-II (BTM-3)	50	10	70	20				100	3	1		4	Offline (OM)	PP
2	120311	DC	Manufacturing Process (DC-2)	50	10	70	20				100	3	1		4	Blended (OT)	PP
3	120312	DC	Mechanics of Materials (DC-3)	50	10	70	30	60	70	70	350	3	1	2	6	Blended (OT)	PP
4	120313	DC	Theory of Machines - I (DC-4)	50	10	70	30	60	70	70	350	3	1	2	6	Blended (OT)	MO
5	120314	DC	Fluid Mechanics and Hydraulic Machines (DC-5)	50	10	70	30	60	70	70	350	3	1	2	6	Blended (OT)	PP
6	120315	DLC	Software lab (DLC-1)					40	70	70	180			2	2	Offline (OM)	MO
7	120316	DLC	Self-learning Presentation (SWAYAM/NPTEL/MOOC)	-							40			2	2	Online Mooc/swayam	SO
8	200008	CLC	Social Engaging Course (Universal Learning)	-	-			50			50			2	2	Interactive	SO
9	120318	DLC	Summer Internship Project-I (Institute Level) (Evaluation)	-				50			50			4	2	Offline	SO
		Total		250	50	100	100	350	120	80	1050	18	5	16	29		
10	100005	MAC	Project Management & Financing	50	10	70	70				200	2			2 credit	Online	MCQ

[1] proficiency in course/subject includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

[2] MCQ: Multiple Choice Questions [3] MP: Assignment + Viva [4] PP: Pen Paper [5] SO: Submission + Oral

Mode of Teaching						Mode of Examination						
Theory				Lab	NEC	Theory			Lab	MP/ MP/ NEC	Total Credits
Offline	Online	Blended		Offline	Interactive	PP	MP	MCQ	SO	SO	
		Offline	Online								
3	0	8	4	7	1	14	4	0	3	6	
23.08	0	24.39	17.3	30.43	4.3	60.86	17.3	0	6.5	13.3	

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Scheme of Evaluation

B. Tech. III Semester (Automobile Engineering)

For batches admitted in academic session 2021-22

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	^{55}Mode of Exam.
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P			
				End Sem. Exam	$^{\$}$Proficiency in subject /course	Mid Sem. Exam	Quiz/ Assign-ment		Lab Work & Sessional	Skill Based Mini Project							
1	100025	BSC	Engineering Mathematics-II (BSC-3)	50	10	20	20	-		-	100	2	1	-	3	Offline (3:0)	PP
2	190319	DC	Manufacturing Process (DC-2)	50	10	20	20	-	-	-	100	2	1	-	3	Blended (2:1)	PP
3	~~190317~~ 190317	DC	Mechanics of Materials (DC-3)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2:1)	PP
4	190313	DC	Automotive Engines (DC-4)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2:1)	PP
5	190314	DC	Fluid Mechanics & Hydraulic Machines (DC-5)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2:1)	PP
6	190315	DLC	Software lab (DLC-1)	-	-	-	-	60	20	20	100	-	-	2	1	Offline (1:0)	SO
7	190316	DLC	Self-learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-		40		40	-	-	2	1	Online +Mentoring	SO
8	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9	190318	DLC	Summer Internship Project-1 (Institute Level) (Evaluation)	-		-		60			60		-	4	2	Offline	SO
Total				250	50	100	100	350	120	80	1050	10	5	16	23	-	-
10	1000005	MAC	Project Management & Financing	50	10	20	20			-	100	2			Grade	Online	MCQ

$^{\$}$ proficiency in course/subject includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

^{55}MCQ: Multiple Choice Question ^{55}AO: Assignment + Oral ^{55}PP: Pen Paper ^{55}SO: Submission + Oral

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	SIP/ SLP/ NEC	
Offline	Online	Blended Offline	Blended Online	Offline	Interactive	PP	A+O	MCQ	SO	SO	
3	0	8	4	7	1	18	0	0	1	4	23
11.04	0	34.78	17.3	30.43	4.3	78.36	0	0	4.3	17.3	

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120319/190317
190312/120312: Mechanics of Materials

Category	Title	Code	Credit-3+1=4			Theory Paper
		120319/190317 190312/120312/ 120302/190302/BME-302/MEL-305/ 3225	L	T	P	Max.Marks-50 Min.Marks-16 Duration-2hrs.
Departmental Core-DC	Mechanics of Materials		2	1	2	

Course Pre-Requisites:

Basic Civil Engineering and Mechanics (Subject Code – 100205)

Course Objectives: To make the students:
1. Learn the basic concepts and principles of strength of materials.
2. Calculate stresses and deformations of objects under external loadings.
3. Apply the knowledge of strength of materials on engineering applications and design problems.

Syllabus

Unit- I Stress and strain: Stress-strain relationship and elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain, compound and combined stresses, thermal stresses.
Unit-II Stresses in beams: Shear Force & Bending Moment diagram, theory of simple bending, Section Modulus, bending Stresses and Shear stresses in beam.
Slope and deflection: Equation of Elastic Curve, Macaulay's Method, Area Moment Method, Strain Energy Methods etc.
Unit- III Shear stress distribution: Horizontal, Vertical, Transverse, Longitudinal Shear Stress, Graphical Methods for Different Sections.
Shafts: Torsion of circular shaft, stress concentration in shafts: series and parallel combination.
Unit -IV Column and Struts: Euler's theory of column, Rankine's formula, slenderness ratio; strut with eccentric load.
Thin cylinder: Stress and Strain in thin cylinder, wire wound thin cylinder; thin spherical shells.
Unit- V Materials testing: Tensile, compressive, hardness, impact and torsion testing. Strain Gauges - types of strain gauges, electrical strain gauges, Gauge factor, strain rosette.
Strain Energy: Strain energy due to direct stress, simple shear, torsion, bending, shear force in beams.

Course Outcomes: After successful completion of this course students will be able to:

CO-1 **Identify** various structural elements and its application.
CO-2 **Illustrate** different types of stress and strain on various types of structural elements like beam, shaft column etc.
CO-3 **Calculate** principal stresses, maximum shearing stress, and the different stresses acting on a structural member.
CO-4 **Analyze** stresses and deflection for beam, shaft, long columns, thin cylinder etc.
CO-5 **Select** appropriate materials in design considering engineering properties, sustainability, cost and weight.

CO-6 **Design** simple bars, beams, and circular shafts to meet desired needs in terms of strength and deformation.

Text & Reference Books

1. Strength of Materials (MoM) **by** R S Lehri and A S Lehri; S K Katariya and Sons Pub.
2. Strength of Materials **by** S S Rattan; McGraw Hill Pub.
3. Mechanics of Materials **by** F P Beer, E R Johnston, J T DeWolf; TATA McGraw Hill Pub.
4. Strength of Materials **by** S. Timoshenko; D Van NostrandCompnay,
5. Mechanics of Solids **by** Mubeen; Pearson Education Pub
6. Strength of Materials **by** S Ramamrurtham, R Narayan; DhanpatRai sons Pub.
7. Strength of Materials **by** Sadhu Singh; Khanna Publisher Pub.
8. Mechanics of Materials **by**AdarashSwaroop, New Age international Pub.

NPTEL Link for Mechanics of Material

https://onlinecourses.nptel.ac.in/noc18_ce04/preview

LIST OF EXPERIMENTS

1. To Study Universal Testing Machine
2. To perform the Tensile test on metal specimen
3. To perform the Compression test on metal specimen
4. To perform Bending test on metal specimen
5. To perform single shear and double shear on UTM
6. To perform Hardness testing with Brinell hardness
7. To perform Hardness testing with Rockwell hardness
8. To study the impact testing machine and perform the IZOD impact test
9. To Perform Charpy impact test
10. To study and Perform Fatigue test
11. To study Bending Moment Diagram
12. To Study stiffness of spring and Modulus of rigidity of spring wire
13. Study of weight measurement using strain gauge

Lab Course Outcomes: After successful completion of this course lab students will be able to:

CO1. **Evaluate** the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test.
CO2. **Conduct** the torsion test to determine the modulus of rigidity of given specimen.
CO3. **Perform** compression tests on spring and wood.
CO4. **Justify** the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
CO5. **Determine** elastic constants using flexural and torsion tests.
CO6. **Examine** the stiffness of the open coil and closed coil spring and grade them

For batches admitted in Academic Session 2021-22

190313: Automotive Engines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Automotive Engines	190313/ 190303/BAUL 304	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives:

To make the students:

1. Understand the working of engine and its subsystems
2. Enhance their knowledge about the fuel supply system of SI engines and CI engines
3. Understand the combustion phenomenon in engines and different combustion chambers.

Syllabus

UNIT I CONSTRUCTION AND OPERATION OF ENGINES

Constructional details of four stroke spark ignition (SI) and compression ignition (CI) engines working principles. Two stroke SI and CI engines – construction and working.Comparison of SI and CI engines, four stroke and two stroke engines.Valve and port timing, timing diagram, firing order.Otto, diesel and dual cycles.

UNIT II FUEL SYSTEMS

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, working of a simple fixed venturi carburetor, starting, idling, acceleration and normal circuits of carburetors, Constant vacuum carburettor.Petrol injection. LPG and CNG fuel systems MPFI systems for petrol. Diesel fuel injection systems- Requirements, Air and solid injection, function of components ,Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector andcommon rail injection systems.

UNIT III COMBUSTION AND COMBUSTION CHAMBERS

Combustion in SI and CI engines and stages of combustion. Dependence of ignition timing on load and speed. Knock in SI and CI engines.

Combustion chambers for SI and CI engines. Direct and indirect injection combustion chambers for CI engines. Importance of Swirl, squish and turbulence. Factors controlling combustion chamber design.

UNIT IV SUPERCHARGING, TURBOCHARGING AND ENGINE TESTING

Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies.

Measurement of friction, Cylinder pressure measurement. Variables affecting engine performance. Methods to improve engine performance. Heat balance. Performance Maps and Drivability Diagnosis.

UNIT V COOLING AND LUBRICATION SYSTEMS

Need for cooling, types of cooling systems- air and liquid cooling systems. Thermo syphon and forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types-mist, pressure feed, dry and wet sump systems. Properties of lubricants.

Course Outcomes:

After successful completion of this course students will be able to:

- **CO1:** **State** various types of engines based on required applications.
- **CO2:** **Explain** the concepts of Internal Combustion Engine working and its industrial applications.
- **CO3:** **Solve** analytical problems of Internal Combustion Engines.
- **CO4:** **Compare** different types of Engines depending on their behavior and their merits and demerits.
- **CO5:** **Select** proper Engine for appropriate applications.
- **CO6:** **Evaluate** the performance parameters of various Engines.

Text & References Books:

1. Internal Combustion Engines by V. Ganesan, 2007, Tata McGraw Hill
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.
3. Advanced Engine Technology by Heisler, SAE Publication.
4. Edward F. Obert Internal Combustion Engines.
5. H.N. Gupta Fundamentals of Internal Combustion Engines by, PHI.
6 .Mathur and Sharma Intendamental Combustion Engines DhanpatRai and Sons2002.

NPTEL Link for Automotive Engines

http://nptel.ac.in/courses/112104033/

List of Experiments (Expandable)

1. Study of dynamometers.
2. Valve timing diagram of single cylinder SI Engine.
3. Study of various types of fuel injectors and nozzzles
4. Performance and emissions test on multi-cylinder on SI Engine.
5. Heat balance sheet on multi cylinder SI Engine.
6. Morse test on Multi-cylinder SI Engines.
7. Study of carburetion and injection system.
8. Study and performance test of two stroke petrol engine.
9. Study and performance test of four stroke petrol engine.
10. Study and performance test of two stoke diesel engine.
11. Study and performance test of four stroke diesel engine.
12. Study of different parts of IC engine.

For batches admitted in Academic Session 2021-22

190314/120314: Fluid Mechanics and Hydraulic Machines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	190314/120314	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: To make the students understand:

1. Fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
2. And give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. And develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

Course Pre-Requisite:
Basic Mechanical Engineering.

Syllabus

Unit-I Properties of fluid: Pressure, density, specific weight, viscosity, dynamic and kinematic viscosity Newton's law of viscosity and its applications.
Fluid Static: Pressure variation with depth, pressure measurement, pressure on immersed surface centre pressure, Buoyancy, flotation, stability of floating bodies.
Unit-II Fluid Kinetics: One dimensional flow approximation, control volumes concept, continuity equation in 3-D, its differential and integral form, velocity and acceleration of fluid particle, stream line, path line. Rotation, vorticity and circulation. Stream function and velocity potential function. Flow net. Free and forced vortex flow.
Unit-III Fluid Dynamics: Momentum theorem, Impulse momentum equation and its application, Euler's equation in 3-D, Bernoulli's equation for incompressible fluid flow, engineering applications of energy equation, Pitot -Tube, Venturi meter, Orifice meter.
Unit-IV Flow through Pipes: Critical Reynolds's number, velocity distribution in pipes, friction factor, Moody's chart, Laminar flow through pipe, Hagen-Poiseulli's equation, Turbulent flow through pipe, Hydraulic gradient line and total energy line. Minor head losses in pipes, Pipe Networking and Transmission of power through pipes.
Unit-V Water Turbine and Pump: Impulse and Reaction principles, Pelton, Francis and Kaplan turbines, velocity diagrams, Work done by turbines, Draft Tube theory. Application of dimensional analysis, similarity to turbines and pumps. Classification, advantage over reciprocation type, definition of manometric head gross head, static head, vector diagram and work done. Performance and Characteristics of turbines and pumps.

Course Outcomes: After successful completion of this course students will be able to:

CO1: **Define** the fundamental properties of fluids.
CO2: **Relate** the concepts of mechanics with various laws of fluid mechanics.
CO3: **Identify** the laws of fluid mechanics applicable for the body in various fluids under different conditions.
CO4: **Analyse** various forces and their effects, related to fluids mechanics.

CO5: **Measure** and compare losses in different fluid flow conditions.

CO6: **Compare** different turbo machines depending on their behaviour and their merits and demerits

Text Books:

1. Fluid Mechanics by Streeter & Wylis; McGraw-Hills Pub.
2. Fluid Mechanics by Modi& Seth; Standard publishing house.
3. Fluid Mechanics by D.S. Kumar ;Katson publisher.
4. Fluid Mechanics by R.K. Bansal; Laxmi Publishing House.
5. Fluid Mechanics byYunus A Cengel& John M. Cimbal.s; Tata McGraw Hill Edition.

NPTEL Link for Fluid Mechanics and Hydraulic Machines

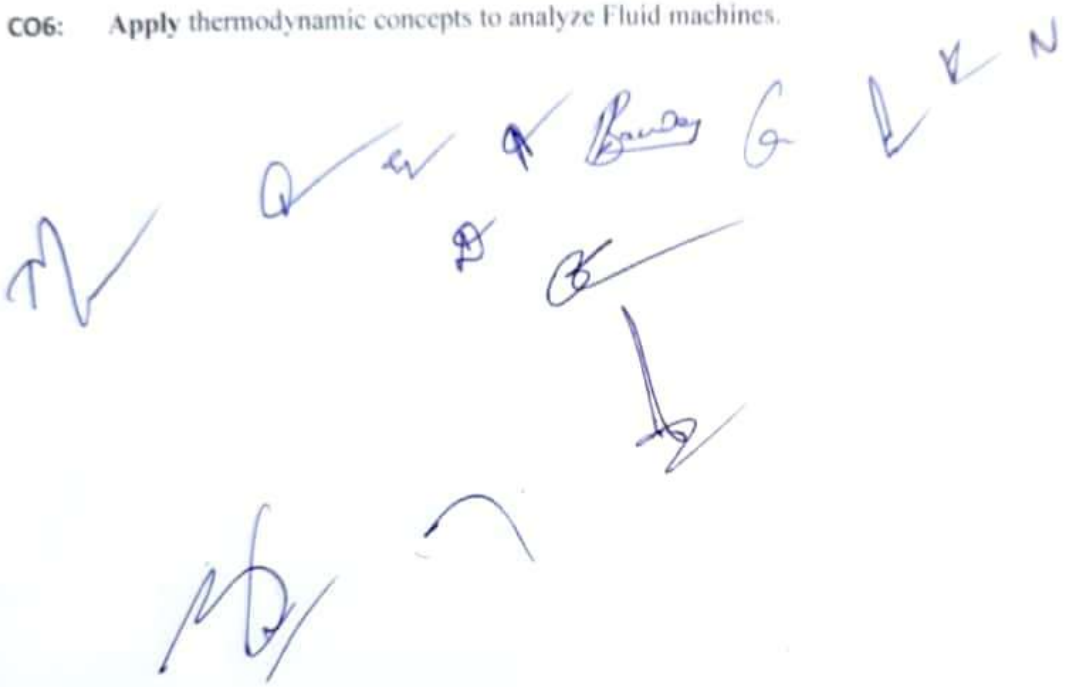
http://nptel.ac.in/courses/112105171/1

List of Experiments:

1. To find out coefficient of discharge of a given Venturimeter.
2. To determine the hydraulic coefficient C_v , C_c , and C_d of an Orifice
3. To study the flow over a rectangular notch to find the coefficient of discharge for it.
4. To determine the coefficient of friction for pipes of different sizes.
5. Experimental determination of Metacentric height of a ship model
6. Study of Redwood viscometer.
7. To study of different types of flow (Reynold's experiment).
8. To verify Bernoulli's Equation Experimentally.
9. To study the performance characteristics of a centrifugal pump and to determine the characteristic with maximum efficiency.
10. To conduct load test on Pelton Wheel Turbine and to study the characteristics of Pelton wheel turbine.
11. To conduct load test on Francis turbine and to study the characteristics of Francis turbine.
12. To study the characteristics of a Kaplan turbine.
13. To study the performance characteristics of a reciprocating pump and to determine the characteristic with maximum efficiency

Laboratory Course Outcomes: After successful completion of this course students will be able to:

- **CO1:** **Conduct** experiment with flow measurement devices like Venturi meter and orifice meter.
- **CO2:** **Estimate** the friction and measure the frictional losses in fluid flow.
- **CO3:** **Predict** the coefficient of discharge for flow through pipes.
- **CO4:** **Evaluate** pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.
- **CO5:** **Calculate** the Critical Reynolds's Number through Pipe Set Apparatus.
- **CO6:** **Apply** thermodynamic concepts to analyze Fluid machines.



For batches admitted in Academic Session 2021-22

190315/120315: Software Lab

Category	Title	Code	Credit-1			Practical Slot
			L	T	P	
Departmental Lab Core-DLC	Software Lab	190315/ 120315 190305	-	-	2	Max.Marks-60 Min.Marks-19

Course Pre-Requisites:
Engineering Graphics

Course Objectives: To make the students:
1. Develop an ability to make familiar with 2D, 3D modelling and simulation software
2. Develop an ability to create and modify complex 2D and 3D entities using CATIA software
3. Develop creative skills in developing new ideas.

SYLLABUS:

Auto CAD: Auto CAD interface, work space setting, Basic commands, viewports and printing.
Snaps: snap to grid, show to grid. Orthographic polar snap, object snap, dynamic UCS.
2D and 3D commands: Trim, extend, Offset, move, mirror, scale, rotate, extrude, union, subtract etc. commands.
Units: properties, measure and dimension.

CATIA concepts: Display-Tree appearance, Three button move, view tool bar, Normal standard and shading view, 2D toolbar, sketch tools, constraint, profile, operation.
Toolbar: Sketch based features toolbar, commands-Pad, Pocket, shaft, groove, holerib etc. Dress up feature, Transformation features, Boolean operation.

Simulation: Assembly and simulation in CATIA, Linear and rotational motion, Nut-bolt mechanism simulation

Course Outcomes: After successful completion of this course students will be able to:

CO1 Describe AutoCAD and CATIA toolbars
CO2 Summarize 2D and 3D commands
CO3 Solve real time problems using AutoCAD and CATIA software
CO4 Analyse various mechanical engineering problems.
CO5 Evaluate technical drawings of machine assemblies as a design engineer
CO6 Generate 2D and 3D solid models with new features in machine elements

Text Books:

1. Franke& Roger: Modelling and simulation for chemical engineering, Willey Interscience
2. Luyben-Process modelling simulation and control for chemical engineers, IInd, McGraw Hill,1989
3. Fundamentals of Engineering drawing Interactive graphics by Luzzader WJ, Duff JM:PHI
4. A general guide to computer aided design and drafting-CAD by Duggal, Vijay, cadd primer; CAD malimax publications.
5. Mechanical design databook by Mahadevan and Reddy;CBS

120311/190319/190414: Manufacturing Processes

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Manufacturing Processes	120311/190319/ 190414/120403 /190404	2	1	-	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: To make students:
1. Able to learn the various methods and types of castings, welding processes, sheet metal forming, powder metallurgy
2. Able to examine the principles associated with basic operations involving the forming, machining and welding of engineering materials;
3. Aware of the necessity to manage manufacturing processes and systems for the best use of material and human resources.

Course Pre-Requisites: Manufacturing Practice

Syllabus

Unit-I Casting: Brief History, Basic principle & survey of casting processes. Sand casting, pattern materials, and allowances. Green and dry moulding, moulding methods, moulding sand properties and testing. Elements of mould and design considerations. Cores use, core materials and core making practice. Die, investment and centrifugal casting processes. Melting practice and concepts in solidification. Inspection and defects analysis.
Unit-II Forming: Elastic and plastic deformation, Concept of strain hardening. Rolling, forging, extrusion, spinning, wire and tube drawing processes, machines and equipment's, parameters and force calculations.
Unit-III Sheet Metal Working: Role of sheet metal components.Cutting mechanism. Description of cutting processes like blanking, Piercing, lancing etc. Description of forming processes like bending cup drawing, coining, embossing etc. Basic elements of presses for sheet metal working. Punch and Die clearances and die elements.
Unit-IV Welding: Principle of welding, soldering, brazing and adhesive bonding.Survey of welding and allied processes. Arc welding: power sources and consumables. MMAW, TIG& MIG processes and their parameter selection. Resistance Welding: principle and equipment. Spot, projection and Seam welding processes, Gas welding and cutting: Processes and equipment.
Unit-V Powder Metallurgy: Powder manufacturing, compaction and sintering processes. Advantages and applications of P/M. Manufacturing of Powder metallurgy components.

Course Outcomes: After successful completion of this course students will be able to:

CO1- Describe the different types of manufacturing processes and their applications.
CO2- Identify suitable manufacturing process to achieve the required product shape with the aim of avoid defects, material and time wastage.
CO3-Illustrate the advantage and limitations of various manufacturing processes with regard to shape formation and surface quality.
CO4-Analyse the manufacturing processes for given problem and able to select an appropriate process according to a specific requirement.
CO5-Evaluate the procedures and techniques involved for the manufacturing of components for its optimization.

CO6-Propose a simplified manufacturing processes with the aim of reduction of cost and manpower.

Text &Reference Books

1. Jain R.K., Production Technology, Khanna Publishers, 2001.
2. Hajra Choudhry, Elements of Workshop Technology, Vol – II Media Promoters & Publishers, 1994.
3. Production Technology by HMT, Tata McGraw-Hill.
4.Chapman, W.A.J., Workshop Technology, Vol - II, Oxford & IBH Publishing Co. Ltd.,
5. Manufacturing Processes by Amstead, B.H., P.F. Oswald and M.L. Begeman, John Wiley and Sons Inc., New York.
6. Manufacturing Technology Vol. I by P.N. Rao.
7. Modern Manufacturing Process Engineering by Neibel, B.W., Alan B. Draper and R.A. Wysk, McGraw-Hill Publishing Co., New York.
8. Manufacturing Engineering and Technology by Kalpakjian, S, Addison-Wesley Publishing Co., New York.
9. Materials and Processes in Manufacturing by E. Paul DeGarmo, J. Temple Black, and Ronald Kohser, Macmillan Publishing Co., New York.
10. Introduction to Manufacturing Processes John A. Schey, McGraw-Hill Book Co., New York.

NPTEL Link for Manufacturing Process

http://nptel.ac.in/courses/112107145/

List of Experiment

1. Performance on mold making of Simple component
2. Performance on pattern making of Simple component
3. Performance on Metal Casting of Simple component
4. Performance on Welding of simple workpiece (Example Arc Welding)
5. Performance on Sheet metal work of Simple component
6. Performance on hot forging of Simple component

120319 / 190317

120312/190312: Mechanics of Materials

Category	Title	Code	Credit-3+1=4			Theory Paper
			L	T	P	
Departmental Core-DC	Mechanics of Materials	120312/190312/ 120302/190302/ BMEL-302/ MEL-305/3225	2	-1-	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Pre-Requisites:

Basic Civil Engineering and Mechanics

Course Objectives: To make the students:

1. Learn the basic concepts and principles of strength of materials.
2. Calculate stresses and deformations of objects under external loadings.
3. Apply the knowledge of strength of materials on engineering applications and design problems.

Syllabus

Unit- I Stress and strain: Stress-strain relationship and elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain, compound and combined stresses, thermal stresses.
Unit-II Stresses in beams: Shear Force & Bending Moment diagram, theory of simple bending, Section Modulus, bending Stresses and Shear stresses in beam.
Slope and deflection: Equation of Elastic Curve, Macaulay's Method, Area Moment Method, Strain Energy Methods etc.
Unit- III Shear stress distribution: Horizontal, Vertical, Transverse, Longitudinal Shear Stress, Graphical Methods for Different Sections.
Shafts: Torsion of circular shaft, stress concentration in shafts; series and parallel combination.
Unit -IV Column and Struts: Euler's theory of column, Rankine's formula, slenderness ratio; strut with eccentric load.
Thin cylinder: Stress and Strain in thin cylinder, wire wound thin cylinder; thin spherical shells.
Unit- V Materials testing: Tensile, compressive, hardness, impact and torsion testing. Strain Gauges - types of strain gauges, electrical strain gauges, Gauge factor, strain rosette.
Strain Energy: Strain energy due to direct stress, simple shear, torsion, bending, shear force in beams.

Course Outcomes: After successful completion of this course students will be able to:

CO-1 **Identify** various structural elements and its application.
CO-2 **Illustrate** different types of stress and strain on various types of structural elements like beam, shaft column etc.
CO-3 **Calculate** principal stresses, maximum shearing stress, and the different stresses acting on a structural member.
CO-4 **Analyze** stresses and deflection for beam, shaft, long columns, thin cylinder etc.
CO-5 **Select** appropriate materials in design considering engineering properties, sustainability, cost and weight.
CO-6 **Design** simple bars, beams, and circular shafts to meet desired needs in terms of strength and deformation.

Text & Reference Books

1. Strength of Materials (MoM) by R S Lehri and A S Lehri; S K Kataria and Sons Pub.

2. Strength of Materials **by** S S Rattan; McGraw Hill Pub.
3. Mechanics of Materials **by** F P Beer, E R Johnston, J T DeWolf; TATA McGraw Hill Pub.
4. Strength of Materials **by** S. Timoshenko; D Van NostrandCompnay,
5. Mechanics of Solids **by** Mubeen; Pearson Education Pub
6. Strength of Materials **by** S Ramamrurtham, R Narayan; DhanpatRai sons Pub.
7. Strength of Materials **by** Sadhu Singh; Khanna Publisher Pub.
8. Mechanics of Materials **by**AdarashSwaroop, New Age international Pub.

NPTEL Link for Mechanics of Material

https://onlinecourses.nptel.ac.in/noc18_ce04/preview

LIST OF EXPERIMENTS

1. To Study Universal Testing Machine
2. To perform the Tensile test on metal specimen
3. To perform the Compression test on metal specimen
4. To perform Bending test on metal specimen
5. To perform single shear and double shear on UTM
6. To perform Hardness testing with Brinell hardness
7. To perform Hardness testing with Rockwell hardness
8. To study the impact testing machine and perform the IZOD impact test
9. To Perform Charpy impact test
10. To study and Perform Fatigue test
11. To study Bending Moment Diagram
12. To Study stiffness of spring and Modulus of rigidity of spring wire
13. Study of weight measurement using strain gauge

Lab Course Outcomes: After successful completion of this course lab students will be able to:

CO1. **Evaluate** the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test.
CO2. **Conduct** the torsion test to determine the modulus of rigidity of given specimen.
CO3. **Perform** compression tests on spring and wood.
CO4. **Justify** the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
CO5. **Determine** elastic constants using flexural and torsion tests.
CO6. **Examine** the stiffness of the open coil and closed coil spring and grade them.

For batches admitted in Academic Session 2021-22

120313/190411:Theory of Machines-I

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-I	120313/ 120303/ 190411/190401	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Pre-Requisite:
Engineering Graphics
Mechanics of Materials

Course objectives: To make the students:
1. Familiarize with different types of mechanisms.
2. Understand the basics of synthesis of simple mechanisms.
3. Apply fundamental of mechanics to machines which include engines, linkages etc.

Syllabus

Unit-I Mechanism: Machine. Mechanism, Kinematics Links, Pairs, Chains, Degree of freedom. Mechanisms and its Inversions; Slider, Double Slider and 4 bar mechanism. Lower pair mechanisms: pantograph, Straight line motions. Davis and Ackerman Steering Mechanisms.

Unit-II Kinematic Analysis: Displacement, velocity and acceleration analysis of plane mechanisms; relative velocity, instantaneous centre, Kennedy's Theorem, Klein's construction methods. Coriolis component.

Unit-III Dynamic Analysis: D'Alembert's principle. Equivalent dynamic system, Graphical and analytical methods of dynamic forces, analysis of mechanisms and machines including reciprocating engines.
Flywheel: Introduction, Turning-moment diagrams and Flywheel analysis.

Unit-IV Brakes: Analysis of simple brake assuming uniform pressures and uniform wear, band brake, block brakes, internal and external shoe brakes, braking of vehicles.
Clutches: Single plate and multi plate clutches, cone clutches, centrifugal clutches.
Dynamometers: Different types and their applications.

Unit-V Governors: Introduction, Types of governors, Various gravity and spring-controlled governors, governor characteristics, Effort and power of a governor, Controlling force diagrams, Coefficient of insensitiveness.

Gyroscopes: Gyroscopic couple, Effect of Gyroscopic couple on the stability of four wheel and two-wheel vehicles, Aeroplanes and Naval ships, Gyrostabilisers.

Course Outcomes: After successful completion of this course students will be able to:

CO 1.Identify basic mechanisms in real life applications.
CO 2.Discuss about mechanics of various machines.
CO 3.Apply fundamental principles of statics and dynamics to machinery.
CO 4.Analyze various types of motions and mechanisms of machinery.
CO 5.Compare various components suitable for different applications.e.g. different types of governor, clutch, brakes, flywheel etc.

CO 6.Create the mechanism or components to justify the demands of work.

Text &Reference Books:

1. Theory of Machines by Rattan, SS; TMH full detail of publicaiton
2. Theory of Machine by Norton, RL; TMH
3. Theory of Machine byBallaney, PL;Kanna Pub.
4. Mechanism and Machine Theory by Ambekar, AG; PHI.
5. Theory of Mechanism and Machines by Sharma, CS and Purohit K; PHI.
6. Theory of Machines by Bevan, Thomos; Pearson/ CBS PUB Delhi.
7. Mechanism and Machine Theory byRao, JS and Dukkipati; NewAge Delhi.
8. Theory of Machines byLal,Jagdish; Metropolitan Book Co; Delhi –
9. Theory of Mechanisms & Machines byGhosh,A.,Mallik,AK; Affiliated East West Press,Delhi.

NPTEL Link for Theory of Machines-I

http://nptel.ac.in/courses/112104121/1 and http://nptel.ac.in/courses/112104114/

List of experiments (expandable)

1. Study of Kinematics links pairs and chains.
2. To find degree of freedom of a given mechanism.
3. To study all inversions of four-bar mechanisms using models.
4. Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism.
5. Study of inertia forces in reciprocating parts and analysis of flywheel.
6. Study of various types of governors.
7. Study of various types of clutches.
8. Study of various types of brakes.
9. Study of various types of dynamometers.
10. Use virtual lab for any two experiments.
11. Determine the gyroscopic effect of a rotating disc.
12. Determine the Coriolli's component of acceleration.
13. Find the total slip, creep, velocity ratio and coefficient of friction between belt and pulley system.
14. Measure the percentage slip at fixed belt tension by varying load on brake drum

Lab Course Outcomes: After successful completion of this course lab students will be able to:

CO1. **Design** and **analyze** mechanism required for the specified type of motion.
CO2. **Draw** inversions and determine velocity and acceleration of different mechanisms.
CO3. **Construct** different types of cam profile for a given data.
CO4. **Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive.
CO5. **Compare** the various components related to machines and mechanism.
CO6. **Determine** the degrees-of-freedom (mobility) of a mechanism.

For batches admitted in Academic Session 2021-22

120314/190314: Fluid Mechanics and Hydraulic Machines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	120314/190314	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: To make the students understand:
1. Fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
2. And give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. And develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

Course Pre-Requisite:
Basic Mechanical Engineering.

Syllabus

Unit-I Properties of fluid: Pressure, density, specific weight, viscosity, dynamic and kinematic viscosity Newton's law of viscosity and its applications.
Fluid Static: Pressure variation with depth, pressure measurement, pressure on immersed surface centre pressure, Buoyancy, flotation, stability of floating bodies.
Unit-II Fluid Kinetics: One dimensional flow approximation, control volumes concept, continuity equation in 3-D, its differential and integral form, velocity and acceleration of fluid particle, stream line, path line. Rotation, vorticity and circulation. Stream function and velocity potential function. Flow net, Free and forced vortex flow.
Unit-III Fluid Dynamics: Momentum theorem, Impulse momentum equation and its application, Euler's equation in 3-D, Bernoulli's equation for incompressible fluid flow, engineering applications of energy equation, Pitot -Tube, Venturi meter, Orifice meter.
Unit-IV Flow through Pipes: Critical Reynolds's number, velocity distribution in pipes, friction factor, Moody's chart, Laminar flow through pipe, Hagen-Poiseulli's equation, Turbulent flow through pipe, Hydraulic gradient line and total energy line. Minor head losses in pipes, Pipe Networking and Transmission of power through pipes.
Unit-V Water Turbine and Pump: Impulse and Reaction principles, Pelton, Francis and Kaplan turbines, velocity diagrams, Work done by turbines, Draft Tube theory. Application of dimensional analysis, similarity to turbines and pumps, Classification, advantage over reciprocation type, definition of manometric head gross head, static head, vector diagram and work done. Performance and Characteristics of turbines and pumps.

Course Outcomes: After successful completion of this course students will be able to:

CO1: **Define** the fundamental properties of fluids.
CO2: **Relate** the concepts of mechanics with various laws of fluid mechanics.
CO3: **Identify** the laws of fluid mechanics applicable for the body in various fluids under different conditions.
CO4: **Analyse** various forces and their effects, related to fluids mechanics.
CO5: **Measure** and compare losses in different fluid flow conditions.

CO6: **Compare** different turbo machines depending on their behaviour and their merits and demerits

Text & Reference Books:

1. Fluid Mechanics by Streeter & Wylis; McGraw-Hills Pub.
2. Fluid Mechanics by Modi& Seth; Standard publishing house.
3. Fluid Mechanics by D.S. Kumar ;Katson publisher.
4. Fluid Mechanics by R.K. Bansal; Laxmi Publishing House.
5. Fluid Mechanics by Yunus A Cengel& John M. Cimbala: Tata McGraw Hill Edition.

NPTEL Link for Fluid Mechanics and Hydraulic Machines

http://nptel.ac.in/courses/112105171/1

List of Experiments:

1. To find out coefficient of discharge of a given Venturimeter.
2. To determine the hydraulic coefficient C_v , C_c , and C_d of an Orifice
3. To study the flow over a Rectangular notch to find the coefficient of discharge for it.
4. To determine the coefficient of friction for pipes of different sizes.
5. Experimental determination of Metacentric height of a ship model
6. Study of Redwood viscometer.
7. To study of different types of flow (Reynold's experiment).
8. To verify Bernoulli's Equation Experimentally.
9. To study the performance characteristics of a centrifugal pump and to determine the characteristic with maximum efficiency.
10. To conduct load test on Pelton Wheel Turbine and to study the characteristics of Pelton wheel turbine.
11. To conduct load test on Francis turbine and to study the characteristics of Francis turbine.
12. To study the characteristics of a Kaplan turbine.
13. To study the performance characteristics of a reciprocating pump and to determine the characteristic with maximum efficiency

Laboratory Course Outcomes: After successful completion of this course students will be able to:

CO1: **Conduct** experiment with flow measurement devices like Venturi meter and orifice meter.

CO2: **Estimate** the friction and measure the frictional losses in fluid flow.

CO3: **Predict** the coefficient of discharge for flow through pipes.

CO4: **Evaluate** pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.

CO5: **Calculate** the Critical Reynolds's Number through Pipe Set Apparatus.

CO6: **Apply** thermodynamic concepts to analyze Fluid machines.

For batches admitted in Academic Session 2021-22

120315/190315: Software Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Departmental Lab Core-DLC	Software Lab	120315/ 190315 120305	-	-	2	Max.Marks-60 Min.Marks-19 .

Course Pre-Requisites:
Engineering Graphics

Course Objectives: To make the students:
1. Develop an ability to make familiar with 2D, 3D modelling and simulation software
2. Develop an ability to create and modify complex 2D and 3D entities using CATIA software
3. Develop creative skills in developing new ideas.

SYLLABUS:

Auto CAD: Auto CAD interface, work space setting, Basic commands, viewports and printing.
Snaps: snap to grid, show to grid. Orthographic polar snap, object snap, dynamic UCS.
2D and 3D commands: Trim, extend, Offset, move, mirror, scale, rotate, extrude, union, subtract etc. commands. Units: properties, measure and dimension.

CATIA concepts: Display-Tree appearance, Three button move, view tool bar, Normal standard and shading view, 2D toolbar, sketch tools, constraint, profile, operation.
Toolbar: Sketch based features toolbar, commands-Pad, Pocket, shaft, groove, holerib etc. Dress up feature, Transformation features, Boolean operation.

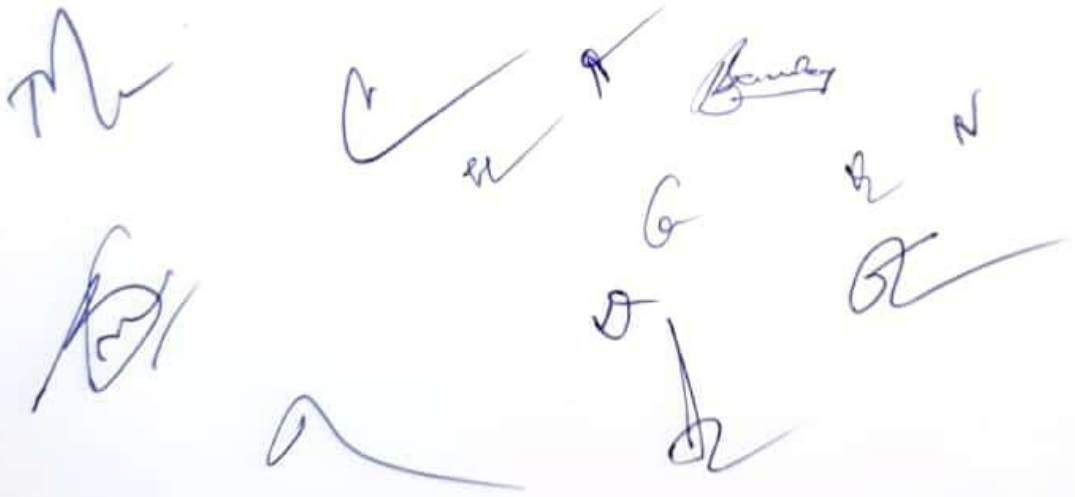
Simulation: Assembly and simulation in CATIA, Linear and rotational motion, Nut-bolt mechanism simulation

Course Outcomes: After successful completion of this course students will be able to:
CO1 Describe AutoCAD and CATIA toolbars
CO2 Summarize 2D and 3D commands
CO3 Solve real time problems using AutoCAD and CATIA software
CO4 Analyse various mechanical engineering problems.
CO5 Evaluate technical drawings of machine assemblies as a design engineer
CO6 Generate 2D and 3D solid models with new features in machine elements

Text Books and Reference books:

1. Franke& Roger: Modelling and simulation for chemical engineering, Willey Interscience
2. Luyben-Process modelling simulation and control for chemical engineers, IInd, McGraw Hill,1989
3. Fundamentals of Engineering drawing Interactive graphics by Luzzader WJ, Duff JM;PHI
4. A general guide to computer aided design and drafting-CAD by Duggal, Vijay, cadd primer: CAD malimax publications.

Item ME16	To review, prepare, finalize and recommend the list of experiments/ Lab manual and skill based mini projects for various laboratory courses to be offered in III Semester ***(for the batch admitted in 2021-22).***



Automobile Engineering			Mechanical Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	190313	Automotive Engines	1	120313	Theory of Machine-I
2	190314	Fluid Mechanics and Hydraulic Machines	2	120314	Fluid Mechanics and Hydraulic Machines

For batches admitted in Academic Session 2021-22

190313: Automotive Engines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Automotive Engines	190313/ 190303/BAUL 304	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

List of Experiments (Expandable)

1. Study of dynamometers.
2. Valve timing diagram of single cylinder SI Engine.
3. Study of various types of fuel injectors and nozzzles
4. Performance and emissions test on multi-cylinder on SI Engine.
5. Heat balance sheet on multi cylinder SI Engine.
6. Morse test on Multi-cylinder SI Engines.
7. Study of carburetion and injection system.
8. Study and performance test of two stroke petrol engine.
9. Study and performance test of four stroke petrol engine.
10. Study and performance test of two stoke diesel engine.
11. Study and performance test of four stroke diesel engine.
12. Study of different parts of IC engine.

Skill Based Projects:

1. Engaging and disengaging engine from transmission through clutch using scrap engine material.
2. To prepare wooden model Connecting rod.
3. To prepare wooden model piston and piston pin.
4. To prepare a model showing the transmission system of two wheelers.
5. To prepare wooden model crank shaft.
6.

Lab Course Outcomes:

After successful completion of this course students will be able to:

CO1: **State** various types of engines based on required applications.
CO2: **Explain** the concepts of Internal Combustion Engine working and its industrial applications.
CO3: **Solve** analytical problems of Internal Combustion Engines.
CO4: **Compare** different types of Engines depending on their behavior and their merits and demerits.
CO5: **Select** proper Engine for appropriate applications.
CO6: **Evaluate** the performance parameters of various Engines.

For batches admitted in Academic Session 2021-22

190314/120314: Fluid Mechanics and Hydraulic Machines

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	190314/120314	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

List of Experiments:

1. To find out coefficient of discharge of a given Venturimeter.
2. To determine the hydraulic coefficient C_v , C_c , and C_d of an Orifice
3. To study the flow over a rectangular notch to find the coefficient of discharge for it.
4. To determine the coefficient of friction for pipes of different sizes.
5. Experimental determination of Metacentric height of a ship model
6. Study of Redwood viscometer.
7. To study of different types of flow (Reynold's experiment).
8. To verify Bernoulli's Equation Experimentally.
9. To study the performance characteristics of a centrifugal pump and to determine the characteristic with maximum efficiency.
10. To conduct load test on Pelton Wheel Turbine and to study the characteristics of Pelton wheel turbine.
11. To conduct load test on Francis turbine and to study the characteristics of Francis turbine.
12. To study the characteristics of a Kaplan turbine.
13. To study the performance characteristics of a reciprocating pump and to determine the characteristic with maximum efficiency

Skill Based Projects:

1. Project to calculate the Meta centric height for different objects.
2. Project to define the concept of forced vortex and free vortex.
3. Project to demonstrate the working of Air Impulse Turbine.
4. Project to show the meaning of Hydrostatic Forces in Plane surface.
5. Project to show the meaning of Hydrostatic Forces in curved surface.

Laboratory Course Outcomes:

After successful completion of this course students will be able to:

CO1: **Conduct** experiment with flow measurement devices like Venturi meter and orifice meter.

CO2: **Estimate** the friction and measure the frictional losses in fluid flow.

CO3: **Predict** the coefficient of discharge for flow through pipes.

CO4: **Evaluate** pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.

CO5: **Calculate** the Critical Reynolds's Number through Pipe Set Apparatus.

CO6: **Apply** thermodynamic concepts to analyze Fluid machines.

For batches admitted in Academic Session 2021-22

120313/190411: Theory of Machines-I

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-I	120313/ 120303/ 190411/190401	2	1	2	Max.Marks-50 Min.Marks-16 Duration-2hrs.

List of experiments (expandable)

1. Study of Kinematics links pairs and chains.
2. To find degree of freedom of a given mechanism.
3. To study all inversions of four-bar mechanisms using models.
4. Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism.
5. Study of inertia forces in reciprocating parts and analysis of flywheel.
6. Study of various types of governors.
7. Study of various types of clutches.
8. Study of various types of brakes.
9. Study of various types of dynamometers.
10. Use virtual lab for any two experiments.
11. Determine the gyroscopic effect of a rotating disc.
12. Determine the Coriolli's component of acceleration.
13. Find the total slip, creep, velocity ratio and coefficient of friction between belt and pulley system.
14. Measure the percentage slip at fixed belt tension by varying load on brake drum

Skill Based Projects:

1. Design and Fabrication of a Universal Coupling (Hooke's Joint)
2. Design and Fabrication of Agricultural Cutter Using 4 Bar mechanism.
3. Design and Fabrication of Air Compressor Using Crank and Slotted Link Mechanism
4. Design and Fabrication of Industrial Conveyor Using Four Bar Mechanism
5. Design and Fabrication of sliding RAM by using quick return mechanism.

Lab Course Outcomes:

After successful completion of this course lab students will be able to:

CO1. **Design** and **analyze** mechanism required for the specified type of motion.
CO2. **Draw** inversions and determine velocity and acceleration of different mechanisms.
CO3. **Construct** different types of cam profile for a given data.
CO4. **Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive.
CO5. **Compare** the various components related to machines and mechanism.
CO6. **Determine** the degrees-of-freedom (mobility) of a mechanism.

Item ME17	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batches admitted in 2021-22)*** in online mode under ***Self-Learning/ Presentation***, in the ***III Semester***

Self-study courses-III Sem (July-Dec 2022)

S.No.	Name of Subject	Code	Week
1.	Manufacturing Processes – Casting and Joining	120316/190316(i)	4
2.	Laws of Thermodynamics	120316/190316 (ii)	4
3.	Principles of Vibration Control	120316/190316 (iii)	4

120316/190316: Manufacturing Processes – Casting and Joining

Category	Title	Code	Credit - 1			Theory Paper
			L	T	P	
Self-learning/ Presentation	Manufacturing Processes - Casting and Joining	120316/190316 (i)	-	-	2	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me100/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	19 Aug 2022	25 Sep 2022	4 Weeks

COURSE LAYOUT

Week 1: Casting: Introduction; Classification of casting processes; Advantages and drawbacks; Historical background: Foundry practice on video; Casting of BMW car wheels on video; Patterns; Shrinkage and Mechanical allowances; Moulds; Gating system; Properties of moulding sand; Gating design: Vertical gating: aspiration effect; Optimum riser design;

Week 2: Solidification of pure metal and alloy; Solidification time: Chvorinov's rule; Categories of metal casting processes; Steps in sand casting; Mould properties and characteristics; Shell moulding; Investment casting: Process characteristics, Process to show through video, Advantages and disadvantages; Multiple mould casting, Steps in permanent mould casting; Die casting: Hot and Cold Chamber die casting; Centrifugal casting; Continuous casting; Cost analysis of casting; Casting defects; Product design considerations in casting;

Week 3: Joining Processes: Preamble, classification of joining processes; Welding: advantages and limitations; Joints in welding; Fusion welding processes; Heat density; Comparison among welding processes; Features of a Fusion Welded Joint; Typical Fusion Welded Joints: Heat Affected Zone; Solidification of Weld; Solid-State (Phase) Welding: Forge welding, butt welding, friction welding, explosion welding, resistance welding;

Week 4: Ultrasonic welding: process characteristics and applications; Electron beam welding; Laser beam welding; Plasma arc welding; Arc welding: characteristics; Consumable and non-consumable electrodes; Power source; Shielded metal arc welding: Principles and applications; Gas metal arc welding; Gas Tungsten Arc Welding; Tungsten-Inert Gas Welding (TIG); Submerged Arc Welding; Gas Welding: Principles, types of flames; Brazing and Soldering: Process capabilities; Welding defects;

Books and references

1. A.Ghosh and Asok Mallik - Manufacturing Science
2. G.K.Lal and S.K.Choudhury - Fundamental of Manufacturing Processes
3. Richard Flinn - Fundamentals of Metal Casting
4. Kalpakjian and Schmid - Manufacturing Processes for Engineering Materials.

120316/190316: Laws of Thermodynamics

Category	Title	Code	Credit - 1			Theory Paper
			L	T	P	
Self-learning/ Presentation	Laws Of Thermodynamics	120316/190316 (ii)	-	-	2	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me107/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	19 Aug 2022	25 Sep 2022	4 Weeks

Course layout

Week 1: Introduction and Fundamental Definitions
Week 2: First Law of Thermodynamics
Week 3: First Law (continued), Second Law of Thermodynamics
Week 4: Entropy and its transport

Books and references

1. Fundamentals of Thermodynamics by Claus Borgnakke and Richard E. Sonntag (7th edition)
2. Thermodynamics: An Engineering Approach by Yunus A. Cengel and Michael A. Boles (7th Edition)

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Department of Mechanical Engineering

120316/190316: Principles of Vibration Control

Category	Title	Code	Credit - 1			Theory Paper
			L	T	P	
Self-learning/ Presentation	Principles of Vibration Control	120316/190316 (iii)	-	-	2	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc22_me78/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
25/07/2022	19 Aug 2022	25 Sep 2022	4 Weeks

Course layout

Week 1: Introduction to Vibration control
Week 2: Dynamic Properties and Selection of Materials
Week 3: Dynamic Vibration Absorbers
Week 4: Principles of Active Vibration Control

Books and references

- Principles of Vibration Control, A. K. Mallik, Affiliated East-West Press, India
- Vibration Control of Active Structures, A Premount, Springer Publication.
- Passive Vibration Control, Denys J. Mead, Wiley Publication

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Item ME18	To review the ***Scheme & Syllabi, list of experiments and skill based mini projects of First semester*** **of the B. Tech. programmes** ***(for the batch 2022-23)***.

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Department of Mechanical Engineering

Scheme of Evaluation

B. Tech. I Semester (Automobile Engineering)

For batches admitted in academic session 2022-23

No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted: Theory Slot: End Term Evaluation: End Sem. Exam	Theory Slot: End Term Evaluation: *Proficiency in subject/course	Theory Slot: Continuous Evaluation: Mid Sem. Exam	Theory Slot: Continuous Evaluation: Quiz/ Assignment	Practical Slot: End Sem. Exam	Practical Slot: Continuous Evaluation: Lab work & Seminar	Practical Slot: Continuous Evaluation: Skill Based Mini Project	Total Marks	Contact Hours per Week: L	T	P	Total Credits	Mode of Teaching (Online, Offline, Blended)	**Mode of Exam.
1	100011	BSC	Engineering Mathematics-I (BSC-1)	50	10	20	20				100	3	1		4	Offline (4:0)	PP
2	100021	ESC	Basic Computer Engineering (ESC-1)	50	10	20	20	60	20	20	200	2	1	2	4	Blended (2:1)	SO
3	100034	ESC	Engineering Graphics (ESC-2)	50	10	20	20				100	1	2		3	Offline (3:0)	SO
4	100015	HSMC	Energy, Environment, Ecology & Society (HSMC-1)	50	10	20	20				100	1			1	Online (0:1)	MCQ
5	100026	HSMC	Technical Language (HSMC-2)	50	10	20	20				100	1			1	Blended (1:0)	PP
6	100037	HSMC	Language Lab (HSMC-3)	-			-	60	20	20	100			2	1	Offline (1:0)	SO
7	100038	ESC	Engineering Graphics Lab (ESC-3)	-	-			60	20	20	100			2	1	Offline (1:0)	SO
Total				250	50	100	100	180	60	60	900	12	4	6	19		
*	100007	MAC	Engineering Physics	50	10	20	20				100	2			Grade	Online (0:2)	MCQ

Induction program of first three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visit / Virtual Visit to local Areas, Familiarization to Dept./Branch & Innovations

*proficiency in course/subject includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

**MCQ: Multiple Choice Question, AO: Assignment + Oral, PP: Pen Paper, SO: Submission + Oral

Mode of Teaching: Theory: Offline	Theory: Online	Theory: Blended: Offline	Theory: Blended: Online	Lab: Offline	Mode of Examination: Theory: PP	Theory: A+O	Theory: MCQ	Lab: SO	Total Credits
7	3	6	1	3	5	-	3	2	19
36.84	15.79	31.58	5.3	15.79	36.84	-	15.79	10.53	100

DEAN (ACADEMICS)
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Department of Mechanical Engineering

Scheme of Evaluation

B. Tech. I Semester (Mechanical Engineering)

For batches admitted in academic session 2022-23

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted: Theory Slot: End Term Evaluation: End Sem. Exam	Theory Slot: End Term Evaluation: *Proficiency in subject /course	Theory Slot: Continuous Evaluation: Mid Sem. Exam	Theory Slot: Continuous Evaluation: Quiz/ Assignment	Practical Slot: End Sem. Exam	Practical Slot: Continuous Evaluation: Lab work & Sessional	Practical Slot: Continuous Evaluation: Skill Based Mini Project	Total Marks	Contact Hours per Week: L	T	P	Total Credits	Mode of Teaching (Online, Offline, Blended)	**Mode of Exam.
1	100011	BSC	Engineering Mathematics-I (BSC-11)	50	10	20	20	-	-		100	3	1	-	4	Offline (4/0)	PP
2	100023	ESC	Basic Computer Engineering (ESC-13)	50	10	20	20	60	70	20	200	3	1	2	4	Blended (3/1)	A+O
3	100014	ESC	Engineering Graphics (ESC-21)	50	10	20	20				100	1	2	-	3	Offline (3/0)	A+O
4	100015	HSMC	Energy, Environment, Ecology & Society (HSMC-13)	50	10	20	20		-	-	100	3		-	3	Online (0/3)	MCQ
5	100016	HSMC	Technical Language (HSMC-21)	50	10	20	20			-	100	3	-	-	3	Blended (2/1)	PP
6	100017	HSMC	Language Lab (HSMC-31)	-	-	-		*60	20	20	100	-		2	1	Offline (1/0)	SO
7	100018	ESC	Engineering Graphics Lab (ESC-31)	-	-	-		60	20	20	100			2	1	Offline (1/0)	SO
Total				250	50	100	100	180	60	60	800	12	4	6	19		
8	1000003	MAC	Engineering Physics	50	10	20	20	-	-	-	100	2			Grade	Online (0/2)	MCQ

Induction program of first three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visit / Virtual Visit to local Areas, Familiarization to Dept./Branch & Innovations

proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.

**MCQ: Multiple Choice Question **AO: Assignment + Oral **PP: Pen Paper **SO: Submission + Oral

Mode of Teaching: Theory: Offline	Theory: Online	Theory: Blended: Offline	Theory: Blended: Online	Lab: Offline
7	3	4	2	1
36.84	15.78	21.05	10.5	15.78

Mode of Examination: Theory: PP	Theory: A+O	Theory: MCQ	Lab: SO	Total Credits
7	3	7	2	19
36.84	15.78	36.84	10.5	100

DEAN (ACADEMICS)
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Department of Mechanical Engineering

For batches admitted in Academic Session 2022-23

100014: Engineering Graphics

Category	Title	Code	Credit-3			Theory Slot
			L	T	P	
Engineering Science-ESC	Engineering Graphics	100014/100105/CEL/MEL/CSL/ EEL/ELL/ITL/CHL/ BTL105/1X25/BEEL/BELL/ BETL/BCHL/BAUL105/ BCEL/BMEL/BCSL/ BITL/BBTL204	1	2	-	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objective:

1. To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects.
2. To impart knowledge about principles/methods related to projections of one,two and three dimensional objects.

Syllabus:

Unit - 1

Introduction and scale: Basics of instruments. Lettering and dimensioning. Plane geometrical constructions. Plain and diagonal scale - Representative fraction, Unit conversion and Exercises based on linear, area, volume and speed. Scale of chord.

Engineering curves: Cycloidal curves - cycloid, epicycloid and hypocycloid curve, tangent and normal. Spiral curves - Archimedean and logarithmic spiral curves. Tangent & normal on the curves. Involute curve.

Unit - 2

Projection of points: Introduction, types of projections, quadrant system, positions of points and Exercise.

Projection of straight line: Introduction, Orientation of a straight line, Traces of a line and Exercise.

Unit - 3

Projection of planes: Introduction, Types of planes, Traces of planes, Position of planes and Exercise.

Projection of solids: Introduction, Types of solids, Positions of solids and Exercise.

Unit - 4

Section of solids: introduction, Types of section planes and Anti-section and Exercise.

Development of surfaces of right solids: Introduction, Methods of development & anti-development and Exercise.

Intersection of cylinders: Introduction, methods of developments, intersection of cylinder by another cylinder and exercise.

Unit - 5

Isometric projections: Introduction, isometric scale, isometric axis, isometric view and isometric projections from orthographic views, orthographic views from pictorial view and exercise.

Computer Aided Drafting using Auto CAD: Introduction, software's basic commands, transformation and editing commands.

Course Outcomes: After successful completion of this course students will be able to:
CO1. Visualize the geometric details of engineering objects.
CO2. Translate the geometric information of engineering objects into engineering drawings.
CO3. Draw orthographic projections and sections.
CO4. Develop knowledge to read, understand and explain drawing.
CO5. Improve their skills so that they can apply these skills in developing new products.
CO6. Prepare simple layout of factory, machine and buildings.

Text books:

1. Engineering Drawing by N. D. Bhatt, Charotar Publication Pvt. Ltd.
2. Engineering Drawing by P.S. Gill, S. K. kataria& sons, Delhi
3. Engineering Drawing by BasantAgrawal& C. M. Agrawal, Tata McGraw Hill Education Pvt. Ltd.
4. Engineering Graphics by K. Venugopal, New Age International Publication, India

NPTEL Link for Engineering Graphics:

http://nptel.ac.in/courses/112103019/

For batches admitted in Academic Session 2022-23

100021: Basic Mechanical Engineering

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering	100021/100204/CEL/ MEL/CSL/EEL/ ELL/ITL/CHL/ BTL114/2X24	2	1	-	Max.Marks-50 Min.Marks-16 Duration-2hrs.

Course Objectives: To make the students:

1. Develop the fundamentals of Engineering materials, measurement and reciprocating machines.
2. Develop an ability to understand the Thermodynamic laws, steam generator and reciprocating machines for solving engineering problems.
3. Demonstrate Engines and Boiler fundamentals using models.

Syllabus

UNIT-I:

Materials: Classification of engineering material, composition of cast iron and carbon steels on iron-carbon diagram and their mechanical properties; Alloy steel and their applications; Stress-Strain diagram, Hooks law and modulus of elasticity. Tensile, shear, hardness and fatigue testing of materials.

UNIT-II:

Measurement: Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set; introduction to lathe drilling, milling and shaping machines.

UNIT-III

Fluids: Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernoulli's equation for incompressible fluids, viscous and turbulent flow, working principle of fluid coupling, pumps, compressors, turbines, positive displacement machines and pneumatic machines. Hydraulic power & pumped storage plants for peak load management as compared to base load plants.

UNIT-IV

Thermodynamics: Zeroth, First, second and third law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, classification and working of boilers, efficiency & performance analysis, natural and induced draught, calculation of chimney height. Refrigeration, vapour absorption and compression cycles, coefficient of performance (COP).

UNIT-V

Reciprocating Machines: Steam engines, hypothetical and actual indicator diagram; Carnot cycle and ideal efficiency; Otto and diesel cycles; working of two stroke & four stroke petrol and diesel IC engines.

Course Outcomes: After successful completion of this course students will be able to:

CO1. **Define** the essential concepts of thermal, design and production used in Mechanical Engineering.
CO2. **Summarize** fundamental techniques and process used in power generating machines

CO3. **Solve** the various problems based on basic concepts of Mechanical Engineering.
CO4. **Analyze** the various gas, steam and air cycles.
CO5. **Evaluate** the problems of Steam Generator, Thermodynamics, Steam and I.C. engines
CO6. **Generate** the skills to demonstrate steam Generator and reciprocating machine in depth.

Reference Books:

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering;
5. Sawhney GS; Fundamentals of Mechanical Engineering; PHI
6. Nakra and Chaudhary; Instrumentation and Measurement; TMH
7. Nag PK; Engineering Thermodynamics; TMH
8. Ganesan; Combustion Engines; TMH

For batches admitted in Academic Session 2022-23

100024: Manufacturing Practices

Category	Title	Code	Credit-1			Practical End Sem
Engineering Science-ESC	Manufacturing Practices	100024/100106	L	T	P	Max.Marks-60 Min.Marks-19
			-	-	2	

Course Objectives:

1. To familiarize with the basics of tools and equipment used in fitting, carpentry, sheet metal, welding and smithy.
2. To with the production of simple models in the above trades.
3. To develop general machining skills in the students.

Syllabus

UNIT-I

Introduction: Manufacturing Processes and its Classification, Casting, Machining, Plastic deformation and Metal forming, Joining Processes, Heat treatment process, Assembly process.

Black Smithy Shop

Use of various smithy tools. Forging operations: Upsetting, Drawing down, Fullering, swaging, Cutting down, Forge welding, Punching and drafting.

Suggested Jobs: Forging of chisel, forging of Screw Driver.

UNIT-II Carpentry Shop

Timber: Type, Qualities of timber disease, Timber grains, Structure of timber, Timber seasoning, Timber preservation. Wood Working Tools: Wood Working Machinery, joints and joinery, various operations of planning using various carpentry planes sawing & marking of various carpentry joints.

Suggested Jobs: Name Plate, Any of the carpentry joint like mortise or tennon Joint.

UNIT-III Fitting Shop:

Study and use of measuring instruments, Engineer steel rule, Surface gauges caliper, Height gauges, feeler gauges, Micrometer. Different types of files, File cuts, File grades, Use of surface plate, Surface gauges drilling tapping Fitting Operations: Chipping filling, Drilling and Tapping.

Suggested Jobs: Preparation of job piece by making use of filing, sawing and chipping, drilling and tapping operation.

UNIT-IV Foundry:

Pattern Making: Study of pattern materials, pattern allowances and types of patterns. Core box and core print, Use and care of tool used for making wooden patterns.

Moulding: Properties of good mould& Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green and bench and pit mould dry sand bench mould using single piece and split patterns.

UNIT-V Welding. Study and use of tools used for Brazing, Soldering, Gas& Arc welding. Preparing Lap & Butt joints using Gas and Arc welding methods, study of TIG and MIG welding processes. Safety precautions.

Course Outcome: After successful completion of this course students will be able to:

CO1. Discuss the hand tools, machine tools and power tools.

CO2. Utilize appropriate tools required for specific operation.

CO3. Apply safety measures required to be taken while using the tools in floor shops, Machine ships and carpentry shop.

CO4. Use the techniques, skills, and modern engineering tools necessary for manufacturing and production engineering.

CO5. Conduct experiments in the field of Production engineering.

CO6. Design a system, components, or process to meet desired needs, ethical, health and safety, manufacturability and sustainability.

Text & References Books:

1. Bawa HS; Workshop Practice, TMH
2. Rao PN; Manufacturing Technology-Vol.1 & 2, TMH
3. John KC; Mechanical Workshop Practice; PHI
4. HazraChoudhry; workshop Practice-Vol.1 & 2.
5. Jain R. K.; Production Technology

NPTEL Link for Manufacturing Practices

http://nptel.ac.in/courses/112107145/

Laboratory Work:

Relevant shop floor exercises involving practice in forging, Carpentry, fitting, pattern making, Sand casting, Moulding, Welding, Sheet metal fabrication techniques.

For batches admitted in Academic Session 2022-23

Engineering Graphics Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
HSMC	Engineering Graphics Lab	100018	-	-	2	Max.Marks-60 Min.Marks-19

Laboratory Work

List of Experiments:

1. To prepare sheet of Plain scale, diagonal scale and Scale of chord.
2. To prepare sheet of Cycloidal curves.
3. To prepare sheet of Projection of points and lines.
4. To prepare sheet of Projection of Planes.
5. To prepare sheet of Projection of Solids.
6. To prepare sheet of Section of Solids.
7. To prepare sheet of Development of Surfaces.
8. To prepare sheet of Isometric and Intersection of Solids

Skill Based Projects:

1. To prepare the 3D view of any object.
2. To Prepare scale for your home and make a map using this scale.
3. To prepare cut section models drawing of any object.
4. To make paper object, cut and show the development of surfaces.

Course Outcomes: After successful completion of this course students will be able to:

CO1. Visualize the geometric details of engineering objects.
CO2. Translate the geometric information of engineering objects into engineering drawings.
CO3. Draw orthographic projections and sections.
CO4. Develop knowledge to read, understand and explain drawing.
CO5. Improve their skills so that they can apply these skills in developing new products.
CO6. Prepare simple layout of factory, machine and buildings.

Text books:

1. Engineering Drawing by N. D. Bhatt, Charotar Publication Pvt. Ltd.
2. Engineering Drawing by P.S. Gill, S. K. kataria& sons, Delhi
3. Engineering Drawing by BasantAgrawal& C. M. Agrawal, Tata McGraw Hill Education Pvt. Ltd.
4. Engineering Graphics by K. Venugopal, New Age International Publication, India

For batches admitted in Academic Session 2022-23

Basic Mechanical Engineering Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering Lab	100026	-	-	2	Max.Marks-60 Min.Marks-19

Lists of Experiments:

1. Study of vertical boilers.
2. Study of Locomotive boilers.
3. Study of Babcock and Wilcox boilers.
4. Study of Lancashire, Cornish and Cochran boilers.
5. Study of boiler mounting and accessories.
6. Study of 2 stroke diesel and petrol engines.
7. Study of 4 stroke diesel and petrol engines.
8. Study of steam engines.
9. Study of Lathe machine.
10. Study of Vernier and Micrometer.
11. Study of Internal Combustion Engine Parts.

Skill Based Projects:

1. Measurement and calibration using slip gauges
2. Performing energy audit using stroboscope and lux meter
3. Make a Free energy Steam Engine at home
4. Make an Air Compressor at home
5. Mini Bench Tapping machine project
6. Make a Robotic Arm
7. Tornado in a bottle
8. Make a Hydraulic Lift
9. Thermal Expansion project
10. Make a positive displacement pump
11. Make a mini thermal power plant
12. Make a fire hydrant.
13. How an airplane wing creates lift and how wind turbine blades are spun by the wind. Make a model.
14. To make a model for measuring the pressure distribution in a convergent – divergent duct to confirm Bernoulli's equation.
15. Make a digital hydraulic bench.
16. To make a model for induced draught and natural draught

Course Outcomes: After successful completion of this course students will be able to:

CO1. **Define** the essential concepts of thermal, design and production used in Mechanical Engineering.
CO2. **Summarize** fundamental techniques and process used in power generating machines
CO3. **Solve** the various problems based on basic concepts of Mechanical Engineering.
CO4. **Analyze** the various gas, steam and air cycles.
CO5. **Evaluate** the problems of Steam Generator, Thermodynamics, Steam and I.C. engines
CO6. **Generate** the skills to demonstrate steam Generator and reciprocating machine in depth.

Reference Books:

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering;
5. Sawhney GS; Fundamentals of Mechanical Engibneering; PHI
6. Nakra and Chaudhary; Instrumentation and Measurement; TMH
7. Nag PK; Engineering Thermodynamics; TMH
8. Ganesan; Combustion Engines; TMH

Mechanical CO Attainment July-Dec 2021

r Mechanical Engg. (B. Tech) Coordinator: Mr. Vedansh			Indirect CO Attainment (Through Fee						Direct CO Attainment (Through Exam						Total CO Attainment (20% Indirect + 80%						Target Level	COs not attained	Action Taken
ubject Cod	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
100001	Mathematics-II		2.40	2.20	2.36	2.10	1.96	1.95	2.16	2.45	2.09	2.79	2.21	2.27	2.21	2.40	2.15	2.65	2.16	2.21	2	NIL	
120311	Manufacturing Process (DC-2)	Prof. R P Kori	3.00	2.17	2.83	2.38	2.45	2.58	2.07	2.58	2.02	2.86	1.96	2.09	2.25	2.50	2.19	2.76	2.06	2.18	2	NIL	
120312	Mechanics of Materials (DC-3)	Mr. V. Shivhar	2.30	2.13	2.27	1.91	1.88	2.21	2.60	2.54	2.00	2.08	2.04	1.84	2.54	2.46	2.05	2.04	2.00	1.92	2	CO6	Students are encouraged to indulge in Skill Based projects
120313	Theory of Machines –I (DC-4)	Dr. Nitin Upad	2.33	2.33	2.26	2.29	2.26	2.33	2.00	1.92	2.01	2.70	1.86	2.13	2.07	2.00	2.06	2.62	1.94	2.17	2	CO5	Gate oriented questions are given
120314	Fluid Mechanics and Hydraulic	Prof. B. Pandey	2.30	2.03	2.25	2.49	2.16	2.21	2.80	2.40	2.80	2.47	2.53	2.68	2.70	2.33	2.69	2.48	2.45	2.59	2	NIL	
120312 (P)	Mechanics of Materials Lab	Prof. V. Shivha	2.25	2.10	2.22	2.32	2.25	2.08	2.80	2.17	2.80	2.01	1.85	2.27	2.69	2.16	2.68	2.07	1.93	2.23	2	CO5	Students are encouraged to indulge in Skill
120313(P)	Theory of Machines –I Lab	Dr. Nitin Upad	2.07	2.23	2.43	2.29	2.25	2.44	2.79	2.34	2.40	3.00	2.33	2.25	2.65	2.32	2.40	2.86	2.32	2.29	2	NIL	
120314(P)	Fluid Mechanics and Hydraulic	Prof. B. Pandey	2.38	2.28	2.33	2.18	2.76	2.44	2.19	2.36	2.13	2.58	2.15	2.27	2.23	2.35	2.17	2.50	2.27	2.30	2	NIL	
120315	Software Lab (DLC-1)	Prof. R P Kori	2.32	2.17	2.06	2.27	2.09	2.25	2.78	2.49	2.34	2.33	2.25	2.04	2.69	2.43	2.28	2.32	2.22	2.08	2	NIL	
120316	Self-learning/Presentation (SW	Dr. Dinesh Rat	2.85	2.44	2.23	1.96	2.02	1.83	2.72	2.56	2.55	2.44	2.45	2.44	2.75	2.53	2.49	2.34	2.36	2.32	2	NIL	
120317	Summer Internship Programm	Dr. Amit Ahirv	2.51	2.25	2.26	2.13	2.20	2.07	2.44	2.20	2.01	2.59	2.74	2.56	2.45	2.21	2.06	2.49	2.64	2.46	2	NIL	

mester Mechanical Engg. (B. Tech) Coordinator: Mr. R. P			Indirect CO Attainment (Through Fee						Direct CO Attainment (Through Exam						Total CO Attainment (20% Indirect + 80%						Target Level	Number of COs not	Action Taken
ubject Cod	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
120501	Industrial Engineering	Mr. Ajay Singh	2.56	2.62	2.60	2.58	1.84	2.43	2.10	2.13	2.17	2.19	2.55	1.92	2.19	2.23	2.26	2.27	2.41	2.02	2	NIL	
120502	Metal cutting and machine tool	Dr. Surendra K	2.30	2.30	2.37	2.72	1.88	2.55	2.19	2.45	2.70	2.50	2.90	1.93	2.21	2.42	2.63	2.54	2.70	2.06	2	NIL	
120503	Heat & Mass Transfer	Dr. M. K. Gaur	2.34	2.43	2.53	2.44	1.78	2.31	1.96	2.02	1.96	2.08	1.96	1.80	2.04	2.10	2.08	2.15	1.92	1.90	2	CO5,CO6	Given More Practical question
120504	Thermal Engineering	Dr Ashish Agar	2.50	2.33	2.38	2.21	1.76	2.12	2.37	2.38	2.56	1.91	1.85	2.04	2.40	2.37	2.52	1.97	1.83	2.05	2	CO4,CO5	Skill based project problems are added
120505	Machine Design	Prof. S. Agraw	2.13	2.10	2.09	2.02	1.81	1.98	2.24	2.37	2.54	2.00	2.08	2.04	2.22	2.32	2.45	2.00	2.03	2.03	2	NIL	
120503 (P)	Heat & Mass Transfer lab	Dr. M. K. Gaur	2.09	2.40	2.45	1.93	2.30	2.47	2.52	2.34	2.49	1.94	1.88	2.08	2.43	2.35	2.48	1.94	1.96	2.16	2	CO4,CO5	Assignments and seminars are given
120504 (P)	Thermal Engineering lab	Dr Ashish Agar	2.36	2.27	1.91	1.80	2.00	2.18	1.93	2.59	2.17	2.68	2.50	2.40	2.02	2.53	2.12	2.50	2.40	2.36	2	NIL	
120505 (P)	Machine Design lab	Prof. S. Agraw	2.20	2.09	2.22	2.38	2.54	2.38	2.34	2.24	2.58	2.24	2.08	2.08	2.31	2.21	2.51	2.27	2.17	2.14	2	NIL	
HS5X01	Principle of Hydraulic Machines and System Design (NPTEL)	Dr. Harbhajan	2.38	2.34	2.30	2.35	1.92	2.37	2.18	2.46	2.34	2.12	1.80	1.91	2.22	2.44	2.33	2.17	1.82	2.00	2	CO5	Labs needed to be upgrade
HS5X02	System Design for Sustainability (NPTEL)	Dr. Harbhajan	2.72	1.88	2.55	2.30	2.11	2.04	2.44	2.45	2.44	2.46	2.42	2.02	2.49	2.34	2.46	2.43	2.36	2.02	2	NIL	

HS5X03	Manufacturing Systems Technology I & II (NPTEL)	Dr. Harbhajan	2.44	1.78	2.31	2.91	2.00	2.02	2.59	2.74	2.56	2.79	2.67	1.96	2.56	2.55	2.51	2.81	2.54	1.97	2	CO6	Some assignments given
MS5X01	Basics of Materials Engineering (NPTEL)	Mr. S.C Pal	2.21	1.76	2.12	2.72	1.93	1.98	2.20	2.07	2.17	2.19	2.55	2.16	2.20	2.01	2.16	2.30	2.43	2.13	2	NIL	
MS5X02	Fluid mechanics (NPTEL)	Dr Ravi Kant K	2.02	2.31	1.98	2.30	1.93	1.83	2.75	2.00	3.00	3.00	3.00	2.75	2.60	2.06	2.80	2.86	2.79	2.57	2	NIL	
120506	Minor Project-I		2.58	2.38	2.51	2.16	2.00	2.13	2.58	2.15	2.27	2.00	2.25	2.00	2.58	2.20	2.32	2.03	2.20	2.03	2	NIL	
120507	Summer Internship Project-II (Evaluation)		2.16	2.33	2.19	2.07	2.00	2.05	2.29	2.27	2.04	2.35	2.00	2.00	2.26	2.28	2.07	2.29	2.09	2.01	2	NIL	
120508	Self-learning/Presentation (SW	Dr. Amit Ahirw	2.38	2.41	2.67	2.09	2.36	2.32	2.43	2.00	2.38	2.10	2.33	2.36	2.42	2.08	2.44	2.10	2.34	2.35	2	NIL	

ter Mechanical Engg. (B. Tech) Coordinator: Prof. Sharad			Indirect CO Attainment (Through Feed						Direct CO Attainment (Through Exam						Total CO Attainment (20% Indirect + 80%						Target Level	Number of COs not	Action Taken
ubject Cod	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
120711	Refrigeration and Air-Conditio	Mr. S.C Pal	2.37	2.27	2.32	2.25	2.16	2.21	2.63	1.97	2.50	2.00	2.00	1.94	2.57	2.03	2.46	2.05	2.03	2.00	2	CO6	Questions from GATE/IES added in assignments
120713	Metrology, Measurement and C	Dr Amit Aherw	2.34	2.07	2.00	2.21	2.28	2.31	2.63	2.11	2.52	2.00	1.99	1.93	2.57	2.10	2.42	2.04	2.05	2.01	2	NIL	
120714	TQM (DE-3)	Dr Dinesh Rath	2.10	2.30	2.20	2.10	2.20	2.30	2.60	2.10	2.60	1.99	1.94	2.00	2.50	2.14	2.52	2.01	1.99	2.06	2	CO5	Extra assignment given
120751	Foundation of Computational I	Mr. Utkarsh Su	2.62	2.88	2.69	1.99	2.20	1.92	2.73	2.00	2.59	2.14	1.96	2.32	2.71	2.18	2.61	2.11	2.01	2.24	2	NIL	
120752	Introduction to Composites (DE	Dr. Surendra K	2.29	2.43	2.00	2.14	1.96	1.93	2.60	1.90	2.46	2.07	2.20	2.17	2.54	2.01	2.37	2.08	2.15	2.12	2	NIL	
120753	Advanced Machining Processes	Dr. Gavendra	2.44	2.74	2.30	2.73	1.80	1.80	3.00	2.30	2.76	2.90	2.08	1.79	2.89	2.39	2.67	2.87	2.02	1.79	2	CO6	Expert lectures from industry are planned to improve learning of students
120705	Reliability and Vibration Lab (	Dr. Nitin Upad	2.25	2.21	2.16	2.56	3.00	1.78	2.64	2.91	2.48	2.45	2.15	2.15	2.56	2.77	2.41	2.47	2.32	2.08	2	NIL	
100008	Intellectual Property Rights (IE	Dr. Ravikant R	2.03	2.25	2.55	2.12	2.45	2.55	2.16	2.41	2.22	2.11	1.80	2.30	2.13	2.38	2.29	2.11	1.93	2.35	2	CO5	Extra resources are provided for selflearning
900203	Industrial Automation	Mr. Neeraj Mis	2.46	2.20	2.21	1.92	2.05	2.59	2.12	2.14	2.55	1.97	1.95	1.97	2.19	2.15	2.48	1.96	1.97	2.10	2	CO4,CO5	sessions are planned with
900204	Solar Energy	Dr. Ravikant R	2.27	2.35	2.36	2.18	2.24	2.38	2.08	2.05	2.15	2.56	2.41	2.62	2.12	2.11	2.19	2.48	2.38	2.57	2	NIL	
900214	Engineering Materials for Indu	Mr. vaibhav sh	2.44	2.08	2.56	2.33	2.42	2.14	2.10	2.43	2.47	2.03	2.09	2.37	2.17	2.36	2.49	2.09	2.16	2.32	2	NIL	
900215	Maintenance Engineering	Dr Gavendra N	2.29	2.53	2.19	2.08	1.96	2.02	2.25	2.25	2.27	2.05	2.09	2.07	2.26	2.31	2.25	2.06	2.06	2.06	2	NIL	
120706	Summer Internship Project - III		2.25	2.16	2.21	2.40	2.45	2.40	2.81	2.04	2.66	2.00	2.56	1.97	2.70	2.06	2.57	2.08	2.54	2.05	2	NIL	
120707	Creative Problem Solving	Dr. Surendra K	2.21	2.28	2.31	2.27	1.91	2.18	2.72	2.02	2.58	2.00	1.80	1.96	2.62	2.07	2.53	2.05	1.82	2.00	2	CO5	projects and

Automobile CO Attainment July-Dec 2021

Automobile Engg. (B. Tech) Coordinator: Mr. Veda			Indirect CO Attainment (Through Fe						Direct CO Attainment (Through Exam						Total CO Attainment (20% Indirect + 80%						Targe Level	COs not attained	Action Taken
bject Co	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
100001	Mathematics-II		2.68	1.96	2.26	2.04	2.10	1.92	2.07	2.39	2.07	2.69	2.52	1.89	2.19	2.30	2.11	2.56	2.44	1.90	2	CO6	
190311	Automotive Materia	Dr. Dinesh Kumar Rathore	2.52	1.99	2.04	2.40	1.95	1.96	1.92	2.02	2.23	2.01	1.96	2.14	2.04	2.01	2.19	2.09	1.96	2.10	2	CO5	More assignments questions were given
190312	Mechanics of Mater	Mr. V. Shivhare	2.60	2.20	2.28	2.46	1.74	1.74	2.06	2.02	2.38	2.60	1.92	1.93	2.17	2.06	2.36	2.57	1.88	1.89	2	CO5,CO6	Students are encouraged to indulge in Skill Based projects
190313	Automotive Engines	Mr. Neeraj Mishra	2.05	2.15	2.23	2.56	1.88	1.88	2.05	2.66	2.25	2.65	2.66	1.96	2.05	2.56	2.25	2.63	2.50	1.95	2	CO6	more focus on Practical exposure
190314	Fluid Mechanics an	Mr. Utkarsh Shrivasta	1.91	2.05	2.12	2.44	2.54	1.90	2.12	1.99	2.12	1.88	2.14	1.92	2.08	2.00	2.12	1.99	2.22	1.92	2	CO4,CO6	Skill based projects are introduced
0312 (P)	Mechanics of Mater	Prof. V. Shivhare	1.95	2.34	2.13	2.60	2.31	1.72	2.43	2.22	1.98	2.12	1.96	2.33	2.33	2.24	2.01	2.22	2.03	2.21	2	NIL	
0313(P)	Automotive Engines	Mr. Neeraj Mishra	2.04	2.11	2.54	1.94	2.28	2.01	2.33	2.73	1.88	2.15	1.92	2.12	2.27	2.61	2.01	2.11	1.99	2.10	2	CO5	more focus on Practical exposure
0314(P)	Fluid Mechanics an	Mr. Utkarsh Shrivasta	2.02	2.25	2.06	2.20	1.92	1.99	2.42	2.30	2.08	2.02	2.38	2.43	2.34	2.29	2.08	2.06	2.29	2.34	2	NIL	
190315	Software Lab (DLC-	Dr. GavendraNorkey	2.01	2.64	2.60	2.29	2.20	2.18	2.55	2.12	1.90	2.16	2.30	2.33	2.44	2.22	2.04	2.19	2.28	2.30	2	NIL	
190316	Self-learning/Preser	Mr. Ajay Singh Rajpu	2.32	2.34	1.96	2.62	2.55	2.09	2.68	2.43	2.01	1.88	2.33	2.08	2.61	2.41	2.00	2.03	2.37	2.08	2	NIL	
190317	Summer Internship	Prof. V. Shivhare	2.52	2.15	2.56	2.34	2.34	2.08	2.41	2.33	1.92	1.92	2.17	2.40	2.43	2.29	2.05	2.00	2.20	2.34	2	NIL	

ester Automobile Engg. (B. Tech) Coordinator: Mr. R.			Indirect CO Attainment (Through Feed						Direct CO Attainment (Through Exam						Total CO Attainment (20% Indirect + 80%						Target L	COs not attained	Action Taken
ubject Co	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
190501	Industrial Engineerin	Mr. Utkarsh Shrivastav	2.45	2.44	1.96	2.14	1.95	2.19	2.20	2.07	2.17	1.90	1.94	2.16	2.25	2.14	2.13	1.95	1.94	2.17	2	CO4,CO5	Planned to give real life industry problems for improvement in learning
190502	Metal cutting and ma	Mr. V. Chaturvedi	2.68	2.11	2.10	2.02	2.01	2.01	2.83	2.45	2.70	1.72	2.08	1.95	2.80	2.38	2.58	1.78	2.07	1.96	2	CO4,CO6	Gate oriented questions are given
190503	Heat & Mass Transfe	Mr. Subash Chand Pal	2.22	2.25	2.16	1.81	1.87	1.80	2.12	2.14	1.96	2.01	2.00	2.13	2.14	2.16	2.00	1.97	1.97	2.06	2	CO4,CO5	

190504	Design of machine ele	Dr. Jyoti Vimal	2.39	2.40	2.51	2.31	2.19	2.50	2.38	2.04	1.92	2.57	1.98	1.94	2.38	2.11	2.04	2.52	2.02	2.05	2	NIL	
190505	Automotive Chassis	Dr Harbhajan Singh	2.18	1.92	2.27	2.49	2.10	2.13	2.33	2.16	2.00	2.15	2.75	1.95	2.30	2.11	2.05	2.22	2.62	1.99	2	CO6	Needed labs to practical demonstration
90503 (P)	Heat & Mass Transfe	Mr. Subash Chand Pal	1.91	2.38	2.03	1.95	2.19	2.45	2.43	2.30	2.49	2.19	1.98	1.99	2.33	2.32	2.40	2.14	2.02	2.08	2	NIL	
90504 (P)	Design of machine ele	Dr. Jyoti Vimal	2.29	2.53	2.19	2.08	1.96	2.02	2.15	2.22	2.25	2.51	1.88	2.10	2.18	2.28	2.24	2.42	1.90	2.08	2	CO5	Continuous up gradation of lab infrastructure is undertaken so as to meet the rapidly going needs of academia
90505 (P)	Automotive Chassis lab	Dr Harbhajan Singh	2.12	2.43	1.98	1.92	2.37	2.38	2.05	2.57	2.10	2.49	1.95	1.94	2.06	2.54	2.08	2.38	2.03	2.03	2	NIL	
HS5X01	Principle of Hydraulic Machines and System Design (NPTEL)	Dr. Harbhajan Singh	2.38	2.34	2.30	2.35	1.92	2.37	2.18	2.46	2.34	2.12	1.80	1.91	2.22	2.44	2.33	2.17	1.82	2.00	2	CO5	Labs needed to be upgrade
HS5X02	System Design for Sustainability (NPTEL)	Dr. Harbhajan Singh	2.72	1.88	2.55	2.30	2.11	2.04	2.44	2.45	2.44	2.46	2.42	2.02	2.49	2.34	2.46	2.43	2.36	2.02	2	NIL	
HS5X03	Manufacturing Systems Technology I & II (NPTEL)	Dr. Harbhajan Singh	2.44	1.78	2.31	2.91	2.00	2.02	2.59	2.74	2.56	2.79	2.67	1.96	2.56	2.55	2.51	2.81	2.54	1.97	2	CO6	Some assignments given
MS5X01	Basics of Materials Engineering (NPTEL)	Mr. S.C Pal	2.21	1.76	2.12	2.72	1.93	1.98	2.20	2.07	2.17	2.19	2.55	2.16	2.20	2.01	2.16	2.30	2.43	2.13	2	NIL	
MS5X02	Fluid mechanics (NPTEL)	Dr Ravi Kant Ranjan	2.02	2.31	1.98	2.30	1.93	1.83	2.75	2.00	3.00	3.00	3.00	2.75	2.60	2.06	2.80	2.86	2.79	2.57	2	NIL	
190506	Minor Project-I		2.58	2.27	2.52	2.16	2.00	2.13	2.58	2.15	2.27	2.00	2.25	2.00	2.58	2.17	2.32	2.03	2.20	2.03	2	NIL	
190507	Summer Internship Project-II (Evaluation)		2.16	2.33	2.19	2.07	2.00	2.05	2.29	2.27	2.04	2.35	2.00	2.00	2.26	2.28	2.07	2.29	2.00	2.01	2	NIL	
190508	Self-learning/Present	Dr. Amit Ahirwar	2.38	2.41	2.67	2.09	2.36	2.32	2.43	2.00	2.38	2.10	2.33	2.36	2.42	2.08	2.44	2.10	2.34	2.35	2	NIL	

er Automobile Engg. (B. Tech) Coordinator: Prof. Shara

			Indirect CO Attainment (Through Feed						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80% D								
bject Co	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	Target	COs not attained	Action Taken
190711	Vehicle Dynamics	Mr. Sharad Agarwal	2.17	1.93	1.82	2.10	2.00	2.45	2.51	2.33	2.60	2.48	2.51	1.70	2.44	2.25	2.44	2.40	2.41	1.85	2	CO6	Mini projects are used to improve
190712	Theory of Fuels and I	Dr Ashish Agarwal	2.47	2.04	2.39	1.94	2.01	2.27	2.06	2.41	2.01	1.88	2.06	1.80	2.14	2.34	2.09	1.89	2.05	1.89	2	CO4,CO6	Extra questions in assignments are added
190713	Hybrid Electric Vehic	Mr. Ajay singh Rajput	1.93	2.41	2.01	2.38	2.45	2.57	2.35	2.10	1.94	1.95	2.39	1.89	2.27	2.16	1.95	2.04	2.40	2.03	2	CO3	Skill Based Project work is assigned

190714	Two and Three-Whee	Dr. Harbhajan Singh	1.96	2.10	2.52	2.50	2.15	1.97	2.36	2.44	1.95	1.80	1.92	1.94	2.28	2.17	2.06	1.94	1.97	1.95	2	04,CO5,C	Assignments and seminars are given
190751	Farm Machinery	Dr. Dharmendra Jain	2.39	2.44	2.22	2.02	2.38	2.26	2.41	2.02	1.99	1.72	2.00	1.90	2.41	2.10	2.04	1.78	2.08	1.97	2	CO4,CO5	More vedios from various sources are given to students
190753	Introduction to Mech	Dr. Nitin Upadhyay	2.37	2.02	2.42	2.53	2.12	2.22	2.09	2.19	2.33	2.25	1.98	2.41	2.15	2.16	2.35	2.31	2.01	2.37	2	NIL	
190754	Introduction to compu	Dr. Dinesh Kumar Rait	2.10	2.14	2.27	2.19	2.43	2.42	2.25	2.51	2.17	2.57	1.88	2.73	2.22	2.44	2.19	2.49	1.99	2.67	2	CO5	Extra classes are conducted
190705	Automotive Maintena	Dr. Harbhajan Singh	2.56	2.41	2.07	2.28	2.52	2.53	1.95	2.09	2.32	2.19	1.95	2.73	2.07	2.15	2.27	2.21	2.06	2.69	2	NIL	
100008	Intellectual Property	Dr. Ravikant Ranjan	2.03	2.25	2.55	2.12	2.45	2.55	2.16	2.41	2.22	2.11	1.80	2.30	2.13	2.38	2.29	2.11	1.93	2.35	2	CO5	extra classes are provided for selflearning
900203	Industrial Automation	Mr. Neeraj Mishra	2.46	2.20	2.21	1.92	2.05	2.59	2.12	2.14	2.55	1.97	1.95	1.97	2.19	2.15	2.48	1.96	1.97	2.10	2	CO4,CO5	sessions are planned with professionals from
900204	Solar Energy	Dr. Ravikant Ranjan	2.27	2.35	2.36	2.18	2.24	2.38	2.08	2.05	2.15	2.56	2.41	2.62	2.12	2.11	2.19	2.48	2.38	2.57	2	NIL	
900214	Engineering Material	Mr. vaibhav shivhare	2.44	2.08	2.56	2.33	2.42	2.14	2.10	2.43	2.47	2.03	2.09	2.37	2.17	2.36	2.49	2.09	2.19	2.32	2	NIL	
900215	Maintenance Enginee	Dr Gavendra Norkey	2.29	2.53	2.19	2.08	1.96	2.02	2.25	2.25	2.27	2.05	2.09	2.07	2.25	2.31	2.25	2.06	2.06	2.38	2	NIL	
190706	Summer Internship Project - III		2.24	2.38	2.08	2.05	2.15	2.42	2.08	2.12	2.42	2.38	2.45	2.35	2.11	2.17	2.35	2.31	2.39	2.36	2	NIL	
190707	Creative Problem Solv	Mr. Vaibhav Shivhare	2.42	2.14	2.10	2.43	2.47	2.03	1.95	2.44	2.46	2.42	1.97	2.67	2.04	2.38	2.39	2.43	2.07	2.54	2	NIL	

I year year November 2021 – February 2022 Semester

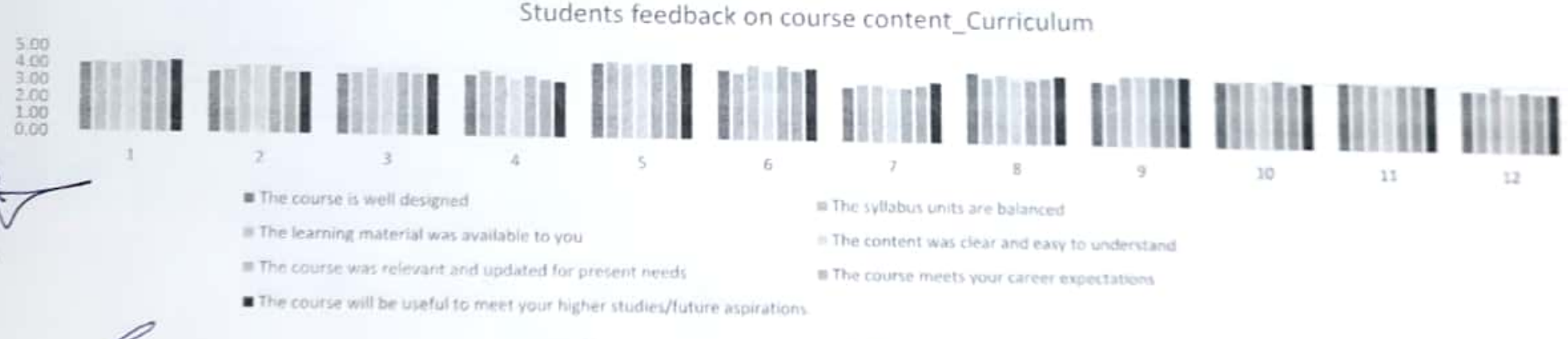
I Semester Mechancial Department Courses for BTech ALL BRAN			Indirect CO Attainment (Through P						Direct CO Attainment (Through Exa						Total CO Attainment (20% Indirect						Target Level	COs not attained	Action Taken
Subject Code	**Subject Name**	**Faculty I/C**	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
AU/ME/100014	Engineering Graphics	Prof. V. Chaturvedi	2.35	2.30	2.16	###	2.14	1.96	2.11	2.29	2.23	2.08	1.91	1.80	2.15	2.29	2.21	2.08	1.96	1.83	2	CO5,CO6	Real life drawing problems were given in assignments
CE/100014	Engineering Graphics	Dr. M. K. Sagar	2.51	2.46	2.50	###	2.04	1.92	2.43	2.29	2.19	1.91	1.85	2.04	2.45	2.32	2.25	2.00	1.89	2.01	2	CO5	More assignments based on high order thinking
EE/100014	Engineering Graphics	Prof R P Kori	2.04	2.21	2.08	###	2.16	2.00	2.28	2.31	2.22	1.86	2.08	2.04	2.23	2.29	2.19	1.95	2.10	2.03	2	CO4	Extra classes were conducted
CSE/IT/100021	asic Mechanical Engineeri	Dr. Jyoti Vimal	2.47	2.53	2.68	###	2.30	2.49	2.12	2.28	2.13	2.04	1.88	2.08	2.19	2.33	2.24	2.12	1.96	2.16	2	CO5	More focus of practicals/Experimental models
CM/100021	asic Mechanical Engineeri	rof. Bhupendra Pand	2.37	2.38	2.56	###	2.06	2.36	2.35	2.56	2.82	2.12	2.39	2.20	2.35	2.52	2.77	2.13	2.33	2.23	2	NIL	
EC/ET/100021	asic Mechanical Engineeri	Dr C S Malvi	2.24	2.37	2.54	###	2.56	2.25	2.35	2.46	2.15	2.25	2.34	2.00	2.33	2.44	2.23	2.21	2.38	2.05	2	NIL	
AU/ME/100015	Environment, Ecology &	Dr G. Norkey	2.50	2.33	2.49	###	2.00	2.12	####	2.16	2.25	2.31	2.28	2.01	####	2.19	2.30	2.26	2.23	2.03	2	NIL	
CM/100024	Manufacturing Practices	Prof. R. P. Kori	2.13	2.10	2.19	###	2.42	1.90	2.04	2.21	2.55	2.30	2.11	2.04	2.06	2.19	2.48	2.31	2.17	2.01	2	NIL	
AU/ME/100014 (P	Engineering Graphics lab	Prof. V. Chaturvedi	2.09	2.40	2.78	###	2.38	2.03	2.47	2.53	2.31	2.91	2.00	2.06	2.40	2.50	2.40	2.82	2.08	2.05	2	NIL	
CE/100014 (P)	Engineering Graphics lab	Dr. M. K. Sagar	2.46	2.43	2.36	###	2.17	1.82	2.74	2.56	2.79	2.67	2.33	2.09	2.69	2.53	2.71	2.61	2.29	2.03	2	NIL	

I st Semester Mechancial/Automobile			Indirect CO Attainment (Through P						Direct CO Attainment (Through Exa						20% Indirect + 80% Direct)						Target Le	COs not attained	Action Taken
Subject Code	**Subject Name**	**Faculty I/C**	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
100011	ngineering Mathematics - I																						
100023	Basic Computer engineering																						
100014	Engineering Graphics	Prof. V. Chaturvedi	2.35	2.30	2.16	###	2.14	1.96	2.11	2.29	2.23	2.08	1.91	1.80	2.15	2.29	2.21	2.08	1.96	1.83	2	CO5,CO6	Real life drawing problems were given in assignments
100015	Environment, Ecology &	Dr G. Norkey	2.50	2.33	2.49	###	2.00	2.12	####	2.16	2.25	2.31	2.28	2.01	####	2.19	2.30	2.26	2.23	2.03	2	NIL	
100016	Technical Language																				2	NIL	
100017	Language Lab																				2	NIL	
100018	Engineering Graphics lab	Prof. V. Chaturvedi	2.09	2.40	2.78	###	2.38	2.03	2.47	2.53	2.31	2.91	2.00	2.06	2.40	2.50	2.40	2.82	2.08	2.05	2	NIL	
100023 (P)	sic Computer engineering Lab																				2	NIL	

Student's Feedback on Curriculum

Action Taken on Student's Feedback

S.No.	Subject	Feedback	Action Taken
1	Thermal engineering	The Syllabus of unit-3 & 4 is not balanced	Some portion is replaced and modified for 2020-21 batch.
		Some advanced topic should be added in subject	Separate course "Turbo Machinery" is running for advanced topic.
2	Design of Machine Elements	Units are not balanced; some units are lengthy and some units are too short	Unit contents is revised for 2020-21 admitted batch
		Course of unit 3rd has to be updated	Unit 3 updated:
3	Automotive Materials	Old content is available in syllabus	Unit-5 has been modified and incorporated in 2021-22 batch.
4	Maintenance engineering	Subject is not interesting as it is based on industrial point of view	Unit 2 and 3 updated
5	Industrial Engineering	Sequence of units is not well arranged	Units no.4 and 5 are re-arranged.



Department of Mechanical Engineering (Stakeholders feedback report May 2022)

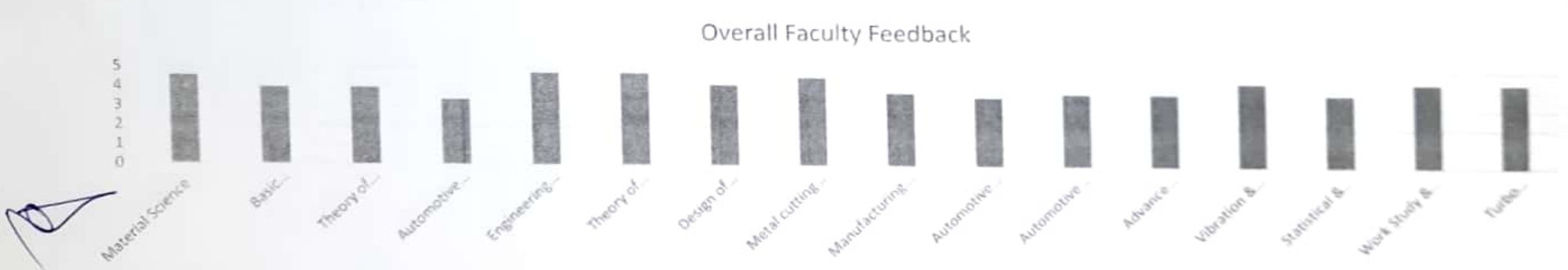
Parameters	Average Feedback (Out of 5)							
	120411	100007	100005	190412	190613	190611	190411	190413
The course is well designed	4.06	3.65	3.64	3.67	4.50	4.17	3.27	4.27
The syllabus units are balanced	4.12	3.78	3.71	3.89	4.56	4.00	3.45	3.95
The learning material was available to you	4.06	4.03	3.96	3.67	4.50	4.50	3.45	4.18
The content was clear and easy to understand	4.18	4.05	3.71	3.44	4.56	4.17	3.27	3.86
The course was relevant and updated for present needs	4.24	4.00	3.75	3.67	4.50	4.50	3.27	3.86
The course meets your career expectations	4.18	3.70	3.71	3.44	4.50	4.17	3.45	4.00
The course will be useful to meet your higher studies/future aspirations.	4.29	3.70	3.71	3.33	4.56	4.33	3.64	4.14

Parameters	Average Feedback (Out of 5)				
	120611	120413	10004	190414	120414
The course is well designed	3.9	4.0	4.07	3.71	4.25
The syllabus units are balanced	3.8	3.9	4.03	3.67	4.25
The learning material was available to you	4.2	4.1	3.97	3.90	4.25
The content was clear and easy to understand	4.2	3.9	3.87	3.57	4.25
The course was relevant and updated for present needs	4.2	4.1	3.97	3.7	4.4
The course meets your career expectations	4.2	3.9	4.00	3.6	4.3
The course will be useful to meet your higher studies/future aspirations.	4.2	4.0	3.93	3.6	4.3

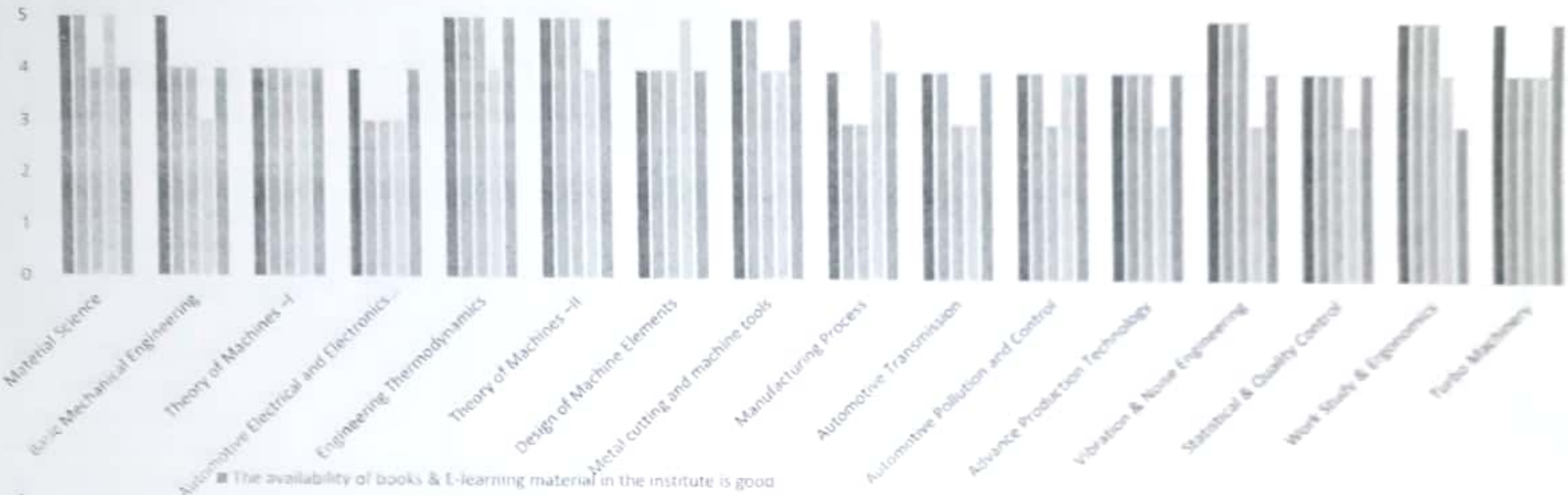
Teacher's Feedback on Curriculum

Action Taken on Teacher's Feedback

S.No.	Subject	Feedback	Action Taken
1	Thermal Engineering	Syllabus is too vast and contains non-interrelated topics	Some units are split and added in other subjects for 2020-21 admitted batch
2	APT	Lab portion should be removed from the subject	Updated in the syllabus.
3	VNC	More utilization of SKF lab is required in vibration subject so it should be departmental core (DC) instead of departmental elective (DE).	This implementation will be done in upcoming BoS meeting, as this course will be offered in final year
4	MP	Laboratory exposure is lacking, as there is no practical slot is in subject	Laboratory portion may be covered by Skill Based Project.
5	DoME	Syllabus for Automobile engineering is vast and need modification	This implementation will be done in upcoming BoS meeting, and will be applicable for 2020 admitted batch



Teacher Feedback (on a scale of 1-5)



- The availability of books & E-learning material in the institute is good
- The Courses and content are up to date. Please suggest if you feel any new course(s) need to be introduced to meet current needs & technological changes?
- The course curriculum/syllabi are helpful in meeting the higher studies/placement requirements according to present global trends.
- The course / contents in your domain/area are well designed and frequently updated, hence need no changes at present.
- The curriculum is capable of inculcating life-long learning abilities in students.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.)

A Govt. Aided UGC Autonomous & NAAC Accredited Institute, Affiliated to R.G.P.V, Bhopal

Department of Mechanical Engineering (Stakeholders feedback report May 2022)

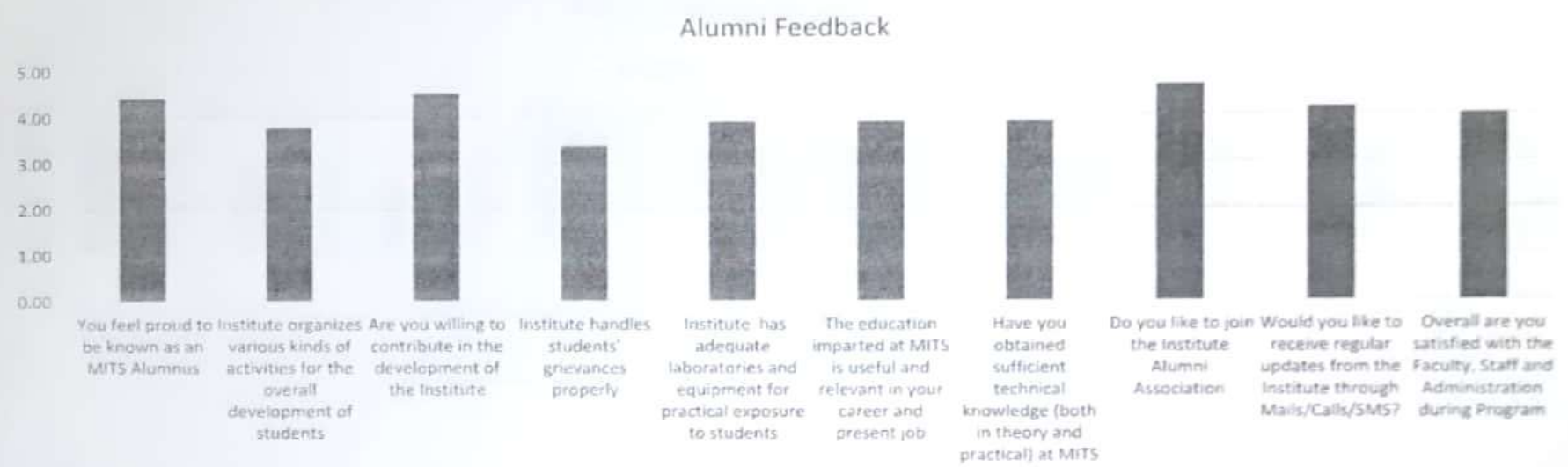
Subject Name	The availability of books & E-learning material in the institute is good	The Courses and content are up to date. Please suggest if you feel any new course(s) need to be introduced to meet current needs & technological changes?	The course curriculum/syllabi are helpful in meeting the higher studies/placement requirements according to present global trends.	The course / contents in your domain/area are well designed and frequently updated, hence need no changes at present.	The curriculum is capable of inculcating life-long learning abilities in students.	Overall Rating
Material Science	5	5	4	5	4	4.6
Basic Mechanical Engineering	5	4	4	3	4	4.0
Theory of Machines –I	4	4	4	4	4	4.0
Automotive Electrical and Electronics System	4	3	3	3	4	3.4
Engineering Thermodynamics	5	5	5	4	5	4.8
Theory of Machines –II	5	5	5	4	5	4.8
Design of Machine Elements	4	4	4	5	4	4.2
Metal cutting and machine tools	5	5	4	4	5	4.6
Manufacturing Process	4	3	3	5	4	3.8
Automotive Transmission	4	4	3	3	4	3.6
Automotive Pollution and Control	4	4	3	4	4	3.8
Advance Production Technology	4	4	4	3	4	3.8
Vibration & Noise Engineering	5	5	5	3	4	4.4
Statistical & Quality Control	4	4	4	3	4	3.8
Work Study & Ergonomics	5	5	5	4	3	4.4
Turbo Machinery	5	4	4	4	5	4.4

Alumni's Feedback on Curriculum

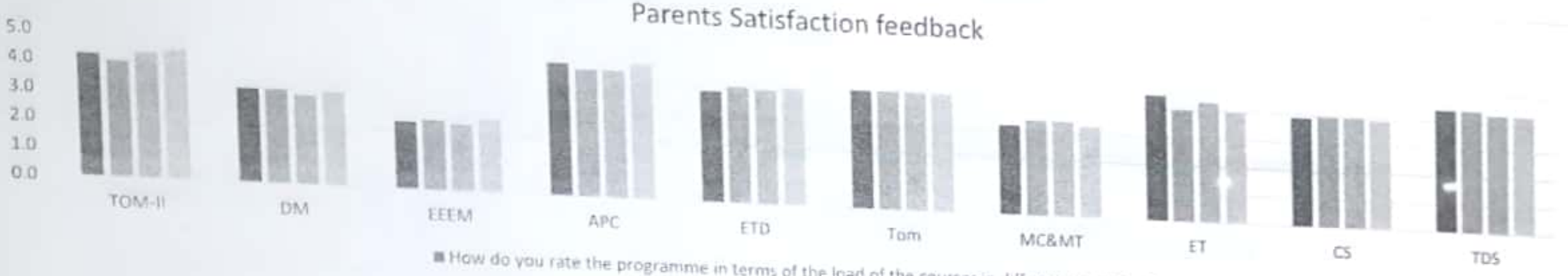
Action Taken on Alumni's Feedback

The feedback responses from alumni and action taken is illustrated in the following table:

S.No	Feedback	Action Taken
1	Need to touch the industrial and research aspects	Internship in industry is offered in Mechanical VIII sem, also ethical classes conducted under NSS.
2	As the mechanical labs still have same equipment which we saw 18 years back, however good that Cad Cam lab has improved a lot and given that industry has moved to automation, it will be beneficial for students.	Advanced software/Technology are covered through various theory subjects and laboratory. SKF lab and Ansys software is available in the department.
3	Add some courses practical classes for core branches like: MATLAB, Coding's and advance simulation tool	In flexible curriculum DE and OCs subjects are available for such courses.
4	It is found there's no course on FEA, Robotics, Mechatronics, CFD introduced at Bachelor's curriculum. It is not included in GATE but holds importance in industry. The interdepartmental collaboration within MITS can also be helpful to learn about Signal Processing, controls (similar to NVH data Processing) and programming python, Java. I think we should allow students to take subjects interdepartmental as per their choice / target (placements or GATE)	Such activity has been initiated and incorporated. CAD lab associated with ANSYS software to analysis modern tools. Also NPTEL course offered for the advance engineering. OC is subjected to inter-discipline subject.
5	Try to add Data science in present curriculum	Data science subject has been implemented in V semester 2020-21 batch.
6	State of the art courses need to be added. This needs to discussed and planed and I would be happy to be part of it.	NEC courses are running for such development..
7	Practical exposure is very less. Collage not provide any campus recruitment or internship opportunity.	6 month Internship opportunity is providing in VIII sem .



Parents Satisfaction Feedback



	TOM-II	DM	EEEM	APC	ETD	Tom	MC&MT	ET	CS	TDS
How do you rate the programme in terms of the load of the courses in different semesters?	4.2	3.3	2.4	4.6	3.9	4.2	3.2	4.5	3.9	4.4
How do you rate the availability of books & E-learning material in the institute library / website?	4.0	3.3	2.4	4.5	4.1	4.2	3.4	4.0	4.0	4.4
Is any new course to be introduced- to meet current needs & technological changes?	4.3	3.1	2.3	4.5	4.0	4.2	3.4	4.3	4.0	4.3
How do you rate the quality and relevance of the courses included in the programme of study.	4.5	3.2	2.5	4.7	4.1	4.2	3.3	4.0	3.9	4.3

Employer Feedback 2021-22